76. Genus SCOMBER Linnæus. Mackerels

Body elongate, fusiform; caudal peduncle slender, with two small keels on each side; mouth comparatively large; maxillary slipping under the preorbital; teeth small, in a single series on the jaws, paired oblique patches on vomer, and in one row on palatines; gill rakers long and slender; scales very small, not forming a corselet anteriorly; first dorsal with 10 to 14 feeble spines; second dorsal and anal similar, each followed by 5 to 9 finlets; caudal fin small, broadly forked; ventrals and pectorals small; air bladder wanting.

101. Scomber scombrus Linnæus. Common mackerel.

Scomber scombrus Linnæus, Syst. Nat., ed. X, 1758, p. 297; Atlantic Ocean. Uhler and Lugger, 1876, ed. I, p. 108; ed. II, p. 91; Jordan and Evermann, 1896–1900, p. 865, Pl. CXXXIII, fig. 363.

Head 3.6 to 3.8; depth 5.65 to 6; D. XI or XII—12—V; A. I, 11 or 12—V. Body fusiform, little compressed; caudal peduncle slender, broader than deep, its depth 10 to 11 in head; head long, slender; snout pointed, its length 2.85 to 3.25 in head; eye 4.75 to 5.55; interorbital 4.1 to 4.75; mouth moderate, terminal, oblique; maxillary reaching nearly to middle of eye, 2.5 in head; teeth small, in a single row on jaws, palatines, and vomer; gill rakers long, slender, about 30 on lower limb of first arch; scales very small; first dorsal with slender spines, its origin about an eye's diameter behind base of pectorals; second dorsal very small, followed by five finlets; caudal fin broadly forked; anal fin similar to and opposite second dorsal, also followed by five finlets; ventral fins small, inserted under or slightly in advance of vertical from origin of dorsal; pectoral fins short, 1.9 to 2.2 in head.

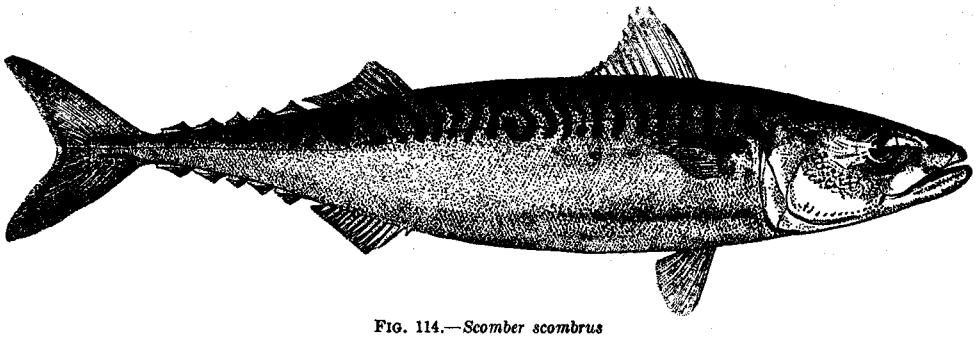

FIG. 114.—*Scomber scombrus*

Color bluish black above, with wavy, blackish transverse streaks; bright silvery below; dorsals, caudal, and pectorals largely dusky; axil of pectoral black, peritoneum black.

This species is represented by four small specimens, ranging from 220 to 240 millimeters (8¾ to 9½ inches) in length.

Garstang (1898, pp. 235–295) made some interesting comparisons among American and various groups of European mackerel (all *Scomber scombrus*) in order to determine what racial differences, if any, exist. In this study he utilized 100 fish from Newport, R. I., and 1,549 fish from Ireland, the English Channel, and the North Sea. As a result of these studies he indicated that a racial difference did exist between American and European mackerel but that this difference is so small that it can only be appreciated by an examination of many specimens.

The number of dorsal spines and rays of the mackerel shows rather wide variation when a large series of specimens is examined. The first dorsal usually contains 11, 12, or 13 spines, rarely 10 or 14. The second dorsal usually contains 12 rays, less frequently 9 to 11 or 13 to 15.

The mackerel is largely a plankton feeder, subsisting chiefly on pelagic crustaceans as well as on fish eggs and fish fry. For a comprehensive account of the feeding habits, spawning, migrations, etc., of the mackerel see Bigelow and Welsh (1925, pp. 188–208).

Spawning takes place during the last half of May and throughout the month of June in the Massachusetts Bay region and a few weeks later in the Gulf of St. Lawrence. Most of the spawning is done at night and when the water temperature ranges from 46° to 61° F. (Bigelow and Welsh, p. 208.) The egg is buoyant, from 0.97 to 1.38 millimeters in diameter, and hatches in about 96 hours at 60° to 62° F., and in about 120 hours at 55° F.

The mackerel is present off the New England coast from spring to fall. The first catches are made between Cape Hatteras and Chesapeake Bay between the end of March and middle of April, but the fish are not seen again in this region until the following year. Off the New England coast the first mackerel appear in May, remaining until November. Not much is known of the winter home of the mackerel in the western Atlantic, but stray fish have been taken on Georges Bank and in South Channel in February or March. It is suggested by Bigelow and Welsh that mackerel may winter on the continental shelf at a depth of 100 to 200 fathoms and not farther south than Cape Hatteras. No mackerel have ever been reported more than a few miles south of Cape Hatteras at any time.

The mackerel, although one of the most valuable food fishes of the north Atlantic, is of no commercial importance in Chesapeake Bay. Toward the end of April and early in May a few small mackerel sometimes stray inside the mouth of the bay and are caught in pound nets below Cape Charles city and at Lynnhaven Roads, Va. In a pound net operated in these localities usually only about five or six mackerel are caught during a season, and sometimes none at all are taken. As early as 1876, Uhler and Lugger state that at that time this fish was much less common in Chesapeake Bay than formerly. Whether the species ever was common enough within the bay to be of commercial value probably will remain unknown.

The mackerel attains a length of 22 inches and, when in prime condition in the fall, a weight of 4 pounds. Fish of the same school are usually all about the same size. We have observed that commonly 90 to 95 per cent of a catch at Provincetown consisted of fish that did not vary more than 1 inch in length (by actual measurement in the course of tagging the fish for the purpose of determining their migrations). At times large numbers of "tinkers" are caught; that is, fish about 8 to 10 inches in length. The usual size of market fish is 12 to 16 inches, but a length of 18 to 20 inches is not unusual.

Habitat.—North Atlantic, inhabiting both coasts; known on the American coast from Labrador to Cape Hatteras.

Chesapeake localities.—(*a*) Previous record: Chesapeake Bay (Uhler and Lugger, 1876). (*b*) Specimens in collection: From Lynnhaven Roads, Va.

77. Genus PNEUMATOPHORUS Jordan and Gilbert. Chub mackerels

This genus differs from Scomber in the possession of a well-developed air bladder. Externally it differs principally in having fewer (9 or 10) weak spines in the dorsal fin.

102. Pneumatophorus colias (Gmelin). Chub mackerel; Thimble-eye mackerel; Bull's-eye.

Scomber colias Gmelin, Syst. Nat., 1788, p. 1329; Sardina. Uhler and Lugger, 1876 ed. I, p. 109; ed. II, p. 91; Jordan and Evermann, 1896–1900, p. 866, Pl. CXXXIII, fig. 364.

This species was once recorded by Uhler and Lugger as entering Chesapeake Bay. It is not reported by other investigators, and it was not seen there by us. Uhler and Lugger (1876) do not say that they had specimens, and their record may have been based only upon an observation. We find no other record showing that this fish has been taken south of the New Jersey coast.

This species is readily distinguished from the common mackerel by the shorter first dorsal (which has only 9 or 10 spines), by the dusky spots extending well below the lateral line in the adult, and by the much larger eye (comparing fish of nearly the same size). Its feeding habits appear to be similar to those of the common mackerel. Nothing is known of its breeding habits.

