oblique forehead, and by the produced anterior rays of the second dorsal and anal. The young of this fish are proportionately shorter and deeper than the adults; the dorsal spines bear long filaments, which disappear with age; the ventral fins are greatly produced, becoming short in the adult; and the sides have four or more dusky cross bars, which later disappear.

The moonfish is carnivorous. Six specimens examined had fed on small crustaceans and on fish. Each alimentary tract, also, contained a considerable amount of smooth sand. Its spawning habits are unknown.

This species was observed in the southern part of the bay and only during September and October, when it was common and many were taken in pound nets and small numbers in large haul seines. During the period from September 23 to October 5, 1921, as many as 300 moonfish per day were caught in a set of two pound nets in Lynnhaven Roads. At Ocean View it was equally abundant. Our field records show that this fish was taken (1 to 15 individuals at a time) in 14 of a total of 32 hauls made at Ocean View, Va., with an 1,800-foot seine from September 23 to October 27, 1922. One fish was only 90 millimeters long. All the others ranged from 117 to 187 millimeters (4½ to 7¼ inches) in length. A number of individuals also were taken in small collecting seines along the beaches at Cape Henry, Cape Charles, Ocean View, and Buckroe Beach. The following weights were secured: 3½ inches, 0.5 ounce (1 fish); 4½ inches, 0.9 ounce (2 fish); 5 inches, 1.1 ounces (1 fish); 5½ inches, 1.5 ounces (5 fish); 6 inches, 1.9 ounces (14 fish); 6½ inches, 2.6 ounces (3 fish); 7 inches, 3 ounces (5 fish); and 7½ inches, 3.5 ounces (2 fish).

The moonfish is reported to reach a maximum weight of 2 pounds. In the Chesapeake fish weighing more than one-half pound are unusual, and virtually none are utilized in the markets. The moonfish is considered a good food fish in some parts of its range, notably at Key West, Fla., where one-half pound is a common size.

Habitat.—Southern Massachusetts (rarely to Cape Cod and Casco Bay, Me.) to Uruguay.

Chesapeake localities.—(*a*) Previous records: Mouth of Potomac River, "southern part of Chesapeake Bay," and Cape Charles city. (*b*) Specimens in collection: Cape Charles, Buckroe Beach, Lynnhaven Roads, and Ocean View, Va.

92. Genus VOMER Cuvier. Horsefishes

Body broad, ovate, very strongly compressed; head short and deep, its anterior profile nearly vertical; snout projecting only slightly; teeth small, present on jaws, vomer, and tongue; palatines with weak teeth or none; scales small, rudimentary; lateral line anteriorly with a prominent arch, the straight part with small bony scutes, at least in adult; spines of first dorsal very short; soft dorsal and anal very low, never bearing produced rays.

120. Vomer setipinnis (Mitchill). Moonfish; Sunfish; Horsefish.

Zeus setipinnis Mitchill, Trans., Lit. and Phil. Soc., New York, I, 1814, p. 384; New York.

Vomer setipinnis Uhler and Lugger, 1876, ed. I, p. 111; ed. II, p. 93; Jordan and Evermann, 1896-1900, p. 934, Pl. CXLIV, fig. 392.

Head 2.7 to 3.5; depth 1.2 to 1.8; D. VIII–I, 21 or 22; A. II–I, 17 or 18. Body rhombic, proportionately deeper in young than in adult, very strongly compressed; back much elevated; anterior profile very steep, concave in advance of eyes; head short and very deep; snout little projecting, 2 to 2.4 in head; eye 3.5 to 3.95; interorbital 3.4 to 4.6; mouth rather large, oblique, slightly superior; maxillary broad, 2.2 to 2.9 in head; teeth small, present on jaws, vomer, and tongue; gill rakers usually somewhat longer than half the eye, 26 or 27 on lower limb of first arch; lateral line anteriorly with a prominent arch, somewhat shorter than straight part, posteriorly with small but distinct bony scutes; first dorsal with eight short, pungent spines; second dorsal and anal similar, very low, scarcely elevated anteriorly; caudal fin broadly forked; ventral fins very small, shorter than eye; pectoral fins rather long, falcate in adult, 2.55 to 3.7 in length of body.

Color bluish green above, shading into bright silvery along sides; larger examples with an obscure dark bar, extending from tip of snout through eye to upper angle of gill opening; upper surface of caudal peduncle bluish black; some of the small specimens with a dusky spot on sides over the beginning of the straight part of lateral line; dorsal, anal, and ventrals plain; caudal greenish yellow; pectorals light yellow.

This species is represented by 35 specimens, ranging in length from 55 to 215 millimeters (2¼ to 8½ inches). The steep, concave forehead and the low dorsal and anal fins, bearing no produced rays, readily separate this fish from related forms occurring in Chesapeake Bay. The young, as in related species, are proportionately shorter and deeper than the adults, and the bony scutes on the sides of the tail are not evident.

The horsefish appears to be carnivorous. Four stomachs were examined and contained only the remains of fish. In one stomach an anchovy was recognizable among the contents. The spawning habits of this fish are unknown.

The size of a catch of 16 fish, taken one day in October with a haul seine at Ocean View, ranged from 49 to 94 millimeters (2 to 3¾ inches). Most of the fish taken on May 25, mentioned below, were 121 to 152 millimeters (4¾ to 6 inches) in length, which probably represents the growth from the preceding October.

The horsefish is not uncommon in the southern part of Chesapeake Bay during the fishing season. However, it was not found far from the entrance of the bay, and probably does not occur above the mouth of the Rappahannock River. Examples taken in the spring included more large fish than those taken during autumn. The fish is caught both in pound nets and in seines. The largest single

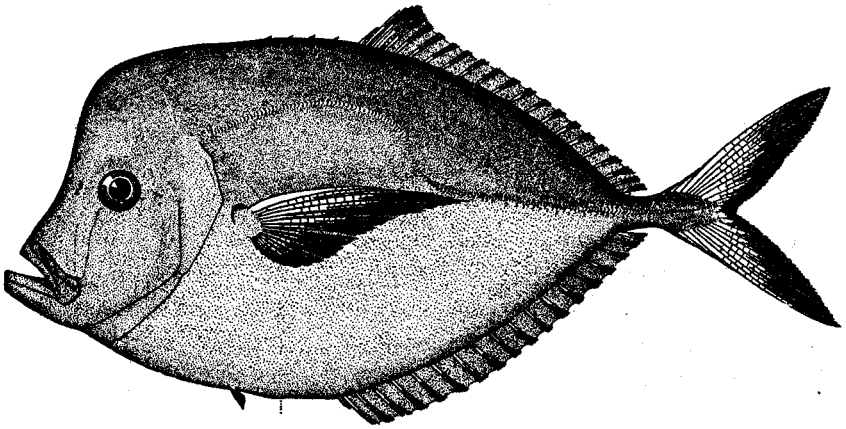

FIG. 132.—*Vomer setipinnis*. From a specimen 9¼ inches long

catch observed was taken from a pound net in Lynnhaven Roads, Va., on May 25, 1922, when about 2,000 horsefish, ranging from 4¾ to 8½ inches in length, occurred in the trap among other fish. It also was taken in small numbers during the fall of 1922, in haul seines at Ocean View, Va. This species, although esteemed as a food fish in some localities, is not utilized in the Chesapeake. The maximum weight attained is said to be about 1 pound. The fish in Chesapeake Bay, however, run rather small, and none approaching 1 pound in weight was seen.

Habitat.—Nova Scotia to Uruguay; rare north of Cape Cod.

Chesapeake localities.—(*a*) Previous record: "Not rare in * * * the southern part of Chesapeake Bay" (Uhler and Lugger, 1876). (*b*) Specimens in collections: Lynnhaven Roads and Ocean View, Va.

93. Genus TRACHINOTUS Lacépède. The pompanoes

Body, short, compressed, more or less ovate; abdomen shorter than anal fin, never trenchant; head short; snout blunt; mouth rather small, terminal or slightly inferior; premaxillaries protractile; maxillary without a distinct supplemental bone; teeth in young in villiform bands on jaws, vomer, palatines, and tongue, almost completely disappearing with age; preopercle serrate in very young, becoming entire with age; gill membranes somewhat united across the isthmus; gill rakers short and rather few; scales small, smooth; lateral line scarcely arched, unarmed; first dorsal with six short, strong spines in addition to a procumbent spine; second dorsal and anal similar, anteriorly more or less elevated in adult, long and falcate in some species; caudal broadly forked, the lobes sometimes produced in adults; pectorals never falcate, always shorter than head.

KEY TO THE SPECIES

a. Soft dorsal rays 19 or 20; soft anal rays 17 to 20; anterior rays of soft dorsal and anal notably produced in adult.
  b. Body deep, ovate, the depth 1.4 to 1.7 in length; no black cross bars on sides..*falcatus*, p. 228
  bb. Body more elongate, the depth 2 to 2.6 in length; sides with 4 or 5 black cross bars..*glaucus*, p. 229
aa. Soft dorsal rays 23 or 24; soft anal rays 20 to 22; anterior rays of soft dorsal and anal never notably produced.....*carolinus*, p. 229

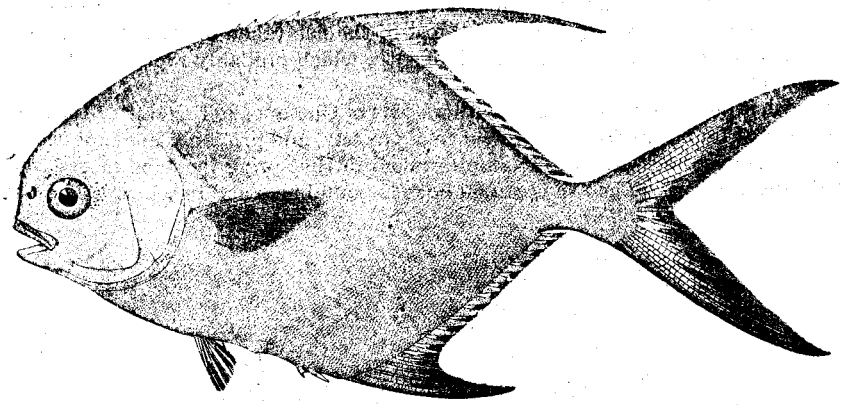

FIG. 133.—*Trachinotus falcatus*

121. Trachinotus falcatus (Linnæus). Round pompano.

Labrus falcatus Linnæus, Syst. Nat. ed. X, 1758, p. 284; America.
Trachynotus ovatus Uhler and Lugger, 1876, ed. II, p. 96.
Trachinotus falcatus Jordan and Evermann, 1896–1900, p. 941, Pl. CXLVI, fig. 396; Evermann and Hildebrand, 1910, p. 161.

Head 2.8 to 3.3; depth 1.4 to 1.7; D. VI–I, 19 or 20; A. II–I, 17 or 18. Body ovate, strongly compressed; dorsal and ventral outlines forming angles at origin of second dorsal and anal; head short; snout very short and blunt, 3.6 to 5.65 in head; eye 3 to 4; interorbital 2.3 to 2.8; mouth

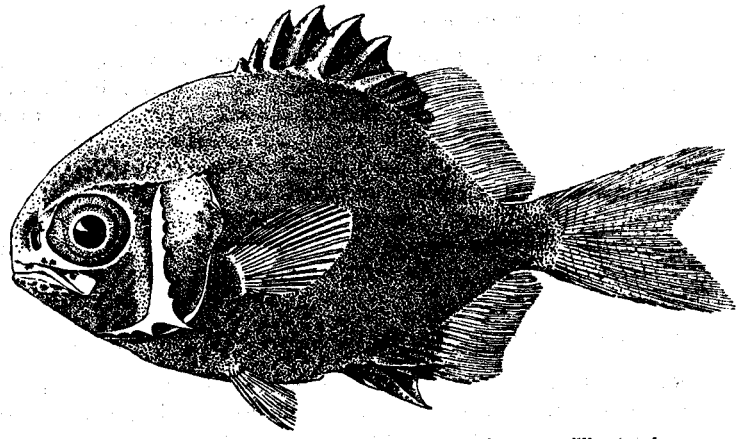

FIG. 134.—*Trachinotus falcatus*. Young, from a specimen 18 millimeters long

rather small, slightly inferior, little oblique; maxillary scarcely reaching middle of eye, 2.8 to 3.1 in head; gill rakers very short, scarcely a third diameter of eye, 9 on lower limb of first arch; lateral line with a slight arch anteriorly, more or less wavy; first dorsal composed of six short stiff spines, preceded by a strong procumbent spine; second dorsal and anal produced anteriorly in adult (the longest rays sometimes reaching base of caudal), scarcely elevated in very young; caudal fin forked,

the lobes produced in adult; ventral fins short, scarcely as long as postorbital part of head; pectorals short, 1.35 to 1.9 in head.

Color bluish above; lower parts of sides silvery; dorsal and anal yellowish, with dusky punctulations, the produced part of dorsal sometimes black; caudal and pectorals plain yellowish; ventrals white. Very young (40 millimeters and less in length) densely punctulate with rusty dots, giving them the color of a dead leaf; dorsals and anal very dark; caudal pale.

This species is represented in the present collection by 28 small specimens, ranging from 20 to 95 millimeters (4/5 to 3¾ inches) in length. This species differs from the others of the genus occurring in Chesapeake Bay in the deep, ovate body and the long soft dorsal and anal fins, the anterior rays of which are much produced in adults.

This pompano is carnivorous, the small specimens at hand having fed on worms, crustaceans, mollusks, and fish. The spawning habits are unknown.

This fish is too rare and the individuals obtained are too small to make it of commercial importance in Chesapeake Bay. The species was seen only in the southern sections of the bay, and although it strays northward to Woods Hole, Mass., it is not abundant anywhere along our shores. Its chief habitat probably extends from the West Indies southward. On the Atlantic coast of Panama it is a food fish of some importance. The species is reported to reach a maximum weight of 3 pounds. Its flesh is of excellent quality.

Habitat.—Massuchusetts to Brazil.

Chesapeake localities.—(*a*) Previous record: Potomac River, St. Marys River, and Ocean View, Va. (*b*) Specimens in collection: Cape Charles, Buckroe Beach, Lynnhaven Roads, and Ocean View, Va., taken during September and October, 1921 and 1922.

122. Trachinotus glaucus (Bloch). Gaff-topsail pompano.

Chætodon glaucus Bloch, Naturg. Ausl. Fische, III, 1787, p. 112, Pl. CCX; Martinique.
Trachinotus glaucus Jordan and Evermann, 1896-1900, p. 940, Pl. CXLVI, fig. 395; Smith, 1907, p. 212, fig. 90.

Head 3 to 3.9; depth 2 to 2.6; D. VI–I, 19 or 20; A. II–I, 17 or 18.

This pompano was not seen during the present investigation and we find no definite record of its capture in Chesapeake Bay. Jordan and Evermann give Virginia as the northernmost limit of its range, and Smith says that it is found from Chesapeake Bay southward. It is on the basis of these records that we include these notes.

This species has the anterior rays of the soft dorsal and anal much produced in the adult, as in *T. falcatus*. The body is not ovate, however. Its depth is contained in the length about 2 to 2.6 times, and in this respect it is more like *T. carolinus*. It differs from both species in the presence of dark vertical bars on the sides.

This pompano is reported to reach a weight of about 2 pounds. Apparently nowhere along our coasts is it abundant enough to be of much commercial importance, and it is less highly regarded as a food fish than most pompanos.

Habitat.—Virginia to Panama. Once recorded from Uruguay.

Chesapeake localities.—(*a*) Previous records: No definite localities. (*b*) Specimens in collection: None.

123. Trachinotus carolinus (Linnæus). Pompano; "Sunfish."

Gasterosteus carolinus Linnæus, Syst. Nat., ed. XII, 1766, p. 490; Carolina.
Trachynotus carolinus Uhler and Lugger, 1876, ed. I, p. 113; ed. II, p. 95.
Trachinotus carolinus Bean, 1891, p. 87; Jordan and Evermann, 1896-1900, p. 944, Pl. CXLVII, fig. 398.

Head 3 to 3.6; depth 1.8 to 2.1; D. VI–I, 23 or 24; A. II–I, 20 to 22. Body moderately elongate, strongly compressed; dorsal and ventral outlines not forming pronounced angles at origin of soft dorsal and anal; head moderate; snout short and blunt, 3.8 to 4.5 in head; eye 3 to 4.1; interorbital 2.5 to 2.95; mouth moderate, slightly inferior, a little oblique; maxillary reaching opposite middle of eye, 2.8 to 3 in head; gill rakers very short, about one-fifth diameter of eye, 7 or 8 on lower limb of first arch; lateral line nearly straight; first dorsal composed of six short, stiff spines, preceded by a sharp procumbent spine; second dorsal and anal anteriorly not greatly elevated, none of the rays especially produced, the longest rays reaching about middle of base of fins in adult when deflexed; caudal fin deeply forked; ventral fins small, scarcely as long as postorbital part of head; pectoral fins short, 1.2 to 1.35 in head.

Color bluish green on back, shading into silvery on sides; fins mostly more or less yellowish, the elevated portion of the dorsal dusky; ventrals white.

This species is represented by 24 specimens, ranging in length from 85 to 200 millimeters (3⅜ to 7⅞ inches). This well-known pompano is recognized from other Chesapeake Bay pompanos by a body less deep, by the more numerous rays of the second dorsal (23 or 24, compared to 19 or 20 for *T. falcatus* and *T. glaucus*), and by the fact that none of the dorsal or anal rays are notably produced.

The contents of seven stomachs examined consisted of parts of mollusks, crustaceans, fish, and ova of unknown origin. The spawning habits of this fish are still unknown. No fish with developed gonads were seen.

The pompano is caught in small numbers in the lower parts of Chesapeake Bay. During 1920 the catch amounted to 1,650 pounds, valued at $330 to the fishermen. Almost the entire catch was taken in pound nets, the rest being caught with haul seines.

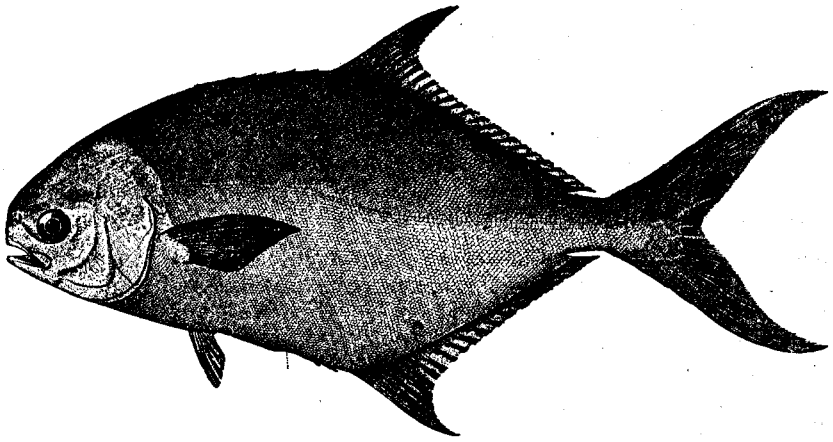

FIG. 135.—*Trachinotus carolinus*

A large catch of pompanos seldom is made in the Chesapeake. Although the quantity taken is small, the fish is valuable, nevertheless, and appears regularly each year. In the report of the United States Commissioner of Fisheries for 1893 (p. 67) the following statement occurs:

> The pompano (*Trachinotus carolinus*) is of constant occurrence in the lower Chesapeake, but rarely appears in great abundance. The bay represents the northern limit of commercial fishing for this fish. In 1891 there was a remarkably numerous run of pompanoes in that part of the bay adjacent to its mouth. According to Mr. J. E. N. Sterling, of Cape Charles City, Va., the catch with pound nets and seines on the shores of Northampton County alone was between 20,000 and 25,000 pounds. The inquiries of the agents of the office disclosed a yield of 93,700 pounds in the Chesapeake, with a value to the fishermen of $9,520. In the following year the catch was much less, the Northampton County fishermen taking less than 5,000 pounds, according to Mr. Sterling, although there was said to be a large quantity in the bay which kept offshore out of reach of the nets.

Very few adult pompanos are caught above Cape Charles city, Va., or the mouth of the York River. Fish of commercial size—that is, fish of about 8 inches or more in length—first appear sometime in May. In 1921, in a pound net in Lynnhaven Roads, the first pompano of the season was taken on May 12. In 1922 the fish first appeared on May 23 at Ocean View, Va., followed by others on the 24th at Lynnhaven Roads and several more on the 25th and 26th at both localities. A set of two pound nets as a rule does not catch as much as 25 pounds of pompanos in one day before the middle of June. The greater part of the fish are taken during July and August. September appears to be a poor month, but in October both the pound-net and haul-seine fishermen sometimes make comparatively good catches. The last pompanos are caught about November 1.

While reviewing the records of the daily catch of pompanos taken by a set of two pound nets at Lynnhaven Roads for the years 1916 to 1922, it was found that the best catch for consecutive days' fishing occurred from July 24 to August 2, 1916, when 540 pounds were taken. The largest amount caught on any one day during this seven-year period was 150 pounds, taken on July 25,

1916. The nets to which the foregoing records apply are two of the largest and most favorably located of any in Chesapeake Bay.

Small pompanos from 3 to 8 inches in length are common along the shores of lower Chesapeake Bay from late summer to fall. Late in the season these small fish are found as far north as Solomons, Md., where a number were taken in October, 1922, with collecting seines and pound nets. During haul-seine fishing for spots and spotted squeteague in the lower part of the bay in the fall, many small pompanos are drawn on the beach, where they become smothered with sand and perish. Pompanos less than 7 inches in length are not marketed.

This species of pompano is one of the choicest of all salt-water fishes and everywhere commands a high price. The retail price in the Norfolk market during 1921 and 1922 ranged from 40 to 50 cents a pound. Most of the catch is marketed locally, but when a good run of fish occurs shipments are made to other markets.

This pompano reaches a weight of about 5 pounds. The Chesapeake fish, however, seldom exceed a weight of 3 pounds, the average size of the market fish ranging between 1 and 2 pounds.

Habitat.—Massachusetts to Brazil.

Chesapeake localities.—(*a*) Previous records: "Chesapeake Bay," Cape Charles city, Va. (*b*) Specimens in collection: Solomons, Md., Cape Charles, Buckroe Beach, Ocean View, and Lynnhaven Roads, Va.

Comparison of lengths and weights of pompanos

Number of fish measured and weighed	Length	Weight	Number of fish measured and weighed	Length	Weight
	Inches	*Ounces*		*Inches*	*Ounces*
1	3¼	0.3	7	6	1.6
1	3¾	.4	5	6¼	1.7
10	4	.5	3	6½	2.1
9	4¼	.6	2	6¾	2.4
27	4½	.7	3	7	2.6
24	4¾	.8	1	7¼	2.8
13	5	.9	4	7½	3.2
11	5¼	1.0	1	7¾	3.5
14	5½	1.1	1	8¼	4.6
9	5¾	1.4	2	15½	30.5

Family LIV.—POMATOMIDÆ. The bluefishes

Body oblong, compressed; head large; mouth large, oblique; premaxillaries protractile; maxillary not slipping under preorbital, provided with a large supplemental bone; lower jaw projecting; jaws each with a series of strong, compressed, unequal teeth, upper jaw with an inner series of small depressed teeth; villiform teeth present on vomer, palatines, and tongue; gill membranes separate, free from the isthmus; gills 4, a slit behind the fourth; branchiostegals 7; opercle ending in a flat point; preopercular margin serrate; scales rather small, weakly ctenoid; lateral line complete, unarmed; first dorsal composed of about eight weak spines; second dorsal and anal similar, the latter preceded by two small free spines; caudal forked; ventrals thoracic, with I, 5 rays; pectorals rather short. A single widely distributed genus and species is known.

94. Genus POMATOMUS Lacépède. Bluefishes

The characters of the genus are included in the family description.

124. Pomatomus saltatrix (Linnæus). Bluefish; Tailor; "Greenfish;" "Snapping mackerel."

Perca saltatrix Linnæus, Syst. Nat., ed. X, 1758, p. 293; Carolina.

Pomatomus saltatrix Uhler and Lugger, 1876, ed. I, p. 136; ed. II, p. 116; McDonald, 1882, pp. 12 and 13; Bean, 1883, p. 366; Bean, 1891, p. 91; Smith, 1892, p. 71; Jordan and Evermann, 1896-1900, p. 946, Pl. CXLVIII, fig. 400.

Head 3.1 to 3.4; depth 3.1 to 3.55 (in large fish about 4); D. VIII–I, 23 to 26; A. II–I, 25 to 27; scales about 95 to 105. Body elongate, moderately compressed; head rather long; snout pointed 3.35 to 3.95 in head; eye 4.4 to 5.6; interorbital 4.05 to 4.6; mouth large, moderately oblique; lower jaw projecting; maxillary reaching nearly or quite to posterior margin of eye, 2.05 to 2.3 in head; gill rakers short, 11 to 14 on lower limb of first arch; scales small, thin, more or less deciduous, densely

covering the soft dorsal and anal; lateral line nearly straight, extending on base of caudal; first dorsal composed of very slender spines; second dorsal and anal similar, slightly elevated anteriorly; caudal fin forked; ventral fins inserted a little behind base of pectorals, notably shorter than postorbital part of head; pectoral fins short, 1.65 to 1.9 in head.

Color in life, of a fish 13 inches long, greenish above; silvery below; first dorsal and caudal dusky; second dorsal olive green; anal white along base, distal half translucent, with punctulations; ventrals white; pectorals yellowish green, with dark bases.