Along our North Atlantic coast this mackerel occurs irregularly. In some years large catches are made off the New England coast, and again it appears to be entirely absent. In the spring of 1925 we observed that about 1 per cent of the mackerel catch at Provincetown consisted of this species.

As a food fish it is said to equal the common mackerel and is not culled from the catch. The maximum length is 14 inches, but fish 11 to 13 inches long are often caught.

Habitat.—Atlantic and Pacific Oceans; on the western Atlantic coast from the Gulf of St. Lawrence to New Jersey, and possibly very rarely to Virginia.

Chesapeake localities.—(*a*) Previous records: "Enters Chesapeake Bay from the ocean" (Uhler and Lugger, 1876). (*b*) Specimen in collection: None.

78. Genus SCOMBEROMORUS Lacépède. Spanish mackerels

Body elongate, more or less compressed; snout quite long, pointed; mouth large; maxillary not concealed by preorbital; teeth in the jaws strong, compressed; vomer and palatines with granular teeth; gill rakers rather short and few in number; scales small, rudimentary, not forming a corselet on anterior part of body; caudal peduncle with a keel in the lateral line and a supplemental one above and below it; first dorsal with 14 to 18 feeble spines; interval between dorsals slight; second dorsal and anal each followed by 7 to 10 finlets; ventrals small; pectorals moderate, inserted near level of eyes; alimentary canal short; air bladder present.

KEY TO THE SPECIES

a. Sides of body with roundish bronzy spots but without dark, longitudinal stripes; pectoral fins scaleless ..... *maculatus*, p. 203

aa. Sides with elongate bronzy spots and with one or two dark, longitudinal stripes; pectoral fins mostly covered with scales ..... *regalis*, p. 205

103. Scomberomorus maculatus (Mitchill). Spanish mackerel.

Scomber maculatus Mitchill, Trans., Lit. and Phil. Soc., N. Y., I, 1814, p. 426; New York.
Cybium maculatum Uhler and Lugger, 1876, ed. I, p. 110; ed. II, p. 92; McDonald, 1882, p. 12, fig. 1.
Scomberomorus maculatus Bean, 1891, p. 87; Smith, 1892, p. 71; Jordan and Evermann, 1896-1900, p. 874, Pl. CXXXIV, fig. 368.

Head 3.2 to 4.8; depth 4 to 5; D. XVIII–14 to 17–VIII or IX; A. II, 14 to 16–VIII or IX. Body elongate, compressed; dorsal and ventral outlines about evenly rounded; caudal peduncle

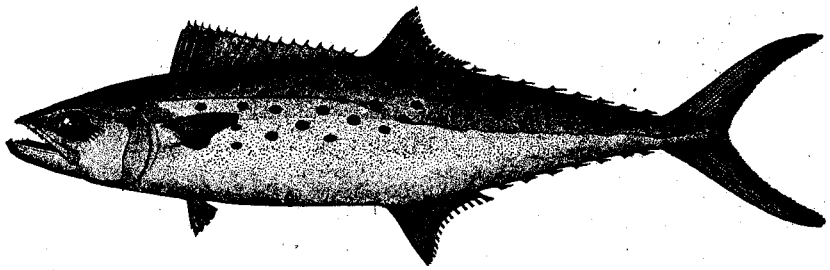

FIG. 115.—*Scomberomorus maculatus*. From a specimen 10¾ inches long

slender, with a median lateral keel and a small supplemental keel both above and below it; head compressed; snout long, pointed, its length 2.45 to 2.75 in head; eye 4.55 to 4.9; mouth large, oblique; lower jaw (at least in young) a little shorter than the upper; maxillary reaching opposite posterior margin of eye, 1.6 to 1.8 in head; teeth in the jaws compressed, variable in size and number; gill rakers about half the length of eye in adult, very short in young, 8 to 10 on lower limb of first arch; first dorsal with slender spines; second dorsal and anal similar, densely scaled, each fin followed by 8 or 9 finlets; the origin of second dorsal a little in advance of anal; caudal fin broadly forked; ventral fins small, shorter than snout; pectoral fins not scaly, short, 1.5 to 2.85 in head.

Color of a fresh specimen 260 millimeters (10¼ inches) in length, dark blue above, with sky-blue reflections; silvery below; sides with roundish yellow spots, forming three longitudinal rows, the lower one present only on anterior part of body; spinous dorsal mostly black, the base of the short spines white; soft dorsal greenish, with dusky tips; finlets pale green; caudal greenish dusky, the tips of lobes mostly black; anal and ventrals pale; pectorals greenish at base, dusky at tips.

No specimens of this common species from Chesapeake Bay were preserved. It is here described from specimens collected at Beaufort, N. C., ranging in length from 45 to 355 millimeters (1¾ to 14 inches).

The Spanish mackerels congregate in schools; they appear to be migratory in their habits, appearing off the Middle Atlantic States in spring and fall runs, the first presumably representing

a northward migration and the latter a southward one. No such runs of Spanish mackerel appear to take place within Chesapeake Bay, however, as the fish usually arrive in May or June and are present continuously until about September. Relative to spawning, Smith (1907, p. 191) says:

> The lower part of Chesapeake Bay was formerly and is still a favorite spawning ground. The eggs are about 1 millimeter (0.04 inch) in diameter and float at the surface; they are laid mostly at night, and the hatching period is about 25 hours in a water temperature of 77° or 78° F. All the eggs of a given fish do not ripen at one time, and the spawning may thus extend over several weeks, during which several thousand eggs may be deposited.

The spawning period in Chesapeake Bay occurs during late spring and early summer.

During 1920 the Spanish mackerel ranked twenty-third in quantity and nineteenth in value in Chesapeake Bay, the catch amounting to 13,766 pounds, worth about $2,114. Only 337 pounds of the entire catch was taken in Maryland waters during 1920, all caught with pound nets. In Virginia the Spanish mackerel ranked twenty-second in quantity and eighteenth in value, the catch being 13,429 pounds, worth $2,052. The entire catch, exclusive of a few fish taken with haul seines, was caught in pound nets. The counties producing the largest quantities were Elizabeth City, 5,900 pounds; Northampton; 3,835 pounds; and Mathews, 2,479 pounds.

The Spanish mackerel is one of the most highly esteemed fishes occurring in the bay. It appears regularly each year, some time in May or June, but it is never taken in such large quantities as farther south. Along the Atlantic coast of Florida and in the Gulf of Mexico, millions of pounds of this fish are caught each year from November to March,[18] a period when it is entirely absent from the Chesapeake. Large quantities sometimes are taken along the coasts of Virginia and North Carolina also. In the South the fish are caught mainly with gill nets and purse seines and, to a lesser extent, with hook and line. In the Chesapeake at least 99 per cent of the catch is taken in pound nets.

The Spanish mackerel, upon their arrival in the spring, first enter the bay as stragglers. In certain pound nets, situated near Cape Charles, Lynnhaven Roads, and Ocean View, Va., one or two fish a day are caught, followed, perhaps, with a few days when none are caught. To illustrate this the following statements are taken from our field notes:

> The first three Spanish mackerel of the 1921 season were taken in Lynnhaven Roads May 12 to 17. A set of three pound nets at Ocean View caught the first Spanish mackerel on May 15, 1922, and until May 27 a total of six fish had been caught. A set of two pound nets at Lynnhaven Roads, the closest nets to the entrance of the bay in 1922, caught one mackerel on each of the following dates: May 16, 20, 24, 25, and 26; on May 30 these nets caught 15 pounds and on May 31, 85 pounds.

The first pound-net catches that were of commercial importance (that is, about 20 pounds of fish, or more, on one day by one net or set of nets) occurred in Lynnhaven Roads on the following dates: May 30, 1916; June 26, 1917; June 17, 1918; June 9, 1919; June 1, 1920; June 15, 1921; May 30, 1922; and June 19, 1923. Almost the entire catch is taken from June to September, and only a few stragglers are taken before and after these dates. A particularly good run of fish occurred in Lynnhaven Roads from June 27 to July 2, 1921, when two pound nets caught 150 to 350 pounds daily and the catch for the week amounted to 1,400 pounds. The catch is confined to the lower part of the bay, and it is seldom that the fish strays above the mouth of the Rappahannock River.