This fish is represented in the collection by many small specimens ranging in length from 70 to 265 millimeters (2¾ to 10½ inches). The bluefish is related to the family of crevallies and pompanos, from which it is distinguished, however, by the serrate preopercle, the rather large unequal teeth, and the stouter caudal peduncle.

The bluefish is a voracious feeder, being highly predatory on other fishes. Schools of bluefish are known to follow schools of menhaden and other fish, and after they have fed to the fullest extent of their capacity they still continue in the destruction of the fish, killing many more than they require for their own support. Nine small specimens, of which the stomach contents were examined in the laboratory, had fed almost exclusively on silversides. Others examined in the field had eaten, in addition to silversides, young gizzard shad (Dorosoma).

Nothing definite regarding the spawning habits of the bluefish has been published, and we are able to add but little. On June 8, Mr. Radcliffe saw a ripe male, which had been caught in a pound

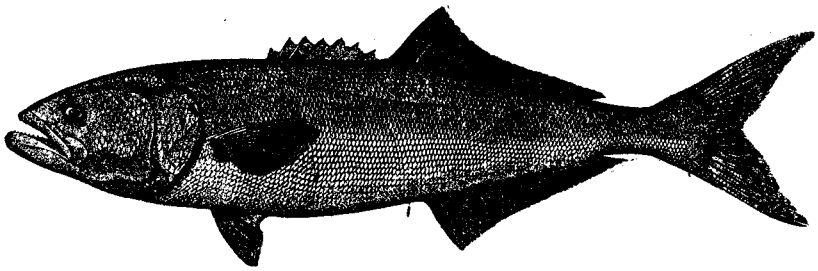

FIG. 136.—*Pomatomus saltatrix*

net at Lynnhaven Roads, Va., and the same investigator saw another there on July 15. It is probable, therefore, that spawning takes place in summer. Smith (1907, p. 216) states that the bluefish probably spawns offshore in summer.

Little is known of the rate of growth of the bluefish. Many young, 4 to 8 inches long, were taken daily throughout October. Fish 9 to 11 inches long were less common, but many ranging from 12 to 14 inches were caught and marketed in the lower bay later in the fall. The last-mentioned group may be one year older than the smallest group, or if fish 4 to 12 inches in length are the product of the same year it must be assumed that spawning is protracted or growth irregular.

The bluefish, among the fishes of Chesapeake Bay, ranked seventeenth in quantity in 1920 and sixteenth in value, the catch being 51,968 pounds, valued at $7,037.

In Maryland it ranked fifteenth in quantity and tenth in value, the catch amounting to 14,989 pounds, worth $2,112. Of this amount, 70 per cent were caught in gill nets, 24 per cent in pound nets, 3 per cent in purse seines, 2 per cent in haul seines, and 1 per cent with lines. The counties having the largest catches were Talbot, 7,200 pounds; Kent, 3,350 pounds; and Somerset, 1,769 pounds.

In Virginia it ranked sixteenth both in quantity and in value, the catch amounting to 36,979 pounds, worth $4,925. Of this amount, 52 per cent were taken in pound nets, 40 per cent in gill nets, 6 per cent in haul seines, and 2 per cent with lines. The counties catching the largest quantities were Northampton, 17,493 pounds; Elizabeth City, 6,870 pounds; and Mathews, 3,556 pounds.

The bluefish is one of the most valuable fish taken along the Atlantic coast and is everywhere highly esteemed. It enters Chesapeake Bay each season, its movements and abundance, however, varying considerably from year to year.

It is stated by many of the fishermen that large bluefish were plentiful 20 years ago, whereas now the fish is scarce and only small ones enter the bay. According to these fishermen, years ago

the New England and New York fishing smacks followed the "blues" up the coast in the spring and entered Chesapeake Bay, where they caught large quantities. A law was enacted, however, excluding the northern bluefish fisherman from the bay, and since the enforcement of that law fishermen firmly believe that the bluefish has diminished in numbers in the bay, because the smacks bait the fish past the capes and prevent them from entering. The fact is, however, that vessels fishing for bluefish remain only a short while off the entrance of Chesapeake Bay, and during much the greater part of the fishing season no lures that prevent the fish from entering the bay are present.

The abundance of menhaden (a favorite food) to some extent governs the movements of the bluefish. During 1921 and 1922 young menhaden were plentiful throughout the lower half of the bay, and in 1922 the catch of bluefish was greater than it had been for many years.

Bluefish migrate up and down the Atlantic coast, following schools of menhaden and other fish, upon which they feed voraciously. In midwinter they are caught off southern Florida with purse seines and gill nets, together with Spanish mackerel. Large schools pass the Carolinas during March and April, and the first catches are made off New Jersey and Long Island during April and May. In southern Massachusetts the first catch is usually made late in May. From this vicinity northward the fishery is small, and only a few stragglers are taken along the coast of Maine during the summer.

Bluefish enter the Chesapeake as stragglers late in March or early in April. In 1922, in a set of pound nets at Lynnhaven Roads, Va., the first fish of the season was taken on April 3. The first capture was made at Ocean View on April 1. On April 7 a set of three pound nets at Ocean View caught 12 bluefish, weighing 1½ to 2 pounds each. The combined catch for the season of 75 small pound nets near Buckroe Beach, prior to April 11, was about 20 bluefish. The first fair catches are made some time in May. During June, July, and August the pound-net catches are small, although the fish are present in the bay and are taken in small numbers with hook and line and with gill nets. In September the pound-net catches increase, and during October the largest catches of the year are made. At Ocean View and Lynnhaven Roads small quantities often continue to be taken by the pound nets until about November 15.

Bluefish do not appear to ascend the bay to the northern sections, as the catch decreases rapidly above the mouth of the York River. All fishermen questioned unanimously stated that at one time bluefish, especially of large size, were abundant in Chesapeake Bay and were caught in comparatively large numbers as far north as Annapolis. The following statements pertaining to specific localities were obtained from conversations with fishermen:

Mouth of Rappahannock River, July 20, 1921: The fish are scarce this year, as in the past few years. The species is seldom seen now, but at one time large schools entered the lower part of the river. Last spring (1921) one pound net caught five bluefish and another caught four.

Lower Potomac River, August 6, 1921: Twenty years ago bluefish were plentiful opposite St. George Island and many large ones were caught in nets and with hand line. At the present time and during the past 10 years they have been very scarce, and only occasionally one is caught, usually a small one. April 21, 1922: Fifteen years ago bluefish were plentiful. They used to come in the spring and meet the glut herring passing out of the river and feed upon them. These fish were often large, weighing 6 to 12 pounds. Now only a few small ones are taken, generally weighing ½ to 3 pounds.

Crisfield, Md., November 21, 1921: Very few are caught and the size seldom exceeds 2 pounds. Most of the very small annual catch is taken in the fall with pound nets. A few are taken during the summer and fall with gill nets.

Oxford, Md., September 13, 1921: Bluefish have not been plentiful in this locality for 15 years. They have been decreasing steadily in numbers until now they are very scarce. During the present year fishing parties have been catching an odd one now and then with hook and line. One fisherman, who fishes regularly with hook and line, caught four this year. Very few are caught in pound nets. A school of these fish had not been seen in this locality for years, but on September 7, 1921, a small school was sighted off Cooks Point. The usual size of the fish caught at the present time is about 1 pound.

Solomons, Md., August 9, 1921: Twenty years ago large schools of bluefish entered the lower Patuxent and were caught about Solomons Island. The size of these fish averaged from 2 to 7 pounds. During the past eight years the fish have disappeared. This year hook-and-line fishermen

have taken, to date, only two to five fish to a man. The size is generally below 2 pounds. October 26, 1921: A few large bluefish were taken in pound nets during September, and occasionally a small one was taken during October. No large run of these fish occurs here now, and not enough are caught at any time during the year to be of much commercial importance.

Annapolis, Md., August 19, 1921: Bluefish have been scarce for five or six years. They were once very plentiful and were caught near by with purse nets along with other species of fish. At the present time a fish is taken only occasionally in a pound net or with hook and line.

Love Point, Md., September 5, 1921: Some years ago bluefish were plentiful in the Chester River and about Love Point. Now they are scarce and are taken only occasionally with hook and line, haul seines, and pound nets. To-day one pound net caught two small ones.

Baltimore, Md.: Bluefish are not taken in commercial quantities in this vicinity. It seems probable that the species rarely strays north of this locality in Chesapeake Bay.

The majority of the bluefish are caught in the bay with pound nets and gill nets. From Annapolis to Ocean View quite a few are caught by sport fishermen with hook and line, but the total yearly catch by this method is not known.

Most of the annual catch is marketed in Norfolk and Baltimore, but when a good run of fish strikes in shipments are made to other points. The catch fluctuates so widely from week to week in the bay, and especially along the Atlantic coast, that wholesale prices are variable. The usual range during 1922 was from 10 to 20 cents a pound.

In the Chesapeake region small fish that weigh 2 pounds and less are known as "tailors," while the larger sizes are called "bluefish." The names "snapping mackerel" and "greenfish" are heard occasionally. The usual size of the fish taken in the bay ranges from ½ to 4 pounds. Fish weighing more than 6 pounds were comparatively rare in 1921 and 1922. Along the Atlantic coast a size of 5 to 10 pounds is common and the maximum authentic weight is given as 27 pounds.

Habitat.—Atlantic Ocean, Mediterranean Sea, Indian Ocean, straying northward on the coast of the United States to Maine.

Chesapeake localities.—(*a*) Previous records: Various localities from Havre de Grace, Md., southward. (*b*) Specimens in collection: Many localities from Love Point (Chester River), Md., southward to the mouth of the bay.

Comparison of lengths and weights of small bluefish

Number of fish weighed and measured	Length	Weight	Number of fish weighed and measured	Length	Weight
	Inches	*Ounces*		*Inches*	*Ounces*
1	4½	0.5	2	8¼	3.2
3	6½	1.5	3	8½	3.6
3	6¾	1.9	3	9	4.3
7	7	2.0	1	9¼	5.0
5	7¼	2.1	1	10	5.3
9	7½	2.3	2	10¼	6.8
3	7¾	2.7	1	12¼	11.7
5	8	3.0			

Family LV.—RACHYCENTRIDÆ. The crab-eaters

Body elongate, somewhat fusiform; head broad, strongly depressed; mouth wide, nearly horizontal; lower jaw projecting; premaxillaries not protractile; maxillaries reaching about to eye; teeth small, pointed, in bands on jaws, vomer, palatines, and tongue; opercle and preopercle unarmed; branchiostegals 7; gill rakers strong; first dorsal composed of eight or nine short, stiff, free spines; second dorsal and anal similar, somewhat elevated anteriorly but not falcate; caudal strongly rounded in very young, forked in adult; ventrals thoracic, with I, 5 rays; pectorals moderate, placed below level of lower margin of eye.

95. Genus RACHYCENTRON Kaup. Crab-eaters

The characters of the genus are included in the description of the family. A single species of wide distribution is known.

125. Rachycentron canadus (Linnæus). Crab-eater; Cabio; Sergeant fish; "Bonito;" "Black bonito."

Gasterosteus canadus Linnæus, Syst. Nat., ed. XII, 1766, p. 491; Carolina.
Elecate canadus Uhler and Lugger, 1876, ed. I, p. 137; ed. II, p. 117.
Elacate canada McDonald, 1882, p. 12; Bean, 1891, p. 91.
Rachycentron canadus Jordan and Evermann, 1896–1900, p. 948, Pl. CXLVIII, fig. 401.

Head 4; depth 5.45; D. VIII–I, 30; A. I, 23. Body elongate, anteriorly nearly as broad as deep, posteriorly compressed; caudal peduncle nearly round, its depth 4 in head; head long and broad, depressed; snout broad, 2.95 in head; eye 8.8; interorbital 2.45; mouth large; lower jaw projecting; maxillary reaching anterior margin of eye, 2.65 in head; teeth small, pointed, in bands on jaws, vomer, palatines, and tongue; gill rakers strong, seven on lower limb of first arch; scales minute; lateral line complete; first dorsal composed of very short, stiff spines; second dorsal long, elevated anteriorly; caudal fin forked (truncate in young); anal fin similar in shape to the second dorsal, but shorter; ventral fins moderate, inserted under base of pectorals, about as long as post-orbital part of head; pectoral fins large, 1.15 in head.