At one time the Spanish mackerel was considered abundant in Chesapeake Bay. The following excerpt is taken from the United States Fish Commission's report for 1880:

> Gill nets were introduced into the Spanish-mackerel fisheries of Chesapeake Bay in 1877, and, proving fairly successful, they soon came into general favor among the fishermen of the eastern shore, though they are even now seldom employed by those living on the opposite side. There are at present about 175 men engaged in "gilling" for mackerel between Crisfield, Md., and Occohannock Creek, which is 30 or 40 miles from the capes. The nets were at first set only in the night, but during 1880 the fishermen of Tangier Island obtained the best results by fishing from the middle of the afternoon until midnight. The nets range from 75 to 100 fathoms in length and have a mesh similar to those already mentioned (3½ to 4 inches). The catch varies considerably, as many as 500 mackerel having been taken at one set, though the average is only 20 to 40 daily to the net.

It is estimated that during the past 10 years the annual catch of Spanish mackerel taken in Chesapeake Bay has ranged from 10,000 to 25,000 pounds. Part of the catch is marketed locally, but when a good run of fish occurs shipments are made to other markets, located principally from Washington to New York. The wholesale price in 1921 and 1922 generally ranged from 18 to 25 cents a pound and the retail price varied from 25 to 40 cents a pound.

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[18] For an account of the Spanish-mackerel fishery of southern Florida, see Schroeder (1924, p. 40).

The size of Chesapeake fish ranges mostly from 1 to 3 pounds. One of the largest Spanish mackerel observed from the bay was caught on September 21, 1922, at Ocean View, Va. This fish was 760 millimeters (30 inches) long and weighed 7 pounds 5 ounces. The largest fish ever recorded from anywhere, so far as known to us, weighed 25 pounds. This weight is very exceptional, however, the usual maximum weight for Atlantic coast fish being only about 10 pounds and the common range of market fish is 1½ to 4 pounds.

Habitat.—Both coasts of America; on the Pacific from Cortez Banks south to the Galapagos Islands, and on the Atlantic from Maine to Brazil; common as far north as New York, stragglers occurring as far north as Monhegan, Me.

Chesapeake localities.—(*a*) Previous records: Various localities, from the mouth of the Potomac River southward. (*b*) Specimens in collection: None. The species was observed in the lower York River, Cape Charles, Buckroe Beach, Lynnhaven Roads, and Ocean View, Va.

104. Scomberomorus regalis (Bloch). Cero.

Scomber regalis Bloch, Ichthyol., 1795, Pl. CCCXXXIII; Martinique.
Cybium regale Uhler and Lugger, 1876, ed. I, p. 111; ed. II, p. 93.
Scomberomorus regalis Jordan and Evermann, 1896-1900, p. 875, Pl. CXXXV, fig. 369.

This fish was once recorded from "Chesapeake Bay near the ocean" by Uhler and Lugger (1876). It has not been reported by other writers and it was not seen during the present investigation. This species is distinguished from the Spanish mackerel principally by the color. The present species has elliptical bronzy spots on the sides and one or two longitudinal dark streaks. The Spanish mackerel also has bronzy spots on the sides, which, however, are less elongate, and

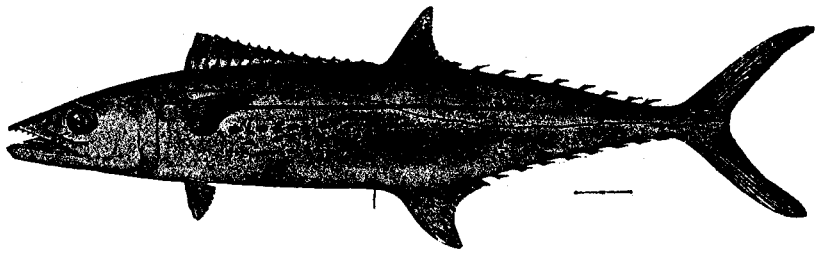

FIG. 116.—*Scomberomorus regalis*

the dark longitudinal stripe or stripes are missing. The cero has the pectoral fins mostly covered with scales, whereas in the Spanish mackerel these fins are naked.

The cero is a good fish, and in some localities where it is caught by trolling it is considered a good game fish. It is said to reach a weight of 35 pounds.

Habitat.—Cape Cod, Mass., to Brazil; not common north of Florida.

Chesapeake localities.—(*a*) Previous record: Chesapeake Bay near the ocean. (Uhler and Lugger, 1876.) (*b*) Specimens in the collection: None.

79. Genus SARDA Cuvier. Bonito

Body elongate, somewhat compressed; head large, pointed; mouth large; teeth on jaws rather strong, compressed, similar teeth on palatines, none on vomer or tongue; scales small, those of the pectoral region forming a corselet; a distinct lateral keel on caudal peduncle; first dorsal with 18 to 22 spines; second dorsal and anal similar, each followed by 6 to 9 finlets; caudal broadly forked; ventrals and pectorals small; upper parts with longitudinal more or less oblique stripes. A single species of this genus occurs in Chesapeake Bay.

105. Sarda sarda (Bloch). Bonito; "Boston mackerel"; "Bloater."

Scomber sarda Bloch, Ichthyol., X, 1793, p. 35, Pl. CCCXXXIV; Europe.
Sarda pelamys Uhler and Lugger, 1876, ed. I, p. 109; ed. II, p. 92.
Sarda sarda Jordan and Evermann, 1896-1900, p. 872; Fowler, 1912, p. 58.

Head 3.6; depth 4.35 to 4.5; D. XXI—16–IX; A. II, 10 or 11–VIII. Body elongate, compressed; caudal peduncle slender, broader than deep, with a membranous fold on the sides, its depth 10 or 11 in head; head rather long; snout pointed, its length 2.8 to 2.95 in head; eye 7.55 to 7.7; interorbital 3.7 to 3.8; mouth large, oblique; upper jaw slightly projecting; maxillary reaching past posterior margin of eye, 1.9 in head; teeth in the jaws rather strong, curved inward; a few teeth on palatines; gill rakers slender, 12 or 13 on lower limb of first arch; spinous dorsal long, the spines slender, highest anteriorly, its origin over or slightly in advance of base of pectorals; second dorsal small, wholly in front of anal, followed by 9 finlets; caudal fin rather small, broadly forked; anal fin similar to second dorsal but smaller, followed by 8 finlets; ventral fins small, inserted nearly under base of pectorals; pectoral fins short, with broad base, 2.6 in head.

Color bluish black above; lower parts silvery; dorsals and pectorals more or less dusky, other fins mostly plain translucent. Young with black crossbars on upper part of sides; these bars replaced in the adult by 7 to 20 black, longitudinal, prominent stripes running backward and slightly upward.

This species was observed only in the southern part of the bay. No specimens were preserved. The above description is based on two specimens, respectively 250 and 255 millimeters (9¾ and 10 inches) in length, from Buzzards Bay, Mass.