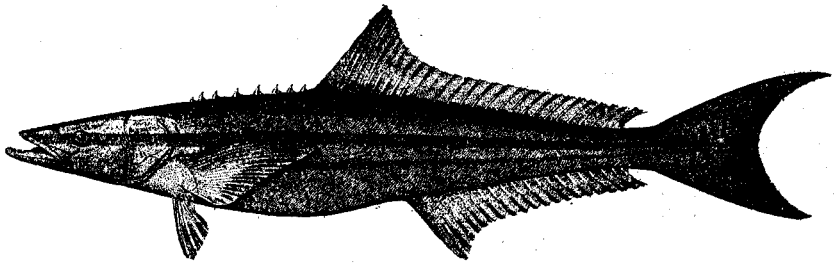

FIG. 137.—*Rachycentron canadus*. From a specimen 29¾ inches long

Color of a fresh specimen black above, grayish white to plain below; dorsal and caudal dusky; anal and ventrals white with gray or dusky markings; pectorals black. Some specimens observed in the Norfolk market were dark brown on back instead of black.

A single specimen, 810 millimeters (32 inches) in length, weighing 8 pounds when fresh, is contained in the present collection, and it forms the basis for the foregoing description. The young differ markedly from the adults in the more elongate body, less strongly depressed head, in having the caudal fin truncate instead of forked, and in being somewhat lighter in color and having a black lateral band, which extends from the snout, through the eye, to the base of the caudal.

This fish is carnivorous, feeding on fish and crustaceans. Relative to the spawning, Smith (1907, p. 221) says: "The fish is known to spawn in Chesapeake Bay in summer, and its eggs have been artificially hatched." Our specimen is a female (captured on May 27, 1922) with ova so small that they are not visible to the unaided eye.

The black bonito is confined to the lower part of Chesapeake Bay, being taken from the York River to Cape Charles and Lynnhaven Roads, Va. There are no published statistics of the annual catch of this fish. During 1921 about 3,000 pounds, worth $300 to the fishermen, were taken.

This fish is present in the bay from May until late summer, but it is most common in June. Most of the catch is taken with hook and line between the York River and Buckroe Beach, Va. On June 21, 1921, at Buckroe Beach, two hand-line fishermen caught four black bonito, weighing 40, 62, 75, and 84 pounds, respectively; while another boat had three fish, weighing 52, 62, and 82 pounds, respectively. Hook-and-line fishing appears to be done only in June, but a few fish are taken in pound nets throughout the summer.

The catch is readily disposed of in the markets of Norfolk, Portsmouth, and Phœbus, the large fish being cut into steaks. The usual size of the market fish is 10 to 50 pounds, and 84 pounds appears to be the largest fish recorded from the bay and the maximum size attained by the species.

Habitat.—New Jersey to Brazil; East Indies.

Chesapeake localities.—(*a*) Previous records: "Southern part of Chesapeake Bay" (Uhler and Lugger, 1876); Norfolk and Cape Charles city, Va. (*b*) Specimens in collection: Ocean View, Va.; also observed at Buckroe Beach and Lynnhaven Roads, and reported by fishermen from the lower York River, Va.

Family LVI.—PERCIDÆ. The perches

Body elongate, compressed or not; head moderate; mouth small or large, terminal or slightly inferior; maxillary without a distinct supplemental bone; teeth pointed (some species with a few canines), present on jaws and usually on vomer and palatines; pharyngeal bones with sharp teeth; branchiostegals 7; gills 4; preopercle serrate; opercle ending in a flat spine; pyloric cœca few; lateral line present; scales firm, ctenoid; dorsal fins 2, with 8 to 16 spines; anal similar to second dorsal or smaller, with two spines; ventrals well developed, situated below or a little behind base of pectorals, with one spine and five soft rays; air bladder present. A single genus and species comes within the scope of the present work.

96. Genus PERCA Linnæus. Yellow perches

Body elongate, only moderately compressed; mouth moderate, terminal; premaxillaries protractile; teeth small, pointed, in bands on jaws, vomer, and palatines; opercle ending in a spine; preopercle serrate; gill membranes separate and free from the isthmus; scales rather small, ctenoid; lateral line complete; dorsal fins 2, well separated, the first with 12 to 16 rather high and slender spines; anal with two weak spines; ventral fins close together, with a strong spine. A single widely distributed species is known from American waters.

126. Perca flavescens (Mitchill). Yellow perch; Red-fin.

Morone flavescens Mitchill, Rept., Fish., New York, 1814, p. 18; near New York City.

Perca flavescens Uhler and Lugger, 1876, ed. I, p. 128; ed. II, p. 109; Jordan and Evermann, 1896–1900, p. 1023, Pl. CLXV, fig. 435; Smith and Bean, 1899, p. 186; Fowler, 1912, p. 55; Snyder, 1917, pp. 18 and 28.

Perca americana Bean, 1883, p. 365.

Head 3.1 to 3.6; depth 3.35 to 3.85; D. XIII or XIV–II, 14 or 15; A. II, 7 or 8; scales 7–67 to 83. Body elongate, moderately compressed; head long and low; snout pointed, 3.3 to 4.1 in head; eye 3.65 to 5.35; interorbital 4.2 to 4.55; mouth rather large, a little oblique, terminal; maxillary broad, reaching to or a little beyond anterior margin of pupil, 2.4 to 2.9 in head; gill rakers short and stout, 15 or 16 on lower limb of first arch; scales small, firm, ctenoid, present on cheeks and opercles and extending on base of caudal; lateral line complete; dorsal fins well separated, the origin of the first over base of pectorals, the spines pungent, the longest about half the length of head; caudal fin rather deeply emarginate; anal fin small, with two rather long, slender spines; ventral fins close together, inserted about an eye's diameter behind base of pectorals; pectoral fins rather short, rounded, 1.7 to 1.9 in head.

Color dark olive green above; sides yellow; abdomen and chest pale; back and sides with six to eight black crossbars (these obsolete in a few of the adult specimens at hand); dorsal and caudal dusky green; spinous dorsal sometimes with a black blotch posteriorly; anal, ventrals, and pectorals red or orange, brightest in males during the breeding season. Young usually with indefinite dark spots on sides in addition to black crossbars.

Numerous specimens, ranging in length from 55 to 250 millimeters (2¼ to 9¾ inches) were collected. This fish is readily recognized by the black crossbars and the yellow coloration on the lower part of the sides. The young are not very different from the adults. They are somewhat more blotched, however, and rather more slender.

The yellow perch is carnivorous, feeding on a large variety of animal life, ranging (according to published accounts) from microscopic organisms to sizeable animals like crawfish, minnows, and young fish. The stomach contents of 20 specimens taken in brackish water contained the following foods, named in the order of their apparent importance: Isopods, amphipods, fish, crabs, shrimp, insect larvæ, and snails. Spawning takes place early in the spring and is described by Smith (1907, p. 251) as follows:

The spawn is very peculiar, in that the eggs are cemented together in a single layer in the form of long, hollow strings, which, when extruded, are several inches wide and folded or plaited like the bellows of an accordian, but are capable of being drawn out to

the length of 3 to 7 feet. One fish in an aquarium at the Bureau of Fisheries, Washington, D. C., deposited a string 88 inches long. The weight after fertilization was 41 ounces, while the weight of the fish before the escape of the eggs was only 24 ounces. The egg masses are not attached to stones, vegetation, or other submerged objects, but are deposited loosely in the water. Spawning takes place at night in water having a temperature of 44° to 50° F., and the hatching period lasts from two to four weeks.

Vast numbers of eggs of this species are hatched annually by fish-cultural stations situated on streams tributary to Chesapeake Bay.

This fish averages less than 1 foot in length and 1 pound in weight. The maximum size recorded is 4½ pounds. The perch is of wide distribution and an important food and game fish in many parts of its range, including the streams tributary to the northern part of Chesapeake Bay. It is common enough in the brackish waters in certain sections of the Chesapeake to be of some commercial value, and ranks fairly high as to the quality of its flesh. It is a ready biter, taking a large variety of baits. It is also caught with fyke nets, pound nets, and seines.

Habitat.—North Carolina to Nova Scotia, the Great Lakes region, northern part of the Mississippi Valley, northward to the Red River Basin.

Chesapeake localities.—(*a*) Previous records: None definitely from brackish water. (*b*) Specimens in collection: From Havre de Grace, Baltimore, Annapolis, Love Point, Solomons, and Oxford, Md., and Lewisetta, Va. Highest salinity, at Annapolis, November 1, 1921, 12.94 per mille.

Comparison of lengths and weights of yellow perch

Number of fish weighed and measured	Length	Weight	Number of fish weighed and measured	Length	Weight
	Inches	*Ounces*		*Inches*	*Ounces*
1	3½	0.3	6	7¼	2.4
3	4½	.6	3	7½	2.6
4	4¾	.7	2	7¾	2.8
4	5	.8	8	8	3.6
9	5¼	1.0	5	8¼	3.9
5	5½	1.1	6	8½	4.2
11	5¾	1.3	1	8¾	4.6
9	6	1.4	3	9	5.0
10	6¼	1.5	1	9¼	5.2
8	6½	1.8	2	9¾	5.7
5	6¾	2.0	1	10½	7.3
4	7	2.3			

Family LVII.—ETHEOSTOMIDÆ. The darters

The darters usually have been considered dwarf or diminutive perches and are often all placed under the perch family, Percidæ. Jordan, in his "A Classification of Fishes" (1923, p. 187), however, gives the darter family rank under the name Etheostomidæ. The Etheostomidæ, as understood by Jordan, differ from the Percidæ in having six branchiostegals instead of seven; head (preopercle) unarmed; air bladder obsolete or nearly so; anal with one or two spines. A single genus and species of this large family of fresh-water fishes comes within the scope of the present work.

97. Genus BOLEOSOMA DeKay. Tesselated darters

Body elongate, fusiform; head small; snout dorsally strongly decurved; parietal region slightly convex; mouth small, horizontal; premaxillaries protractile; small, pointed teeth present on jaws and vomer; gill membranes narrowly to broadly connected; scales rather large, those on median line of abdomen not enlarged or deciduous; lateral line complete or interrupted; dorsal with 8 to 10 spines; soft dorsal notably longer than the anal; anal with a single short spine; ventral fins well separated; coloration rather plain, without red or blue.

127. Boleosoma olmstedi (Storer). Darter; Johnny darter.

Etheostoma olmstedi Storer, Jour., Bost. Soc. Nat. Hist., 1839, p. 61, Pl. V, fig. 2; Hartford, Conn.

Estrella atromaculata Girard, Proc., Ac. Nat. Sci., Phila., 1859, p. 66; Potomac River.

Boleosoma olmstedi Uhler and Lugger, 1876, ed. I, p. 134; ed. II, p. 115; Smith and Bean, 1899, p. 186.

Boleosoma nigrum olmstedi Jordan and Evermann, 1896–1900, p. 1057, Pl. CLXXI, fig. 451; Evermann and Hildebrand, 1910, p. 161; Fowler, 1912, p. 55.

Head 3.85 to 4.15; depth 5.45 to 6.1; D. VIII to X–14 or 15; A. I, 9 to 11; scales 48 to 55. Body slender, scarcely compressed anteriorly; caudal peduncle compressed, 2.4 to 2.8 in head;

head low, as broad as deep at eyes; snout rather short, decurved, 3.45 to 3.85; eye 3.4 to 3.75; interorbital very narrow, 11.15 to 13.6; mouth placed low, horizontal, terminal; maxillary reaching to or a little beyond anterior margin of eye, 2.9 to 3.25 in head; opercle ending in a strong spine; preopercle unarmed; gill membranes somewhat united, free from the isthmus; scales strongly ctenoid, covering entire body, including the chest, also present on cheeks and opercles; lateral line complete; dorsal fins well separated, the spines of the first slender, the longest one equal to distance from tip of snout to preopercular margin; soft dorsal somewhat higher; caudal fin straight to slightly rounded; anal fin small, its origin falling slightly behind that of soft dorsal; ventral fins moderate, inserted a little behind base of pectorals; pectoral fins rather long, pointed, 0.86 to 1 in head.

Color olivaceous above; pale underneath; back with six to eight black, saddlelike blotches; sides with irregular dark markings; a dark bar below the eye and one in front of it; dorsal fins, caudal, and pectorals spotted and barred with black; anal and ventrals plain.

Many specimens, ranging from 35 to 80 millimeters (1½ to 3⅛ inches) in length, were preserved. This is the only darter taken in brackish water. The species appears to be variable and varieties have been recognized. The form herein described, as a matter of fact, is often considered only a subspecies or variety of *B. nigrum*, the typical form of which occurs in the upper Mississippi and the Great Lakes region. *B. olmstedi* may be recognized by the complete lateral line, the completely scaled chest, cheeks, and opercles, the high fins, and the more profuse and distinct dark markings on the body and fins.

The stomach contents of 12 specimens taken in brackish water consisted wholly of small crustaceans (principally Gammarus) and insect larvæ. Specimens taken in May, 1922, are in spawning condition. The ovary of a female 62 millimeters in length contained 340 eggs of uniform size, approximately 1 millimeter in diameter after preserving in alcohol. The smallest sexually mature female found in the collection is 43 millimeters long, and the smallest sexually mature male has a length of only 40 millimeters.