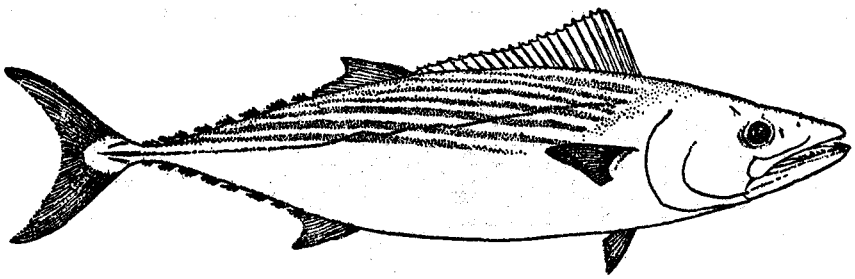

FIG. 117.—*Sarda sarda*

This fish, like most mackerels, travels in schools along the coast. It is a rapid swimmer and feeds mainly at the surface. When seen in the water, the adults are readily recognized by the dark stripes on the back. Apparently the entire catch in Chesapeake Bay is taken in pound nets. Along the coast, however, the bonito is often caught by trolling with tackle that is also used for catching bluefish. Its spawning habits remain almost unknown. Bean (1903, p. 395) says that this fish is believed to live in the open sea, coming to the shores only to feed or to deposit eggs. Of its feeding habits this author says that it is predacious, feeding insatiably on mackerel and menhaden, and that it takes bait as freely as does the bluefish. The catch of bonito in Chesapeake Bay during 1920 amounted to about 1,400 pounds, valued at $192. The entire catch was made with pound nets set in the waters of Virginia.

The bonito is never taken in large quantities inside the bay. Large schools of fish pass up and down the coast outside of the capes, but apparently only stragglers, and occasionally a small school, enter the Chesapeake. This species is taken only in the southern part of the bay and seldom above the mouth of the York River or Cape Charles city, Va.

The first fish are caught some time in May, and small numbers are taken by the pound nets operated in the lower parts of the bay throughout the summer, or until September. The first fish caught during the season of 1921 was taken at Lynnhaven Roads on May 20. The following year (1922), in a set of three pound nets at Ocean View, bonitos were caught for the first time on May 17. The second catch, however, was not taken until May 26. The records of fish taken in a set of two pound nets situated at Lynnhaven Roads show that the largest amount of bonito caught in any one month during a period of seven years (1916 to 1922) was 135 pounds. This record catch was made in June, 1920.

The bonito, although a good food fish, is not generally regarded as highly as the common and the Spanish mackerels. However, it is more esteemed in the lower Chesapeake than in many other localities. The small catch is marketed locally and brings a good price, selling at retail (in 1921 and 1922) for 25 to 40 cents a pound. This species is known in the Norfolk markets as "Boston mackerel," a name generally given to the common mackerel, *Scomber scombrus*. *Rachycentron canadus* is known as bonito or black bonito in the lower Chesapeake. This fish is very different and must not be confused with *Sarda sarda*.

The bonito is said to reach a weight of 12 pounds along the Atlantic coast; the usual size of the fish from the Chesapeake, however, is only about 2 to 4 pounds.

Habitat.—Atlantic Ocean, on both coasts; common in the Mediterranean and on the coast of the United States from Cape Ann southward to Florida; rarely northward to Maine; no definite West Indian, Central, or South American records.

Chesapeake localities.—(*a*) Previous records: Entrance of Chesapeake Bay; Norfolk fish market. (*b*) Specimens in collection: None. Observed at Lynnhaven Roads and Ocean View, Va.

80. Genus THUNNUS South. Great tunnies or albacores

Body robust; mouth large; teeth in the jaws small, conical, in a single series; vomer and palatines with bands of villiform teeth; scales small, corselet well developed; dorsal fins close together, the first with 12 to 15 spines; dorsal and anal finlets about 9.

106. Thunnus thynnus (Linnæus). Tuna; Horse mackerel; Tunny; Albacore.

Scomber thynnus Linnæus, Syst. Nat. ed. X, 1758, p. 297; Europe.
Thunnus thynnus Jordan and Evermann, 1896–1900, p. 870.

"Head 3¾; depth 4. D. XIV–I, 13–IX; A. I, 12–VIII. Body oblong, very robust; corselet well developed, extending farther back than pectorals; caudal keel extending forward to second finlet from caudal. Mouth rather large; maxillary reaching pupil; posterior margin of preopercle somewhat shorter than inferior. Eye small. Dorsal and anal falcate, short, 2 in height of first dorsal; ventrals longer than anal; caudal very widely forked; pectorals short, reaching to about ninth dorsal spine. Dark blue above; below grayish, with silvery spots." (Jordan and Evermann, 1896–1900.)

This species was not seen during the present investigation. However, we find mention of "one horse mackerel" among the records of the Buchanan Brothers' pound-net fishery for August, 1909. We have only this record of the occurrence of this species in Chesapeake Bay.

The horse mackerel is generally readily recognized by its large size, and the presence of teeth on the vomer separate it from all the other mackerels of Chesapeake Bay.

Little is known of the life history of this large pelagic fish, which inhabits all warm seas. It feeds mainly on smaller fish, probably chiefly on other pelagic species, such as the menhaden, herring, and mackerels. Its eggs and fry are unknown. Even moderately small individuals seldom are taken along the Atlantic coast.

The horse mackerel, formerly considered of no value as a food fish, has gained rapidly in favor during recent years. In California and in the Mediterranean it is highly prized, and it now has some sale value on the Atlantic coast of America. It is also regarded with considerable favor by sport fishermen.

This fish is reported to attain a length of 14 feet or more and a weight of 1,600 pounds, whereas fish of 1,000 pounds are said to be not uncommon; the usual weight is from 100 to 400 pounds.

Habitat.—Warm parts of the Atlantic and Pacific Oceans; Mediterranean Sea.

Chesapeake localities.—(*a*) Previous records: None. (*b*) Specimens in collection: None. The species is here included because of a mention found in a record of fishes caught at the Buchanan Brothers' fishery located in Lynnhaven Roads, Va., who list "one horse mackerel" in their record of catches for August, 1909.

Family L.—TRICHIURIDÆ. The cutlass fishes

Body elongate, strongly compressed, band-shaped, the tail tapering to a point; head long, compressed; snout more or less beaklike; mouth large; lower jaw projecting; premaxillaries not protractile; pseudobranchiæ present; gills 4, a slit behind the fourth; gill membranes separate, free from the isthmus; teeth on the jaws strong, unequal; lateral line continuous; scales wanting; dorsal fin very long and low, beginning on head and extending over the entire length of body; anal long and very low, composed of separate spines; ventrals rudimentary and thoracic when present, sometimes wanting; air bladder present.

81. Genus TRICHIURUS Linnæus

This genus is distinguished from others of the family by the absence of ventral fins. A single species of wide distribution is known.

107. Trichiurus lepturus Linnæus. Silverfish; Cutlass fish; Hairtail.

Trichiurus lepturus Linnæus, Syst. Nat., ed. X, 1758, p. 246; America. Bean, 1891, p. 87; Jordan and Evermann, 1896–1900, p. 889, Pl. CXXXVII, fig. 375.

Head 7.2 to 8.2 in total length; depth 13 to 14.5; D. 133 to 140; A. XCVII to CVIII. Body extremely elongate, strongly compressed, bandlike; tail very slender, tapering to a point; head long, compressed; snout long, pointed, its length 2.75 to 2.9 in head; eye 6.1 to 7.45; interorbital 7.05 to 7.8; mouth large; lower jaw strongly projecting; maxillary concealed under preorbital, reaching about to anterior margin of pupil, 2.2 to 2.7 in head; teeth in the jaws strong and unequal, compressed, the largest ones with distinct barbs on posterior edges; gill rakers poorly developed

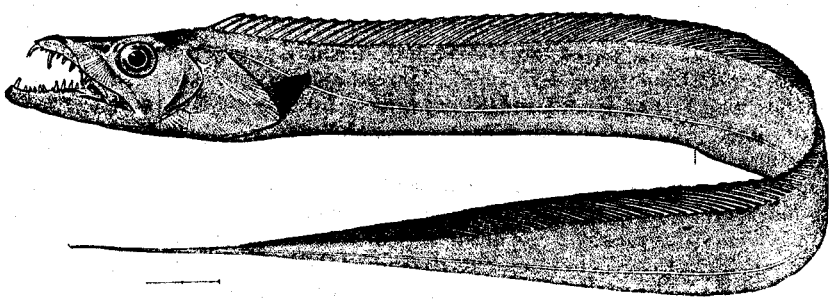

FIG. 118.—*Trichiurus lepturus*

and of unequal length, from 5 to 15 more or less developed on the lower limb of first arch; dorsal fin extremely long, beginning over the preopercular margin and occupying the whole length of the back; caudal and ventral fins wanting; anal fin consisting of very short spines, the anterior ones directed backward and the posterior ones forward; pectoral fins small, 3.3 in head.

Color plain silvery; tips of jaws blackish; dorsal plain, with dusky margin; pectorals plain, with dusky punctulations, at least on distal parts.

This species is represented by four specimens, ranging in length from 550 to 965 millimeters (21¾ to 38 inches). The fish is unique in the long, ribbon-shaped, silvery body, with the long, tapering, filamentous tail, large mouth, and very large, barbed teeth.

The cutlass fish, with its large mouth and formidable teeth, probably is a terror among small fish. Four stomachs examined contained only the remains of fish that gave the appearance of having been bitten into pieces before being swallowed. In one stomach the remains were recognized as those of anchovies; in the others maceration had proceeded too far to permit of identification. The ovary in this fish is single, and specimens taken during May have the sexual organs well distended with eggs and milt, showing that their spawning time was near at hand.

This fish is not common in Chesapeake Bay and it is not used there for food. In some other localities it is eaten, although it is not regarded as a choice food fish. It is said to attain a length

of 5 feet; no individuals approaching that size, however, were seen in Chesapeake Bay. It was observed only during the month of May and from Mobjack Bay and Cape Charles city southward.

Habitat.—All warm seas; on the Atlantic coast of America from Massachusetts Bay southward.

Chesapeake localities.—(*a*) Previous record; Cape Charles city, Va. (*b*) Specimens in collection: Mobjack Bay and Lynnhaven Roads, Va.

Family LI.—XIPHIIDÆ. The swordfishes

Body elongate, compact; caudal peduncle slender, with strong median keel, upper jaw greatly produced, forming a sword, composed of the premaxillaries, ethmoid and vomer; lower jaw also prolonged in young; teeth wanting in adult, present in young; gills 4, the laminæ of each united into a single plate; gill membranes separate, free from the isthmus; scales wanting; dorsal fins 2 in adult (single, high, and continuous in young), the first beginning over gill opening, the second small, situated posteriorly; anal fins 2 in adult (single and continuous in young), the first rather large, the second small and opposite second dorsal; caudal fin large and broadly forked; pectorals long, narrow, pointed; ventrals absent; all the fins sharklike, the rays enveloped in skin; intestinal canal long; pyloric cæca numerous; air bladder present. A single genus and species, of large size and great power, is known. The young (as indicated in the foregoing description) differ very markedly from the adult.

82. Genus XIPHIAS Linnæus. Swordfishes

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

108. Xiphias gladius Linnæus. Swordfish.

Xiphias gladius Linnæus, Syst. Nat., ed. X, 1758, p. 248; Europe. Uhler and Lugger, 1876, ed. I, p. 108; ed. II, p. 90; Jordan and Evermann, 1896–1900, p. 894.

Head about 2.25; depth about 5.5; D. 40–4; A. 18–4. Body fusiform, tapering uniformly from head to tail, deepest at anterior dorsal fin; head, with sword, longer than rest of body; snout long, flat, about 3 in total length, or about three times as long as rest of head; lower jaw in adult extending in advance of eye, a distance equal to half the length of postorbital part of head, much produced in young; first dorsal in adult very high, falcate, its height being as great as depth of body; second dorsal and second anal small, similar, placed nearly opposite each other; first anal similar to first dorsal, but smaller; caudal lobes long; pectoral fins inserted very low.

Color lustrous blue-black above, shading into whitish underneath; head and upper side of sword purplish blue; lower side of sword brownish purple; eye deep blue; fins mostly dark bluish.

This species was not observed in Chesapeake Bay during the present investigation. The above description is compiled from published accounts. The swordfish was once reported by Uhler and Lugger (1876) as "sometimes entering Chesapeake Bay," but it quite evidently is very rare there.

The swordfish is readily distinguished from all other fish by the greatly produced snout, high dorsal, and large size. The young differ greatly from the adult and have the skin covered with rudimentary scales, both jaws produced, and the dorsal and anal fins are high and not divided.

Swordfish feed upon many species of fish as well as upon squid. No ripe fish and very few bearing eggs have been found in the western Atlantic. The following records have been taken from the field notes of Marie Poland Fish, formerly of the Bureau of Fisheries: A 150-pound swordfish harpooned off Coxs Ledge, about 20 miles southeast of No Mans Land, Mass., on July 24, 1924, contained a pair of ovaries weighing 1,430 grams, full of partially matured eggs. The number of ova were estimated at 16,130,400 and measured from 0.1 to 0.55 millimeter in diameter. The eggs of another fish, taken at Provincetown on September 10, 1909, were further developed and averaged 1.2 millimeters in diameter. The smallest swordfish caught on our coast weighed 7⅜ pounds and was taken on August 9, 1922, on Georges Bank.[19] Individuals under 50 pounds are rare. In the Mediterranean, however, young of one-half pound and up are common.

The swordfish is one of the largest and most powerful fish sought by man. It is a fish of the high seas, appearing on our North Atlantic coast near the end of May or some time in June, leaving in late October. It is most abundant during July and August. The favorite fishing grounds extend

[19] U. S. Bureau of Fisheries Service Bulletin No. 88, Sept. 1, 1922, p. 3.

along the continental shelf from La Have Bank to Georges Bank, Nantucket Shoals, and Block Island. Swordfish are harpooned. Rarely it is caught on a halibut or cod trawl and in a few instances it has been taken on hand lines baited for other fish. The fishery is a valuable one, for in 1919 there were landed in Maine and Massachusetts 1,136,542 pounds, valued at $270,164.

The swordfish attains a length of 16 feet and a weight of about 800 pounds. Fish of this size are very rare, however, and usually only two or three weighing more than 500 pounds are taken each year. The usual size ranges from 200 to 350 pounds.

Habitat.—Both coasts of the Atlantic Ocean; also found in the Indian and Pacific Oceans. Known on the Atlantic coast of America, from Newfoundland southward beyond the Tropic of Capricorn.

Chesapeake localities.—(*a*) Previous record: Sometimes entering Chesapeake Bay (Uhler and Lugger, 1876). (*b*) Specimens in collection: None. The species was not seen or reported by fishermen from Chesapeake Bay during the present investigation.

Family LII.—STROMATEIDÆ. The butterfishes

Body compressed, moderately to extremely deep; head more or less blunt; mouth moderate or small; premaxillaries not protractile; teeth weak, usually present in the mouth only on jaws; œsophagus with lateral sacks provided with hooked or barbed teeth; pseudobranchiæ present; gills 4, a slit behind the fourth; scales small, cycloid; lateral line well developed; dorsal fin single, long, preceded by a few weak and often obsolete spines; anal similar, usually with three spines; caudal fin well forked; ventral fins thoracic, often wanting; pectoral fins usually rather long.

KEY TO THE GENERA

a. Body very deep, ovate, the depth about 1.2 to 1.4 in the length; dorsal and anal fins anteriorly prominently elevated, falcate; no conspicuous pores on back.....Peprilus, p. 210

aa. Body more elongate, the depth about 1.7 to 2.1 in the length; dorsal and anal fins not prominently elevated, never falcate; a row of conspicuous pores on back near base of dorsal .....Poronotus, p. 212

83. Genus PEPRILUS Cuvier. Starfishes or harvestfishes

Body ovate or more or less elongate, strongly compressed; head short; snout very short and blunt; mouth small, terminal or nearly so; premaxillaries not protractile; opercles and preopercles entire; teeth small, in a single series on jaws; gill membranes separate, free from the isthmus; lateral line high, following the outline of the back; scales small, cycloid; rather loosely attached, small scales present on the dorsal and anal and sometimes on the caudal; dorsal and anal similar, elevated anteriorly; caudal deeply forked; ventrals represented by a single short spine attached to the pubic bone; pectorals long and narrow.