The largest specimens in the collection (slightly exceeding 3 inches in length) appear to represent the maximum size attained by the Johnny darter. This fish is generally common in clear, running streams, occurring also in quiet and standing waters. The writers find no mention in literature of its occurrence in brackish water. It was taken only at the head of Chesapeake Bay, where it was common in water that was slightly saline.

Habitat.—Massachusetts to North Carolina in coastwise streams.

Chesapeake localities.—(*a*) Previous records: None from brackish water. (*b*) Specimens in collection: All from the vicinity of Havre de Grace, Md. Highest salinity, Elk River, opposite Turkey Point, November 11, 1921, 2.23 per mille.

Family LVIII.—CENTRARCHIDÆ. The fresh-water basses and sunfishes

Body usually rather short and compressed; mouth large or small; premaxillaries protractile; maxillary usually with a supplemental bone, obsolete in small-mouthed species; teeth pointed, in bands on jaws, vomer, and palatines, rarely on tongue; opercle ending in two points, or with a single long flap; preopercle entire or slightly serrate; pseudobranchiæ small; branchiostegals usually 6; gill membranes separate and free from the isthmus; gill rakers usually short; scales present on body, opercles, and cheeks; lateral line present, usually complete; dorsal fin continuous, sometimes deeply notched, with 6 to 13 spines; anal fin large or small, with 3 to 8 spines. This family includes some of the best known and most important fishes of American fresh waters. Nearly all the species are carnivorous, and they build nests in which the eggs and young are carefully guarded.

KEY TO THE GENERA

a. Anal fin somewhat longer than the dorsal, with six spines; body and fins profusely and irregularly spotted with black ..... Pomoxis, p. 239

aa. Anal fin much shorter than the dorsal, with three spines.

b. Body comparatively short and deep, strongly compressed, the depth frequently half the length, always exceeding one-third of the length; dorsal fin continuous, scarcely or not at all notched at the beginning of the soft rays.

c. Caudal fin rounded; opercle without a flap, ending in two flat points; dorsal with nine spines; size small, rarely exceeding a length of 3 inches ..... Enneacanthus, p. 240

cc. Caudal fin emarginate, never rounded; opercle with a large black flap in the adult; dorsal with 10 spines; size larger ..... Lepomis, p. 241

bb. Body elongate, not strongly compressed, the depth rarely as great as one-third the length; dorsal fin deeply notched; mouth large; maxillary reaching opposite middle of eye to beyond eye ..... Micropterus, p. 242

98. Genus POMOXIS Rafinesque. Crappies

Body rather deep, strongly compressed; upper anterior profile more or less concave over eyes; mouth large, oblique; lower jaw projecting; maxillary broad, with a large supplemental bone; teeth pointed, present on jaws, vomer, palatines, and tongue; gill rakers long and slender; scales moderate, feebly ctenoid; anal fin larger than the dorsal, with about 6 spines and 18 soft rays; dorsal with about 6 spines and 14 soft rays; caudal fin emarginate; ventral fins close together; with a strong spine and 5 branched rays. One species was taken in slightly brackish water.

128. Pomoxis annularis Rafinesque. Crappie; Speckled perch; Strawberry bass.

Pomoxis annularis Rafinesque, Amer. Month. Mag., 1818, p. 41; falls of the Ohio River. Jordan and Evermann, 1896–1900, p. 987, Pl. CLIV, fig. 415; Smith and Bean, 1899, p. 185.

Head 2.8; depth 2.75; D. VI, 14; A. VI, 18; scales 48. Body elongate; the back not greatly elevated; a line at right angles to the posterior margin of the maxillary passing notably in front of origin of dorsal; upper profile moderately concave over eyes; head rather long; snout moderate, 3.75 in head; eye 4.1; interorbital 5.4; mouth large, oblique; lower jaw projecting; maxillary reaching nearly opposite posterior margin of pupil, 2.25 in head; preopercular margin with small serrations at lower posterior angle; gill rakers slender, 21 on lower limb of first arch; scales moderate, weakly ctenoid; dorsal and anal fins similar, but with the spines in the anal rather stronger; caudal fin rather deeply emarginate; ventral fin moderate, inserted a little behind base of pectorals; pectoral fins rather pointed, 1.7 in head.

Color olive silvery, mottled with darker, irregular spots and blotches, forming more or less definite bars on upper part of sides; the dark markings extending on dorsal and caudal and to a smaller extent on the anal; ventrals and pectorals plain translucent.

A single specimen of this species, 160 millimeters (6¼ inches) in length, was taken in slightly brackish water. *P. sparoides*, a closely related species, was not seen in brackish water. Smith and Bean (1899, p. 185) offer the following remarks relative to crappies:

> Both of these species were introduced into the Potomac River and the Chesapeake and Ohio Canal by the Fish Commission in 1884, and have become very common in places, noticeably Little River, Four-mile Run, Eastern Branch, and in the river near Seven Locks; also through the canal as far as Harpers Ferry. *P. annularis* is the more abundant here. These are excellent game and food fishes and many are now caught by anglers. The two species are much alike and not usually distinguished by local fishermen, who apply the names crappie, strawberry bass, strawberry perch, and speckled perch indiscriminately.

The species are distinguished principally by the difference in the depth of the body, the shape of the upper anterior profile, and the color; *P. annularis* being more slender, with a more concave profile, and having more or less definite dark bars on the sides; whereas, the dark markings in *P. sparoides* are irregular, more or less elongate, never forming vertical bars. A straight line placed at the posterior margin of maxillary and at right angles to the anterior margin of the maxillary passes in front of the dorsal in *P. annularis*, while a line similarly placed in *P. sparoides* passes through the dorsal.

This crappie, according to published accounts, is strictly carnivorous, living mainly on insects, crustaceans, and fish. Spawning takes place during the spring.

This fish lives under a large variety of conditions, adapting itself particularly well to artificial ponds. It has been widely distributed by fish culturists and is an important food fish in many localities. It is only a straggler in brackish water and is of no commercial importance among the fishes of Chesapeake Bay.

The maximum weight attained by this crappie is recorded as 3 pounds. (Bean, 1903, p. 461.) The average weight of market fish, however, is less than a pound.

Habitat.—Great Lakes, southward to Alabama and Texas and westward to Kansas and Nebraska. Through canals and through the efforts of fish culturists, the species has become established in various places on the Atlantic slope, from New York to Georgia.

Chesapeake localities.—(*a*) Previous records: None known to be brackish-water. (*b*) Specimen in collection: Near the mouth of the Susquehanna River, Havre de Grace, Md., November 9, 1921, salinity, 1.53 per mille.

99. Genus ENNEACANTHUS Gill. Little sunfishes

Body short, deep; mouth small; teeth present on jaws, vomer, and palatines; maxillary with a well developed supplemental bone; margin of opercle entire; opercle ending in two flat points; scales large; lateral line usually complete; gill rakers short and rather few; dorsal with about nine spines; anal with three spines; caudal fin with round margin. One species was taken in brackish water in the northern sections of Chesapeake Bay.

129. Enneacanthus gloriosus (Holbrook). Speckled perch; Blue-spotted sunfish; Little sunfish.

Bryttus gloriosus Holbrook, Journ., Ac. Nat. Sci., Phila., 1855, p. 51; Cooper River, S. C.

Enneacanthus gloriosus Uhler and Lugger, 1876, ed. I, p. 131; ed. II, p. 112; Jordan and Evermann, 1896–1900, p. 993, Pl. CLVIII, fig. 422; Smith and Bean, 1899, p. 185; Evermann and Hildebrand, 1910, p. 161; Fowler, 1912, p. 55.

Head 2.75 to 3.05; depth 2 to 2.65; D. IX, 10 or 11; A. III, 9 to 11; scales 30 to 32. Body moderately deep, compressed; head rather short; snout blunt, 4 to 5.3 in head; eye 2.85 to 3.75; interorbital 3.4 to 4.6; mouth small, oblique, terminal or slightly superior; maxillary reaching opposite anterior margin of pupil, 2.8 to 3.1 in head; gill rakers short, 9 or 10 on lower limb of first arch; scales large, firm, ctenoid; lateral line usually wanting on several scales posteriorly; dorsal fin long, its origin over base of pectorals; caudal fin round; anal fin short, with three short, stout spines; ventral fins reaching somewhat beyond origin of anal, inserted a little behind base of pectorals; pectoral fins rather long, 1.25 to 1.55 in head.

Color of male dark green above, abdomen golden; sides with sky-blue spots, about half as large as scales, extending on dorsal, caudal, and anal; opercle with jet-black spots; ground color of dorsal greenish (dusky in spirits); caudal and anal reddish; ventrals plain, with red on longest ray; pectorals slightly greenish. Females olive green with purplish luster; bluish spots wanting. Some preserved specimens have indications of dusky crossbars on sides and pale lines along the rows of scales.

Numerous specimens of this little fish, ranging from 20 to 85 millimeters (¾ to 3⅜ inches) in length, were preserved. This species is separated from other sunfishes by the small mouth and round tail. It inhabits sluggish water, especially frequenting places with aquatic growths of vegetation. It is not uncommon in the brackish waters near mouths of streams in the northern sections of Chesapeake Bay, frequenting water with a specific gravity as great as 1.0095. It was particularly abundant in a brackish pond near Annapolis, where more than 1,000 were caught in 20 hauls of a 30-foot collecting seine.

The food of this fish, according to the contents of 13 stomachs examined, consists mainly of small crustaceans—that is, copepods, amphipods, and isopods. Insects and worms, too, were present in a few stomachs; also fragments of plants. Spawning apparently takes place in May and June, as specimens taken at about this time contained well-developed roe.

The blue-spotted sunfish is one of the most beautiful of our local fishes. It is hardy and an attractive aquarium fish. It is of no commercial importance because of the small size attained. The largest specimen at hand, having a length of 3⅜ inches, represents the maximum size for the species.

Habitat.—New York to Georgia.

Chesapeake localities.—(*a*) Previous records: None known to be from brackish water. (*b*) Specimens in collection: Havre de Grace, Baltimore, Annapolis, Love Point, and Oxford, Md., and Lewisetta, Va. Highest salinity, entrance to Lake Ogleton, Annapolis, Md., November 3, 1921, 12.88 per mille.

100. Genus LEPOMIS Rafinesque. Common sunfishes

Body ovate, quite strongly compressed; mouth moderate or small, terminal; maxillary narrow, not extending beyond pupil, with or without a small supplemental bone; no teeth on pterygoids or tongue, short or blunt teeth on the narrow pharyngeal bones; preopercular margin entire; opercle ending in a more or less elongated, conspicuously colored flap; gill rakers usually short and feeble; dorsal with 10 spines; anal with 3 spines and much shorter than the dorsal; caudal fin emarginate.

A single species of this genus was taken in the brackish waters of the Chesapeake. In the fresh waters the fishes of this genus are numerous, both as to species and individuals. Some of the species, especially the young, are difficult to distinguish.

130. Lepomis gibbosus (Linnæus). "Tobacco box;" Pumpkin seed; Sand perch; "Sunfish;" Bream.

Perca gibbosus Linnæus, Syst. Nat., ed. X, 1758, p. 292; Carolina.
Lipomis aureus Uhler and Lugger, 1876, ed. I, p. 132.
Pomotis aureus Uhler and Lugger, 1876, ed. II, p. 113.
Lepomis gibbosus Bean, 1883, p. 365; Smith, 1892, p. 71.
Eupomotis gibbosus Jordan and Evermann, 1896, p. 1009, Pl. CLXI, fig. 429; Smith and Bean, 1899, p. 186; Evermann and Hildebrand, 1920, p. 161; Fowler, 1912, p. 55.

Head 2.75 to 3.35; depth 1.85 to 2.9; D. X, 10 to 12; A. III, 9 or 10, scales 34 to 40. Body deep, ovate, strongly compressed; head rather short; snout broad, its length 3.05 to 4.8 in head; eye 3 to 4.3; interorbital 2.9 to 3.9; mouth small, oblique, terminal; maxillary scarcely reaching anterior margin of eye in some specimens, to anterior margin of pupil in others, 3.55 to 4 in head; preopercular margin entire; opercular flap very broad; gill rakers very short, 9 to 11 more or less developed on lower limb of first arch; scales of moderate size, firm, ctenoid; lateral line complete; dorsal fin long, its origin over or a little behind base of pectorals, the spinous portion longer than the soft part; caudal fin rather deeply emarginate; anal fin short, with three strong spines, the soft part similar to that of dorsal and coterminal with it; ventral fins moderate, reaching to vent, and in some specimens to or slightly beyond origin of anal, inserted somewhat behind base of pectorals, pectoral fins rather long, pointed, 1.05 to 1.4 in head.

Color above greenish, variously spotted with brown and with bluish reflections; head mostly brassy, with irregular sky-blue lines under eye; opercular flap jet black, margined with scarlet; abdomen golden; dorsal and caudal mainly dusky; anal and ventrals more or less dusky yellowish; pectorals light yellowish.