109. Peprilus alepidotus (Linnæus). Harvestfish; "Starfish"; "Star"; "Butterfish"; "Diamond."

Chætodon alepidotus Linnæus, Syst. Nat., ed. XII, 1766, p. 460; Charleston, S. C.
Peprilus gardenii Uhler and Lugger, 1876, ed. I, p. 115; ed. II, p. 97.
Stromateus paru Bean, 1891, p. 88.
Stromateus alepidotus Smith, 1892, p. 71.

Head 3 to 3.6; depth 1.2 to 1.4; D. III, 45 or 46; A. III, 42 to 44. Body very deep, oval, strongly compressed; dorsal profile anteriorly more strongly convex than the ventral; head short, deep; snout very blunt, 3.65 to 5.1 in head; eye 3 to 3.4; interorbital 2.15 to 3.1; mouth rather small, terminal or slightly inferior; maxillary scarcely reaching anterior margin of eye, 3.3 to 3.9 in head; teeth in the jaws minute; gill rakers rather short, 14 to 16 on lower limb of first arch; scales small, thin, deciduous; lateral line arched, following the curvature of the back; dorsal and anal similar, notably elevated anteriorly; caudal fin deeply forked; ventral fins wanting; pectoral fins long, 2.5 to 3.35 in length of body.

Color greenish-silvery above; lower parts of sides plain silvery or with a tinge of yellow; dorsal and anal dusky, slightly yellowish in some specimens; caudal and pectorals plain or slightly dusky, and sometimes slightly yellowish.

Many specimens of this species, ranging from 25 to 175 millimeters (1 to 7 inches) in length, were preserved. This fish is recognized by its deep body and the anteriorly elevated dorsal and anal fins. The young do not differ markedly from the adults. They appear to be proportionately deeper, however, and the dorsal and anal fins are less strongly elevated anteriorly. Specimens vary considerably in color, some being plain grayish-silvery, with no yellow; others are greenish above and the lower parts of the sides are yellowish or golden.

The food of this starfish appears to be identical with that of the butterfish. The stomach contents are always ground to pulp. Occasionally fish bones and scales are recognizable.

Spawning appears to occur simultaneously with the butterfish—that is, during June and July—and the eggs are similar, being spherical and approximately 1 millimeter in diameter.

The smallest starfish taken during the present investigation (which probably were the result of the same summer's spawning) consisted of a lot of four specimens, ranging from 25 to 28 millimeters (about 1 inch) in length. These fish were caught from July 25 to August 1, 1921, in the

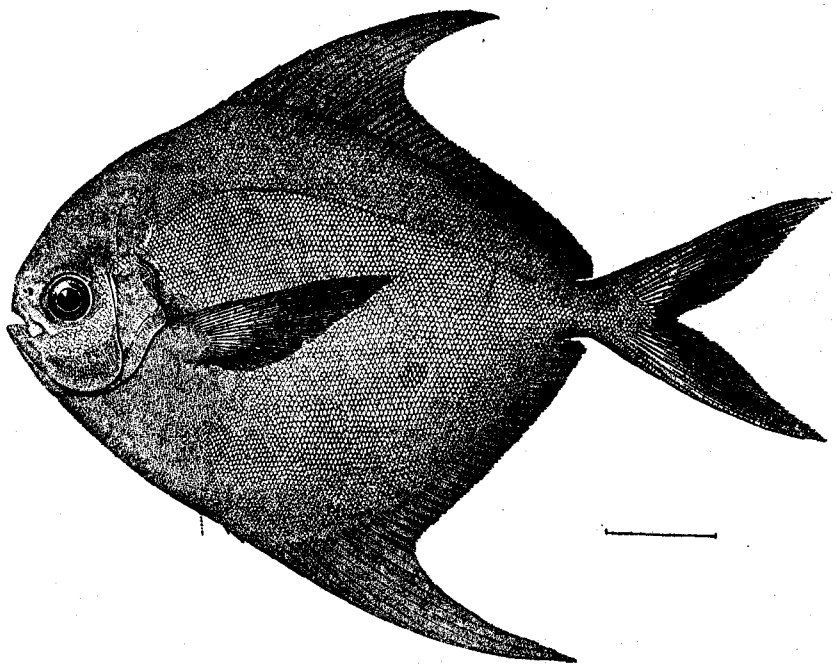

FIG. 119.—*Peprilus alepidatus*

lower Rappahannock, along the shore. A gap occurs in the collections, however, for no young fish were taken from the first of August until late in September, although intensive collecting was continued; those caught during the latter part of September and October ranged from 64 to 130 millimeters (2½ to 5 inches) in length. Only a few of the many that were collected exceeded a length of 4½ inches, and the average length was only 3½ inches. If the starfish spawns in Chesapeake Bay, as seems to be indicated by the small fish taken during the latter part of July and early in August, it seems rather strange that no young fish were taken from the first of August until late in September. Fish ranging in length from 2½ to 5 inches are abundant in October in the lower sections of the bay, and many of this size are often taken in pound nets. The fish within this range, of which numerous specimens were measured, may be separated into two definite size groups by means of plotting frequency curves, the break coming between 4 and 5 inches. The fish making up the group ranging around 5 inches in length are believed to be in their second year.

The starfish is one of the Chesapeake's valuable food fishes. During 1920 it ranked tenth in quantity and thirteenth in value, the catch being 319,681 pounds, worth $10,650.

In Maryland it ranked seventeenth both in quantity and value, the catch in 1920 being 3,765 pounds, worth $150. The entire catch was taken with pound nets. The counties having the largest catches were Somerset, Kent, and Dorchester.

In Virginia the starfish ranked ninth in quantity and thirteenth in value, the catch in 1920 being 315,916 pounds, worth $10,500. The entire catch was taken with pound nets. The counties taking the most fish were Elizabeth City, with 138,850 pounds; Mathews, with 72,399 pounds; and Warwick, with 38,880 pounds.

The starfish is caught in commercial quantities in the Chesapeake from May until October. The first catches, amounting to 10 pounds or more, taken by a set of two pound nets in Lynnhaven Roads, were made on the following dates: May 17, 1916; May 22, 1917; May 16, 1918; May 29, 1919; June 7, 1920; May 9, 1921; May 6, 1922; and May 21, 1923. The starfish appears in the bay about a month later and leaves the bay about a month earlier than the butterfish. Small numbers are taken during the latter half of April, and occasionally a fair catch is made near the mouth of the bay as late as early in November. Large catches are made from the end of May until the end of September. During the seven-year period, 1916 to 1922, the largest catch of starfish made by a set of two pound nets at Lynnhaven Roads, Va., on any one day of each successive month from May to October, was as follows: May 30, 1919, 3,400 pounds; June 4, 1918, 3,800 pounds; July 8, 1919, 2,100 pounds; August 23, 1922, 5,500 pounds; September 10, 1921, 4,000 pounds; October 4, 1919, 400 pounds.

The starfish is confined chiefly to the lower part of the bay, and, like the butterfish, only small quantities are caught above the Potomac River. The season in the upper parts of the bay is somewhat shorter. At Love Point, Md., the most northern locality where this species is taken in commercial numbers, the season commences in June and ends early in October.

This species is closely associated with the butterfish, *Poronotus triacanthus*, and in appearance, size, and edible qualities the two species are very much alike. Both species are frequently sold together under the name "butterfish."

Because of the great body depth, fish as small as 3 inches long can not escape through the meshes of the usual size used in the pound-net trap. Each year thousands of pounds of small, unmarketable starfish are trapped and destroyed in Chesapeake Bay. Frequently 1,000 or more undersized fish are taken in a single pound net on one day. The greater part of these waste fish could be returned to the water alive if fishermen would give the small amount of time and care that would be necessary.

Although large catches of starfish are made frequently, particularly in the lower parts of the bay, the total annual catch in the Chesapeake is only about one-fourth as great as that of the butterfish.