Many specimens of this common sunfish, ranging in length from 22 to 180 millimeters (⅞ to 7⅛ inches), were preserved.

This fish is not uncommon in the brackish waters in the northern sections of Chesapeake Bay, occurring at times in strongly brackish water. On September 6, 1921, at Thighmans Creek near Love Point, for example, 115 adults and 580 small fish were taken in eight hauls of a 30-foot collecting seine in brackish water. In the streams tributary to the bay it is among the commonest of species; and it is well known for its gameness and beauty, making it the joy of youthful anglers.

The food of the tobacco box in the brackish waters of Chesapeake Bay, according to the contents of 65 stomachs, consists of the following, named in the order of their apparent importance: Isopods, annelids, amphipods, mollusks, and insect larvæ. A comparatively large amount of vegetable débris also was present. However, it is uncertain whether this was eaten as food or obtained more or less by accident in the capture of small animal life.

Spawning takes place in the spring and early summer. The breeding habits are described by Smith (1907, p. 243) as follows:

> The nest is a slight depression on the bottom, made by the fins, and after the eggs are laid and attached to stones or weeds, the male stands guard and repels intruding fishes or other animals; the care of the young also devolves on the male, which at this season is in his brightest colors and even in the water can be readily distinguished from his mate.

Many of the specimens at hand have isopods (*Livoneca ovalis*) attached to the gills. In the field hundreds of fish were examined, and at least 80 per cent of those found in brackish water bore this parasitic isopod. One or two, and sometimes three or four, were found on the gills on one or both sides. A number of sunfish found dead along the shore probably were killed by this large isopod, and the destruction from this cause may be large.

Habitat.—Northern part of the Mississippi Basin, the Great Lakes, and along the Atlantic seaboard from Maine to Florida (not found by Hildebrand (1923) in the Savannah River Basin in the vicinity of Augusta, Ga.).

Chesapeake localities.—(*a*) Previous records: "In the region of Baltimore they prefer the brackish water * * *" (Uhler and Lugger, 1876); St. George Island (other localities not definitely brackish water). (*b*) Specimens in collection: Many localities, from Havre de Grace, Md., southward to Lewisetta, Va. Highest salinity, Blackistone Island, Md., October 20, 1921, 18.17 per mille.

Comparison of lengths and weights of the tobacco box

Number of fish weighed and measured	Length	Weight	Number of fish weighed and measured	Length	Weight
	Inches	*Ounces*		*Inches*	*Ounces*
5	3½	0.5	5	5¼	1.7
5	4	.7	5	5½	2.0
4	4¼	1.0	4	5¾	2.4
11	4½	1.1	2	6	2.7
9	4¾	1.3	1	6¼	3.0
8	5	1.5	1	6½	4.1

101. Genus MICROPTERUS Lacépède. Black basses

Body elongate, compressed; back not much elevated; head long, rather low; snout conic; mouth large, oblique; lower jaw projecting; maxillary broad, with a well-developed supplemental bone, reaching opposite middle to beyond eye; teeth pointed, in bands on jaws, vomer, and palatines; opercle ending in two broad points; preopercle entire; gill rakers moderate; scales rather small, ctenoid; lateral line complete; dorsal fin continuous, rather deeply notched, with 10 rather low spines; caudal fin emarginate; anal fin with three spines, the soft part similar to that of the dorsal. This genus has three species; two are represented in the fresh and slightly brackish waters of the Chesapeake region.

KEY TO THE SPECIES

a. Mouth moderate; maxillary reaching to or a little beyond middle of eye; scales rather small, 69 to 72 in lateral series, 10 between lateral line and beginning of soft part of dorsal; color nearly uniform (young more or less barred and spotted) ..... *dolomieu*, p. 242

aa. Mouth very large; maxillary reaching to or beyond posterior margin of eye; scales larger, 61 to 64 in lateral series, 7 or 8 between lateral line and beginning of soft part of dorsal; a distinct black lateral band usually present, occasionally obsolete in adults ..... *salmoides*, p. 243

131. Micropterus dolomieu Lacépède. Black bass; Smallmouth black bass.

Micropterus dolomieu Lacépède, Hist. Nat. Poiss., IV, 1803, p. 325; locality doubtful. Bean, 1883, p. 365; Jordan and Evermann, 1896-1900, p. 1011, Pl. CLXII, figs. 430, 430a; Smith and Bean, 1899, p. 186; Fowler, 1912, p. 55.

Head 2.8 to 2.85; depth 3.35 to 3.6; D. X, 14; A. III, 11; scales 10–69 to 72. Body elongate, compressed; head rather long and low; snout pointed, 3.2 to 3.8 in head; eye 3.35 to 4.15; interorbital 5.25 to 5.65; mouth moderate, slightly oblique; lower jaw projecting; maxillary reaching about middle of eye, 2.15 to 2.3 in head; gill rakers moderate, about seven more or less developed on lower limb of first arch; scales rather small, firm, feebly ctenoid, scales on cheeks much smaller than on body; lateral line complete, arched a little anteriorly; dorsal fin long and low, the spinous part lower than the soft portion; caudal fin emarginate; anal fin short, preceded by three short spines, the soft part similar to that of the dorsal and coterminal with it; ventral fin inserted under or slightly behind base of pectorals, failing to reach vent; pectoral fins short, round, 2.2 to 2.3 in head.

Color in life, of young 2½ to 4 inches long, greenish blue or greenish brown, mottled with brown, the mottlings most conspicuous above lateral line; five brownish stripes on sides of head back of and below eye; underneath head and parts of opercle sky-blue; abdomen grayish white; dorsal dusky and light brown, slightly mottled; caudal dusky at base, median parts yellowish brown, distally with black, margined with white or salmon red; anal dusky yellow, slightly mottled, margined with white; ventrals and pectorals yellowish, the latter slightly dusky on one specimen. No adults were

taken, but published accounts give the color as nearly uniform olive green; several of the stripes present on the head in the young persist in the adult.

Five small specimens of this bass, ranging in length from 65 to 100 millimeters (2½ to 4 inches), were secured in slightly brackish water, and they form the basis for the foregoing description. This species differs from the large-mouthed black bass principally in the smaller mouth, slightly smaller scales on body, the much smaller scales on cheeks, and in the more uniform color.

The food of the adult smallmouth bass, according to published accounts, consists mainly of fish and crawfish. Three small specimens, taken in slightly brackish water, had fed on isopods, insects, and fish. Spawning takes place during the spring. The species is cultivated through pond-cultural methods, as it does not lend itself well to stripping. In this species, as in others of this family, the male builds a nest, in which the female deposits the eggs, which are fertilized when laid. The male then stands guard over the nest, fanning the eggs with its fins and fighting off intruders.

This species generally lives in higher altitudes than the large-mouthed species, preferring cooler and swifter water. It is not a native of the Chesapeake, having reached that vicinity through artificial means. Its occurrence in still, brackish water seems quite unusual.

The maximum weight recorded for this fish is 6 pounds. It is an important game fish in many sections, taking live minnows and other live bait, and it also rises to the artificial fly. It is only a straggler in the brackish waters of the Chesapeake, where it is of no importance either as a food or a game fish.

Habitat.—Vermont to the Great Lakes and Manitoba; southward to South Carolina, Mississippi, and Arkansas. (Its range has been considerably extended by artificial means beyond its natural habitat as given here.)

Chesapeake localities.—(*a*) Previous records: None from brackish water. (*b*) Specimens in collection: Havre de Grace and Love Point, Md. Highest salinity, Love Point, May 11, 1922, 7.39 per mille.

132. Micropterus salmoides (Lacépède). Largemouth black bass; Black bass; "Chub;" "Trout."

Labrus salmoides Lacépède, Hist. Nat. Poiss., IV, 1803, p. 716; South Carolina.

Micropterus salmoides Uhler and Lugger, 1876, ed. I, p. 129; ed. II, p. 111; Jordan and Evermann, 1896–1900, p. 1012, Pl. CLXIII, fig. 431; Smith and Bean, 1899, p. 186; Evermann and Hildebrand, 1910, p. 161.

Head 2.8 to 3.05; depth 2.95 to 3.3; D. X, 12 or 13; A. III, 11; scales 7 or 8–61 to 64. Body elongate, compressed; head rather long and low; snout pointed, 3.55 to 3.85; eye 4.15 to 5; interorbital 4.1 to 4.45; mouth large, slightly oblique; lower jaw projecting; maxillary reaching to or a little beyond posterior margin of eye, 2 to 2.15 in head; gill rakers rather short, about seven more or less developed on lower limb of first arch; scales moderate, firm, rather weakly ctenoid scales on cheeks nearly as large as on body; lateral line complete, slightly arched anteriorly; dorsal fin long and rather low, deeply notched, the spinous part lower than the soft portion; caudal fin emarginate; anal fin preceded by three rather short, graduated spines, the soft part similar to that of the dorsal and coterminal with it; ventral fins short, failing to reach vent, inserted slightly behind base of pectorals; pectoral fins short, round, 2.15 to 2.3 in head.

Color dull green above, with brassy luster; sides silvery; abdomen white; three dark bars on sides of head back of and below eye; sides with a dark lateral band, usually more distinct in the young than in the adult, sometimes broken up into blotches and indistinct or occasionally wanting, sides usually also with irregularly placed dark blotches; dorsal fin slightly spotted, the caudal distally dusky with pale margin; fins otherwise plain.

This bass is represented by numerous specimens, ranging from 90 to 323 millimeters (3½ to 12⅝ inches) in length, which were taken in brackish water. This fish has a larger mouth than its congener, larger scales, particularly on the cheeks, and usually it has a dark lateral band, which also distinguishes it from the related species.

The food of the largemouth black bass in fresh water is reported to consist mainly of fish and crustaceans. The contents of 22 stomachs taken from specimens caught in brackish water of the Chesapeake consisted exclusively of fish remains. This fish is highly predatory, and where it is common the destruction of minows and smaller fish is great. What has been said relative to the spawning habits and artificial culture of the smallmouth black bass applies equally as well to the present species.

This bass is of wide distribution, apparently thriving best in the warmer waters of the United States, where it reaches the largest size. It is at home in sluggish streams, ponds, and lakes, and it enters brackish water freely. It is not a native of the Chesapeake region, having been first introduced in the Potomac River, according to Uhler and Lugger, prior to 1876, the date of publication of their "List of Fishes of Maryland." These authors say: "Introduced into the Potomac River from the Youghioghany, and now abounds in some of the upper parts of that stream; likewise in the Chesapeake and Ohio Canal, and has become naturalized in Lake Roland near Baltimore."

While "black bass" is the most universally used name throughout the fish's range, many local terms are used. In the Chesapeake region it is frequently called "chub" and in the South, "trout." The largemouth black bass is one of the most sought-after game fish in the United States, particularly throughout the Mississippi Valley, to the Atlantic seaboard, and even down to the lower reaches of streams flowing into the Gulf of Mexico, where very large fish frequently are taken. In St. Andrews Bay, northwestern Florida, we have taken the largemouth black bass in brackish water along with spotted squeteage (*Cynoscion nebulosus*) and blue crabs (Callinectes). In the Potomac and other tributary streams of the Chesapeake, as elsewhere, it is an important food and game fish, but it is not abundant enough in the brackish waters to be considered of commercial value in connection with the fisheries of the bay.

The following weights were obtained from Chesapeake Bay fish: Length 6¼ inches, 1.9 ounces (3 fish); 6½ inches, 2.3 ounces (6 fish); 7 inches, 2.7 ounces (1 fish); 7½ inches, 3.2 ounces (1 fish); 8 inches, 4.2 ounces (1 fish); 12½ inches, 17.3 ounces (1 fish).

Habitat.—Great Lakes to southern Florida and Mexico. Through the activities of the Federal and State fish commissions it has been introduced into nearly every State in the Union and also in Europe.

Chesapeake localities.—(*a*) Previous records: None definitely from brackish water. (*b*) Specimens in collection: Havre de Grace and Howells Point, Md., and Lewisetta, Va. Highest salinity, Lewisetta, August 6, 1921, 12.87 per mille.

Family LIX.—MORONIDÆ. The white basses

Body elongate, compressed; mouth large; teeth well developed, pointed, fixed; *maxillary without a supplemental bone;* scales of moderate size; dorsal fins separate. Two genera of important food fishes of this family are included in the fauna of Chesapeake Bay.

KEY TO THE GENERA

a. Body rather short and deep; jaws nearly equal; anal fin with III, 8 to 10 rays....Morone, p. 244
aa. Body more elongate; lower jaw projecting; anal fin with III, 10 to 12 rays.....Roccus, p. 247

102. Genus MORONE Mitchill. White perches

Body rather short and deep; jaws nearly equal; edge of tongue with linear patches of teeth; lower margin of opercle finely serrate; scales rather large; dorsal fins more or less connected by membranes, the spines stout; anal fin short, with three strong spines and with 8 to 10 soft rays.