Large shipments of starfish are made to various points in Maryland and Virginia. Shipments are made to the large markets of the North, but there the species is not as well known as the butterfish. The retail price in 1921 and 1922 generally varied from 12 to 20 cents a pound, but large fish frequently brought 25 cents. The size of most of the market fish ranges from 7 to 9 inches in length, but fish 10 and 10½ inches long are not uncommon. The maximum length is about 11 inches and the weight about 1¼ pounds. Many fish were used in determining the following relationship between lengths and weights: Three inches, 0.4 ounce; 3½ inches, 0.7 ounce; 4 inches, 1 ounce; 5 inches, 1.6 ounces; 6 inches, 2.5 ounces.

Habitat.—Southern Massachusetts to Florida.

Chesapeake localities.—(*a*) Previous records: "Many parts of Chesapeake Bay, as far north as the Patapsco River" (Uhler and Lugger, 1876); lower Potomac River and Cape Charles city, Va. (*b*) Specimens in collection and observed: In many localities from Annapolis, Md., southward to Cape Charles and Cape Henry, Va.

84. Genus PORONOTUS Gill. Butterfishes

This genus is similar to Peprilus, differing, however, in having a more elongate body, a row of large conspicuous pores on the back near the base of the dorsal, and in having the dorsal and anal fins anteriorly much less strongly elevated.

110. Poronotus triacanthus (Peck). Butterfish; "Butter;" Harvest fish; Dollarfish.

Stromateus triacanthus Peck, Memoir., Amer. Ac., II, Part II, 1800, p. 48, Pl. II, fig. 2; Piscataqua River, N. H.

Poronotus triacanthus Uhler and Lugger, 1876, ed. I, p. 114; ed. II, p. 96; Jordan and Evermann, 1896-1900, p. 2849, Pl. CL, fig. 405.

Stromateus triacanthus Bean, 1891, p. 88.

Rhombus triacanthus Jordan and Evermann, 1896-1900, p. 967, Pl. CL, fig. 405.

Head 3.35 to 4.3; depth 1.7 to 2.1; D. III, 44 to 46; A. III, 40 to 42. Body moderately ovate, strongly compressed; dorsal and ventral outlines about evenly rounded; head short, deep; snout blunt, 3.25 to 4.5 in head; eye 3 to 4.05; interorbital 2.55 to 2.85; mouth moderate, oblique, slightly

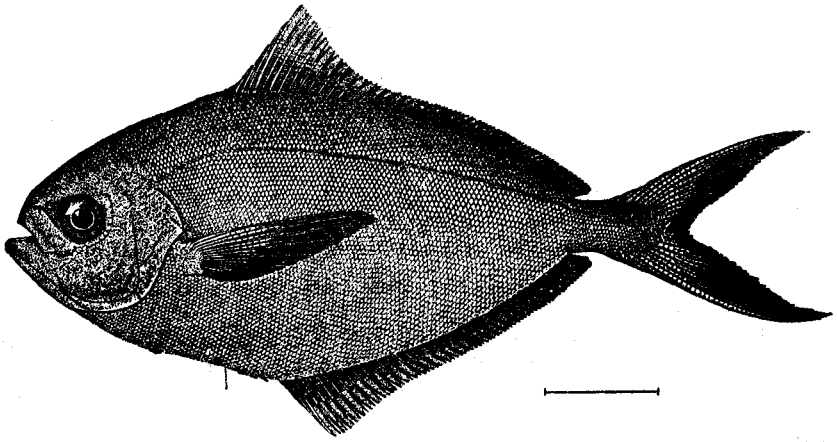

FIG. 120.—*Poronotus triacanthus*

superior; maxillary failing to reach eye, 2.15 to 2.45 in head; teeth present in jaws, feeble; gill rakers short, 15 to 17 on lower limb of first arch; scales small, thin, more or less deciduous; lateral line running high, following the curvature of the back; a row of conspicuous pores on back near base of dorsal; dorsal and anal similar, little elevated anteriorly, the spines small; caudal fin deeply forked; ventral fins wanting; pectoral fins long, 2.95 to 3.15 in length of body.

Color silvery blue or gray above; sides paler, with numerous irregular dark spots, prominent when the fish is seen swimming in the water, but fading completely after death; silvery below; pectoral fins plain, with dusky axil, other fins pale to dark gray, sometimes slightly dusky.

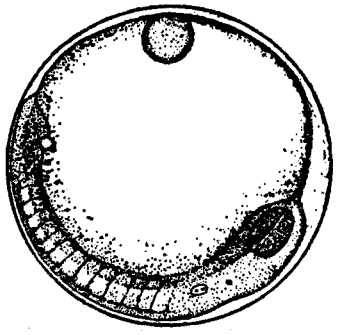

FIG. 121.—Egg with embryo

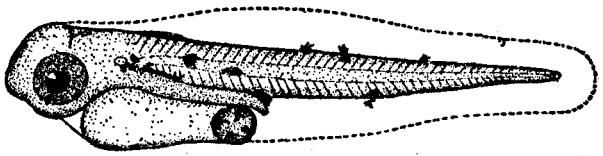

FIG. 122.—Larva 1 day old; 2.1 millimeters

This species is represented by many specimens, ranging from 20 to 235 millimeters (¾ to 9¼ inches) in length. This butterfish is readily distinguished from *Peprilus alepidotus* (the only other "butterfish" of Chesapeake Bay) by the more elongate body and the lower dorsal and anal fins, which are scarcely elevated anteriorly. The young of this species do not differ greatly from the adult. The pores, situated along the back near the base of the dorsal, which are very conspicuous in the adult, are not very noticeable until the fish reaches a length of about 50 millimeters.

It is of interest, as an illustration of the severe mutilations which fish sometimes overcome, to mention that we have at hand a specimen 205 millimeters in length, which met with an accident,

during life in which it lost its snout from the nostrils forward. The injury became completely healed over; and, notwithstanding that it had not even rudiments of jaws, the mouth being represented by an oval-shaped opening, this fish not only survived but at the time of its capture was fatter and apparently in better condition than many normal individuals.

It has been difficult to determine upon what this fish feeds, for the stomachs examined contained mainly finely divided, flocculent substances, without definite shape or form. A few stomachs contained some cycloid scales, one contained fragments of shells of mollusks, and a few contained what appeared to be strands of algæ. It seems probable that the food is finely divided before it reaches the stomach. It is possible that grinding the food is a function of the teeth situated in

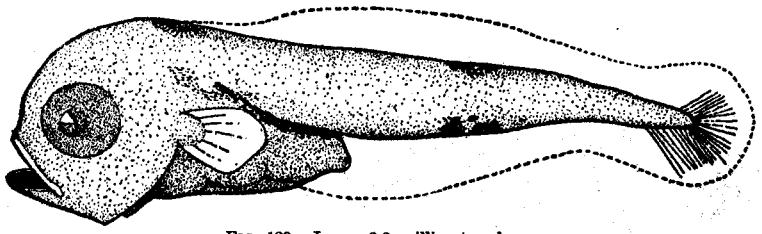

FIG. 123.—Larva 3.2 millimeters long

the œsophagus. Butterfish taken at Woods Hole were found feeding on small fish, squid, crustaceans, annelids, and ctenophores.

Spawning takes place chiefly during June and July in Chesapeake Bay. The earliest date when we observed ripe fish was May 26. Fish as small as 145 millimeters (5¾ inches) had well developed roe late in May, indicating that maturity is reached at a length of about 6 inches. Apparently, the butterfish spawns throughout most of its range, for Bigelow and Welsh (1925, p. 247) give the season for the Gulf of Maine from June to August. The eggs are transparent, round, and 0.7 to 0.8 millimeter in diameter, and hatch in less than 48 hours at a temperature of 65° F.[20] The larvæ are 2 millimeters long at the time of hatching. At 15 millimeters the tail is forked, the dorsal and anal fins are formed, and the fry can be identified readily.