133. Morone americana (Gmelin). White perch; "Blue-nosed perch"; "Gray perch"; Black perch.

Perca americana Gmelin, Linnæus's Syst. Nat., ed. XIII, vol. I, pt. 3, 1788, p. 1205; New York.

Morone americana Uhler and Lugger, 1876, ed. I, p. 127; ed. II, p. 108; Jordan and Evermann, 1896-1900, p. 1134, Pl. CLXXXI, fig. 479; Smith and Bean, 1899, p. 186; Evermann and Hildebrand, 1910, p. 161; Fowler, 1912, p. 55; Snyder 1917, pp. 18 and 28.

Roccus americanus Bean, 1883, p. 366.

Head 2.6 to 2.95; depth 2.6 to 3.2; D. IX–I, 12; A. III, 8 to 10; scales 7–48 or 49. Body rather deep, compressed; back elevated; head rather low; snout pointed, 3.6 to 4.2; eye 3.2 to 4.85; interorbital 4.6 to 5.65; mouth rather large, oblique, terminal or with the lower jaw slightly projecting; maxillary reaching about opposite anterior margin of pupil, 2.65 to 3.1 in head; teeth small, pointed, in bands on jaws, vomer, and palatines; opercle ending in two flat points; preopercular margin serrate; gill rakers rather slender, 13 or 14 on lower limb of first arch; scales strongly ctenoid, reduced scales extending on base of vertical fins, and forward on head to nostrils; dorsal fins separate, the spines large and strong; caudal fin slightly forked; anal fin with three

strong spines, the soft part similar to that of the dorsal; ventral fins rather large, inserted a little behind base of pectorals; pectoral fins moderate, not reaching tips of ventrals, 1.4 to 1.7 in head.

Color variable, mostly silvery, often greenish to bluish and blackish above; sides sometimes brassy, frequently with irregular, dark longitudinal lines; fins often all more or less dusky; ventrals sometimes white; pectorals often plain. Large individuals often with bluish luster on head; young less than 4 or 5 inches in length usually silvery gray, never with blue on head.

Many specimens of this species, ranging from 55 to 280 millimeters (2⅛ to 11 inches) in length, were preserved. No individuals smaller than the ones preserved were seen in salt and brackish water. The plain coloration and the strong spines in the fins are among the distinguishing characters of this common and well-known fish. The young do not differ greatly from the adult. The white perch is essentially an anadromus species, but it is not infrequently landlocked in fresh water.

The food of this fish according to Smith (1907, p. 275) consists of minnows, shrimps, and other animals, and Bigelow and Welsh (1925, p. 258) mention small fish fry of all kinds, young squid, shrimps, crabs, and various other invertebrates, as well as the spawn of other fish. The contents of 130 stomachs of this fish taken in Chesapeake Bay consisted of fish, crustaceans of various kinds and sizes, annelids, and insect larvæ. A small amount of vegetable débris, too, frequently is present. The larger individuals had fed mainly on fish. Shrimp, Mysis, and annelids also are eaten by the larger fish. Young 4 inches and less in length had fed mainly on annelids, amphipods, isopods, copepods, and insect larvæ.

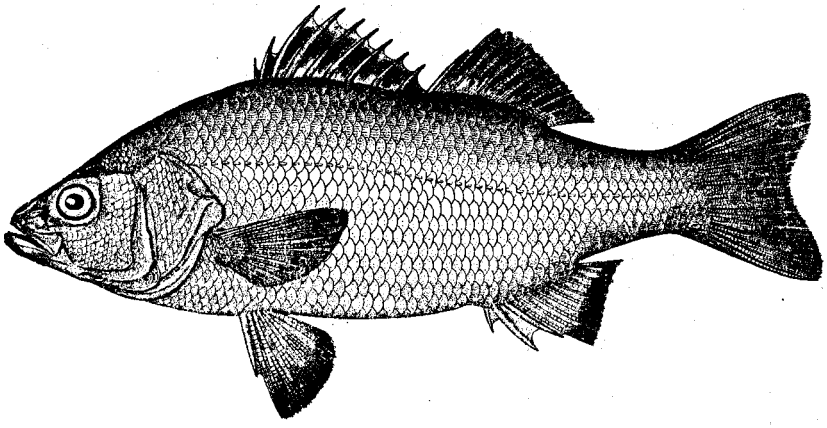

FIG. 138.—*Morone americana.* From a specimen 12¼ inches long

The white perch spawns from April to June, according to published accounts. Smith (1907, p. 275) gives a short season for the Albermarle, N. C., region, beginning between April 1 and 10 and lasting 10 days. Bigelow and Welsh (1925, p. 259) state that in southern New England the white perch breeds in April, May, and June. It has been learned through the present investigation that in Chesapeake Bay spawning occurs not only during April and May but that it may occur under certain conditions during December, for the *Fish Hawk* took 10 ripe males and 3 ripe females on December 9 and 10, 1915, at the following localities: Thomas Point Light, Sandy Point, and Sharps Inlet Light, in depths varying from 9½ to 21 fathoms. The ripe fish ranged in length from 5½ to 7¼ inches. It can not be concluded, however, that spawning takes place regularly at this season of the year, as no other ripe fish were taken in the winter months during subsequent collecting in the deeper holes of the bay. Further investigation relative to the winter spawning of this fish is highly desirable. Fish in spawning condition occur regularly in the shallow shore waters in April. The earliest date upon which ripe fish (two males, taken at Buckroe Beach, Va.) were taken is April 10, 1922.

According to Welsh (field notes) the spawning season was at its height at Havre de Grace on April 29, 1912. In this same locality many spawning fish were seined on May 8 to 10, 1922, in 3 or 4 feet of water (fresh) along the immediate shores. In one haul of a 300-foot seine, 600 males and 196 females 3 to 7 inches in length were taken. Nearly all the larger fish were ripe. In three

other hauls in the same locality a preponderance of males also occurred, as a total of 91 males and 26 females was taken. The smallest ripe male in these lots of fish measured 109 millimeters (4⅛ inches), and the smallest ripe female measured 121 millimeters (4¾ inches) in length.

The eggs are small (0.73 millimeter in diameter) and hatch in six days at a water temperature of 51° to 53° F. At the time of hatching the fry measure 2.3 millimeters in length, reaching 3 millimeters at the end of 24 hours. (Ryder, 1887, pp. 518–519.) The eggs may be artificially stripped and fertilized; millions are hatched annually by fish-cultural stations situated on the streams tributary to Chesapeake Bay.

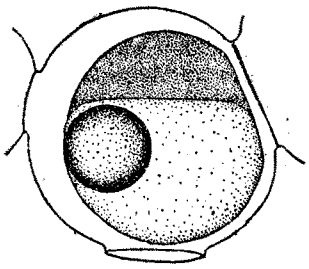

FIG. 139.—Egg recently fertilized

Virtually nothing is known of the rate of growth of the white perch, and our collections are inadequate and too erratic to permit the addition of any tangible information. Many fish taken in April ranged in length from 74 to 140 millimeters and may have been about 1 year old. The individuals of a collection made in the lower Rappahannock on July 25 ranged in length from 55 to 65 millimeters. These fish probably were the product of the last previous spawning season.

The white perch is one of the important food fishes of the Chesapeake. During 1920 it ranked eighth in quantity and seventh in value, the catch being 535,080 pounds, worth $51,914.

In Maryland the white perch ranked sixth in quantity and fifth in value, the catch being 316,915 pounds, worth $32,026. Of this amount, 42 per cent was caught in pound nets, 28 per cent in fyke nets, 21 per cent in haul seines, 6 per cent in gill nets, 3 per cent with lines, and 3 per cent with other apparatus. Dorchester, Cecil, Kent, and Baltimore Counties take first place in Maryland, with catches ranging from 53,400 to 41,000 pounds.

In Virginia it ranked twelfth in quantity and ninth in value, the catch being 218,165 pounds, worth $19,888. Of this amount, 32 per cent was taken in fyke nets, 28 per cent in pound nets, 24 per cent in haul seines, 9 per cent with gill nets, and 7 per cent with other apparatus. The largest catches are attributed to Norfolk and King George Counties, with 28,350 and 23,440 pounds, respectively. A catch of 420,000 pounds of white perch was made in Back Bay, Princess Anne County. This body of water, however, is removed from Chesapeake Bay and connects with the Atlantic Ocean, and therefore the catch is excluded from the statistics for the bay.

This fish is caught in all parts of Chesapeake Bay and its tributaries. It is commonest in brackish water, and the largest numbers are taken in the lower sections of tributary streams. Good catches, however, are also made in the spring, during the spawning season, far up various rivers where the water is always fresh. It is taken chiefly in the spring and the fall, from March until May and from September until November. A small number are caught in the winter with otter trawls or drift nets while fishing for striped bass. In the lower part of the bay, chiefly near the mouth of the Rappahannock River, a few pound nets fish all winter and report fair catches of white perch. In the upper sections of the bay good catches are made with pound nets during April and May. It was not infrequently taken by the *Fish Hawk* during the winter with the beam trawl in comparatively deep water. The greatest depth in which it was secured was 138 feet.

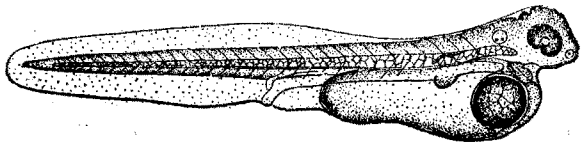

FIG. 140.—Larva, 6 days old, 8 millimeters long

Various names are given to this fish in Chesapeake Bay, but the one in most general use, especially north of the York River, is "white perch." In the vicinity of Norfolk "blue-nosed perch" is the most common name, whereas in various other parts of the bay "gray perch" and "black perch" are used. These various common names lead to confusion, especially as the name "white perch" is used in the vicinity of Norfolk for *Bairdiella chrysura*, a species belonging to the croaker family. The name "white perch" is the most widely used of all the various names. It would seem advantageous, in order to prevent confusion, if this name alone were to be adopted throughout the Chesapeake region.

The white perch is a rather small fish, those seen in the markets usually weighing less than 1 pound. However, it is always in demand and is one of the favorite food fishes of the bay. The maximum weight attained by the species is 2 pounds, but in the Chesapeake it seldom exceeds 1½ pounds.

Habitat.—Nova Scotia to South Carolina.

Chesapeake localities.—(*a*) Previous records: From many localities, principally from the upper sections of the bay. (*b*) Specimens in collections: From many localities from Havre de Grace, Md., to Cape Charles and Cape Henry, Va.

Comparison of lengths and weights of white perch

Number of fish weighed and measured	Length	Weight	Number of fish weighed and measured	Length	Weight
	Inches	*Ounces*		*Inches*	*Ounces*
2	3¾	0.4	31	7½	3.6
4	4	.5	16	7¾	3.8
5	4¼	.6	25	8	4.4
10	4½	.7	17	8¼	4.7
8	4¾	.9	11	8½	5.2
14	5	1.0	8	8¾	5.7
25	5¼	1.1	5	9	6.2
26	5½	1.3	9	9¼	6.7
23	5¾	1.5	10	9½	7.9
32	6	1.7	3	9¾	8.8
36	6¼	2.0	3	10	9.1
35	6½	2.1	1	10¼	9.9
34	6¾	2.5	2	10¾	11.4
30	7	2.8	1	12¼	18.0
40	7¼	3.1			

103. Genus ROCCUS Mitchill. Striped basses or rockfishes

Body elongate, moderately compressed; head long, pointed; lower jaw projecting; base of tongue with patches of teeth; dorsal fins well separated, the first with about 9 or 10 spines; anal with 3 spines and 10 to 12 soft rays. Two species, one in the Great Lakes and Mississippi Basin and the other coastwise from New Brunswick to Alabama (and introduced on the Pacific), are known.

134. Roccus lineatus (Bloch). Striped bass; Rock; Rockfish.

Sciæna lineata Bloch, Ichthyol., IX, 1792, p. 53, Pl. CCCV; "Mediterranean Sea" (?).

Roccus lineatus Uhler and Lugger, 1876, ed. I, p. 126; ed. II, p. 107; Smith, 1892, p. 71; Jordan and Evermann, 1896–1900, p. 1132, Pl. CLXXX, fig. 478; Evermann and Hildebrand, 1910, p. 161; Fowler, 1912, p. 55; Snyder, 1919, p. 55.

Roccus saxatalis Bean, 1883, p. 365.

Head, 3.1 to 3.25; depth, 3.45 to 4.2; D. IX or X–I, 11 or 12; A. III, 10 or 11; scales, 7 or 8–60 to 67. Body elongate, compressed; head rather low and long; snout pointed, 3.3 to 4.15; eye, 3 to 4.9; interorbital, 3.75 to 5.4; mouth large, oblique; lower jaw projecting; maxillary broad, reaching middle of eye, 2.4 to 2.7 in head; teeth small, present in bands on the jaws, vomer, palatines, and in two parallel patches on tongue; preopercle serrate; gill rakers long, slender, 14 or 15 on lower limb of first arch; scales rather small, ctenoid, extending on the base of the vertical fins; dorsal fins well separated, the first with rather long stiff spines; caudal fin forked; anal fin with three rather strong graduated spines, the soft part similar to that of the dorsal, each with concave outer margin; ventral fins moderate, inserted a little behind base of pectorals; pectoral fins rather short, 1.8 to 2.1 in head.

Color in life of a 17-inch specimen, greenish above; silvery on sides and below, with a brassy luster, except on belly; sides with 7 or 8 prominent longitudinal black stripes, several above and below lateral line, one running along lateral line, those below decreasing in length; the longest stripes reach base of caudal, but none extend on head; dorsal, caudal, and anal dusky or black; ventrals white, slightly dusky; pectorals greenish. Some of the side stripes are sometimes interrupted, but in number they remain fairly constant. Young of less than about 60 millimeters in length usually without dark longitudinal stripes, sometimes with indications of dusky crossbars.

Numerous specimens of this common species, ranging in length from 30 to 360 millimeters (1¼ to 14¼ inches), were preserved, and larger ones were examined in the field. The dark longi-

tudinal stripes on the sides from which it receives its scientific name, *lineatus*, at once distinguish this fish from all others in the Chesapeake. The young do not differ greatly from the adults, except in color, as stated in the description.

The rockfish is carnivorous, feeding on various kinds of animal life of suitable size. The contents of 48 stomachs taken from specimens caught in salt and brackish water of the bay consisted of fish, crustaceans, annelid worms, and insects. The larger fish had fed principally on fish, whereas the smaller ones had eaten mainly crustaceans. The young had fed on Mysis, Gammarus, annelids, and insects.

The striped bass is anadromous, coming in from the sea to brackish and fresh waters to spawn. Its chief spawning grounds perhaps are located in swift-running fresh-water streams. It ascends

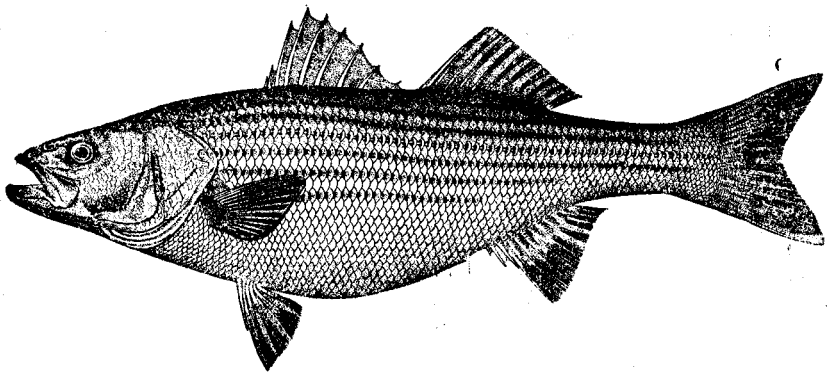

FIG. 141.—*Roccus lineatus*. From a specimen 21¼ inches long

the Potomac River to above Washington, where each spring it is taken among the rapids and bowlders. Smith (1907, p. 272) states that in the Roanoke River, N. C., the most important striped-bass spawning ground is in the vicinity of Weldon, where the river falls 50 feet in about 6 miles. "In these rapids, where the muddy current is exceedingly strong and rendered very erratic by islands, bowlders, and rocks, the fish spawns * * *." Bean (1903, p. 527) states that spawning takes place either in the rivers or in the brackish waters of bays and sounds. In North Carolina spawning takes place from late April to early May; in the Chesapeake region most of the spawning occurs in May; while in the Gulf of Maine (Bigelow and Welsh, 1925, p. 256) the chief spawning season apparently occurs in June.

The eggs of the striped bass may be incubated in shad jars, the young emerging in 48 hours in a water temperature of 67°, or in 36 hours at 70° F. After fertilization the eggs increase greatly in

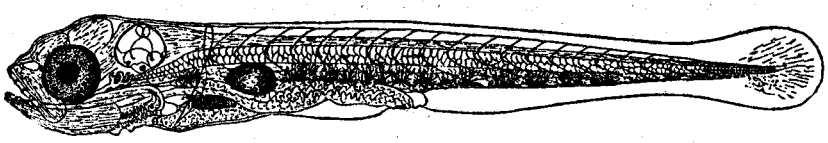

FIG. 142.—*Roccus lineatus*. Larva 5 millimeters long

size. Smith (1907, p. 272) says that in 1903 S. G. Worth, while conducting hatching operations on the Roanoke River, N. C., stripped from a 20-pound fish a mass of eggs that after fertilization and immersion in water measured 60 quarts and contained 1,500,000 eggs, on the basis of 25,000 eggs to a quart. According to the same author, who quotes Mr. Worth, a single female may be surrounded by many small males on the spawning grounds, and severe fights among the males take place.

The growth of the striped bass appears to be variable, and it is difficult to determine age by length frequencies alone. Bean (1903, p. 527) records young 1 inch in length taken the second week of June in the Delaware, and he states that some of these had grown to a length of 4½ inches by mid-October. In the Chesapeake the smallest fish, 30 millimeters (1⅙ inches) in length, were taken on

June 23. In July fish ranging from 45 to 53 millimeters (1⅝ to 2$\frac{1}{12}$ inches) were taken, and in August large numbers, measuring 50 to 70 millimeters (2 to 2⅞ inches), were collected. After this date the sizes vary so greatly that in some cases it is difficult to determine whether a fish is in its first or second year. Specimens taken by the *Fish Hawk* during the winter months appear to give no clue to the rate of growth. Eleven fish taken in April and May range quite gradually from 3¾ to 8½ inches in length, and it seems probable that they are fish about 1-year old.

The striped bass, or rockfish, is one of the most valuable and esteemed fish caught in Chesapeake Bay. During 1920 it ranked fifth, both in quantity and value, the catch being 1,410,630 pounds, worth $261,918. In Maryland it ranked fourth in quantity and second in value, the catch being 1,040,274 pounds, worth $193,295. Of this amount, 45 per cent was caught in pound nets, 27 per cent in gill nets, 21 per cent in haul seines, 4 per cent in purse seines, and 3 per cent with other apparatus. The counties taking the largest quantities were Kent, 459,475 pounds; St. Marys, 101,645 pounds; Cecil, 85,105 pounds; and Dorchester, 83,151 pounds.

In Virginia it ranked eighth in quantity and fifth in value, the catch being 370,356 pounds, worth $68,623. Of this amount, 55 per cent was caught in pound nets, 18 per cent in fyke nets, 18 per cent with haul seines, 7 per cent with gill nets, and 2 per cent with lines. The counties with the largest quantities were Northumberland, 49,330 pounds; Westmoreland, 45,355, pounds; Richmond, 35,200 pounds, Warwick, 33,500 pounds; and Lancaster, 33,025 pounds.

This fish is caught in all parts of Chesapeake Bay and its larger tributaries during the entire year, but it is taken in greatest numbers in the spring and fall. During the winter a special fishery is pursued by means of drift nets, which are gill nets that fish the bottom and drift with the tide. This winter fishery is confined to the region between Swan Point and Bloody Point, Md., where large numbers of striped bass apparently are present in the deeper channels during the winter months.

In certain localities this fish assumes first rank, and because of the prolonged season during which it may be caught it affords various fishermen a constant source of income. In many parts of the bay, notably the lower York, Rappahannock, and Potomac Rivers, this fish is taken in small pound nets, which may be operated by one man. A small catch taken in this manner often is profitable.

Haul seining is carried on during the late summer and fall and is confined principally to the lower parts of the larger rivers. The haul-seine fishermen usually operate at night and select localities where the bottom is free of débris and that have a proper depth and a good landing place for the seine. Such places are known as "hauls." The striped bass is a very elusive fish and great care must be exercised in selecting the "haul" and in operating and landing the net in order to make a profitable catch. The quantity caught fluctuates greatly; it is not unusual for a fishing crew to catch only 2 or 3 fish during one night and as many as 500 or even more during the following night.

The striped bass commands a good price in the markets, the fishermen receiving from 16 to 24 cents a pound during 1922. Four trade names are used in the Baltimore wholesale market. "Shinie rock" are small fish; "hank rock" are fish weighing 3 pounds; "boilers," 3 to 6 pounds; "big rock" 6 pounds or more. "Big rock" command a slightly lower price than the other sizes, and very large fish, 20 pounds or more in weight, are worth considerably less. The great majority of the fish sent to market weigh less than 15 pounds, but large ones, weighing 50 pounds or more, are sometimes seen. The maximum weight recorded for this species appears to be 125 pounds.

The striped bass is always in demand. It bears shipment well and is considered one of the best of all the salt-water fishes. The names most used in the Chesapeake for this species are "rock" and "rockfish."

Habitat.—Atlantic and Gulf seaboards, ascending streams from the Gulf of St. Lawrence to Alabama; most numerous between Massachusetts and North Carolina. Introduced on the Pacific; now common and an important food fish in California.

Chesapeake localities.—(*a*) Previous records: Many localities, from Chesapeake Bay and streams tributary to it. (*b*) Specimens in collection: From many localities in fresh, brackish, and salt water, from Havre de Grace, Md., to Cape Charles and Cape Henry, Va. Many small fish were taken during the winter by the *Fish Hawk* with the beam trawl in water having a depth as great as 138 feet.

Comparison of weights and lengths of striped bass

Number of fish weighed and measured	Length	Weight	Number of fish weighed and measured	Length	Weight	
	Inches	*Ounces*		*Inches*	*Pounds*	*Ounces*
1	4½	0.5	2	10¾		8.3
1	4¾	.6	4	11		10.0
1	5	.7	4	11¼		8.2
1	6	1.3	1	11½		8.3
1	6¼	1.4	2	12¼		12.0
1	6½	1.6	3	13		14.2
2	7	1.8	1	15	1	7.0
2	7¼	2.0	1	17	1	14.2
5	7½	2.5	1	17½	1	15.2
1	7¾	2.8	1	18¼	2	9.2
8	8	2.9	1	19	2	10.2
2	8¼	3.7	1	19½	2	14.1
4	8½	3.8	1	20	4	
2	9	4.7	1	21	3	7.4
4	9½	5.2	1	22¼	4	11.3
2	9¾	4.7	2	23	4	11.8
3	10	6.1	1	23¾	4	
2	10¼	7.2	1	24½	5	2.1
			1	28	8	8.0

Family LX.—EPINEPHELIDÆ. The groupers

Body oblong, more or less compressed; teeth in jaws usually depressible; canine teeth more or less distinct; *maxillary with a supplemental bone;* scales small, firm, commonly extending on top of head; dorsal rays about VIII to XIV, 12 to 20; anal III, 7 to 12; ventral fins inserted slightly behind base of pectorals.

104. Genus MYCTEROPERCA Gill. Groupers

Head broad and transversely concave between the eyes; lateral crests of cranium strong, nearly parallel with the supraoccipital crest and extending farther forward, joining the supraoccipital crest above the eye; supraoccipital crest not extending on the frontals; lower jaw strongly projecting; scales small, mostly cycloid; anal fin rather long, rarely with 9 or 10, usually with 11 or 12, soft rays; spines of fins slender, none of them much elevated; caudal fin lunate.

135. Mycteroperca microlepis (Goode and Bean). Gag.

Trisotropis microlepis Goode and Bean, Proc., U. S. Nat. Mus., 1879, p. 141; west coast of Florida.

Mycteroperca microlepis Jordan and Evermann, 1896–1900, p. 1177, Pl. CLXXXVIII, fig. 494; Evermann and Hildebrand, 1910, p. 161.

Head 2.6; depth 3.5; D. XI, 16 to 19; A. III, 11; scales 140 to 145. Body elongate, compressed; head pointed; mouth large; maxillary reaching beyond eye; teeth in narrow bands, two canines in front in each jaw, the lower ones smaller; dorsal spines slender, the third and fourth spines longest; caudal fin with concave margin, pectoral fins reaching beyond ventrals, 2 in head.

Color variable; usually brownish gray above, paler below, with faint traces of darker spots; black mustache; dorsal dark green, edge of soft dorsal black; caudal black with blue shades, edge white; anal indigo blue with white edge; ventrals black, first ray white-tipped; pectorals green.

No specimens of this species were taken. The foregoing description was compiled from published accounts.

The gag is a common food fish in Florida. A maximum weight of 50 pounds has been reported, but market fish seldom exceed 10 pounds. It is known from Chesapeake Bay only from a single small specimen 140 millimeters (5½ inches) in length. (Evermann and Hildebrand, 1910, p. 161.)

Habitat.—Both coasts of Florida, northward to Chesapeake Bay.

Chesapeake localities.—(*a*) Previous record: Old Point Comfort, Va. (*b*) Specimens in collection: None.