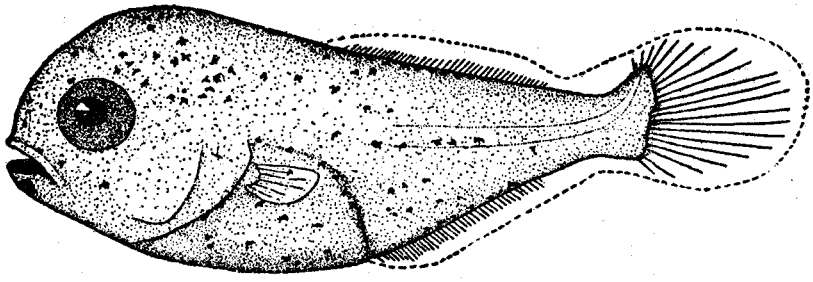

FIG. 124.—Larva 6 millimeters long

While butterfish spawn in Chesapeake Bay, no very young fish were collected, due in part, at least, to the fact that tow nets seldom were used during the summer. At the time when large catches of adults were being made with pound nets none were taken near-by along shore with our collecting seines. It was noted throughout the collecting that butterfish rarely were taken within a few hundred feet of the shore. Large numbers of unmarketable fish, 3 to 5 inches long, taken the middle of May with pound nets, probably were about 1 year old. In the lower York River, on October 13, 13 butterfish 128 to 155 millimeters (5 to 6 inches) long were seined, and in the evening of that same day the catch was 10 of 135 to 165 millimeters (5.3 to 6.5 inches) in length, indicating that the growth from May to October is from about 4 to 5¼ inches. It is probable that by the following spring, when 2 years old, the fish will have reached a length of about 7 inches and maturity.

[20] For an account of the embryology and larval development of the butterfish see Kuntz and Radcliffe, 1918, pp. 112 to 116, figs. 58 to 68.

The butterfish is one of the most valuable and abundant food fishes caught in Chesapeake Bay. During 1920 it ranked sixth in quantity and ninth in value, the catch being 1,278,628 pounds, worth $42,603.

In Maryland it ranked fourteenth in quantity and fifteenth in value, the catch for 1920 being 15,062 pounds, worth $603. The entire catch was taken in pound nets. Somerset County records the largest catch, having taken 6,550 pounds, followed by Kent with 6,440 pounds, Dorchester with 1,532 pounds, and Calvert with 540 pounds.

In Virginia it ranked fifth in quantity and seventh in value, the catch for 1920 being 1,263,566 pounds, worth $42,000. Virtually the entire catch was taken with pound nets. The remainder, amounting to less than 1 per cent, was taken with haul seines and fyke nets. The counties taking the largest quantities of fish were Elizabeth City with 555,550 pounds, Mathews with 289,596 pounds, and Warwick with 155,520 pounds.

The butterfish is caught in the Chesapeake from April until November. The first catches of the season, amounting to 10 pounds or more, were made by a set of two pound nets in Lynnhaven Roads, Va., on the following dates: April 19, 1916, April 24, 1917, April 3, 1918, April 15, 1919, March 30, 1920, April 15, 1921, April 15, 1922, and April 21, 1923. Generally no butterfish are taken above the Rappahannock River before May. Stray fish are taken in the lower part of the Chesapeake as early as the last week in March. Sometimes a set of two pound nets catches small quantities (from about 10 to 50 pounds) daily throughout the last half of April, but usually the first

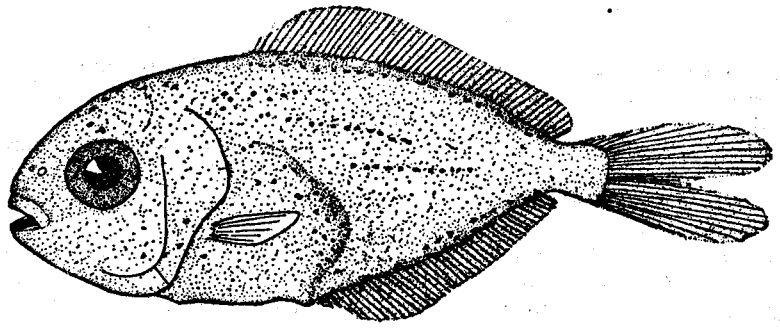

FIG. 125.—Young fish 15 millimeters long

large catches are not made until May. The fish is caught throughout the summer and fall and often well into November. During the seven-year period, 1916 to 1922, the largest catch of butterfish, made by a set of two pound nets at Lynnhaven Roads, Va., on any one day of each month from April to November, was as follows: April 21, 1919, 1,700 pounds; May 14, 1918, 5,225 pounds; June 12, 1918, 4,600 pounds; July 30, 1917, 8,100 pounds; August 8, 1919, 5,200 pounds; September 21, 1919, 3,000 pounds; October 6, 1919, 850 pounds; and November 14, 1918, 900 pounds. A run of fish occurring about the middle of November is not unusual, and pound nets in the lower sections of the bay make small catches until the nets are taken up for the winter at the end of November.

The greater part of the catch of butterfish in the Chesapeake is taken below the Potomac River, particularly from Mobjack Bay to the capes. A large part of the catch is shipped to markets principally between Washington and Boston, and good prices, especially early and late in the season, often are obtained. During a part of May, 1921, and in 1922 the wholesale price of butterfish in New York was around 20 cents a pound. Later in the season, however, the price, especially for the small sizes, dropped to 3 and 4 cents a pound.

Many small, unsalable butterfish, 3 to 5 inches in length, are caught in pound nets. As a rule these small fish are not culled from the catch until the pound-net boats are en route to or have reached shore, with the result that many thousands of fish are wasted annually in Chesapeake Bay. Most of the marketable butterfish are from 7 to 9 inches long, but fish of 10 or 11 inches are not uncommon. A butterfish 6 inches long weighs about 1¾ ounces; one 7 inches long, 2¾ ounces; and one 8 inches long, from 4 to 4½ ounces. A fish 11 inches long and in prime condition weighs about 1 pound. The maximum length is 12 inches and the maximum weight is 1¼ pounds.

The butterfish is a good pan fish and, particularly along the Atlantic coast, finds a ready sale. In the Chesapeake region it is frequently not separated from the starfish or harvest fish (*Peprilus alepidotus*), and the two are sold together.

Habitat.—Nova Scotia to Florida.

Chesapeake localities.—(*a*) Previous records: "* * * many parts of Chesapeake Bay, as far north as the Patapsco River." (Uhler and Lugger, 1876); Cape Charles city, Va. (*b*) Specimens in collection and observed: At many localities from Annapolis southward to the capes.

Family LIII.—CARANGIDÆ. The crevallies, pompanoes, etc.

Body deep or elongate, usually more or less compressed; head compressed; mouth variable in size; premaxillaries usually protractile; maxillary with or without a supplemental bone; teeth variable, usually small, occasionally wanting in adult; gills, 4, a slit behind the fourth; pseudobranchiæ large, sometimes lost with age; branchiostegals commonly 7; scales small, cycloid, sometimes embedded, occasionally obsolete; lateral line complete, usually with a prominent arch anteriorly, sometimes wholly or in part armed with bony scutes; dorsal fins 2; spinous dorsal rather weak, usually preceded by a procumbent spine; second dorsal long, usually more or less elevated anteriorly; caudal fin broadly forked; anal fin similar in form to second dorsal, sometimes much shorter, preceded by two strong spines, these sometimes disappearing with age; ventrals thoracic, I, 5; pyloric cæca generally numerous.

KEY TO THE GENERA

a. Shoulder girdle with a deep furrow near its juncture with the isthmus and a fleshy knob above it; eye large ..... Selar, p. 217

aa. Shoulder girdle normal, not as above; eye moderate.

b. Anal fin much shorter than the second dorsal; body elongate, not strongly compressed; lateral line entirely unarmed ..... Seriola, p. 217

bb. Anal fin little, if any, shorter than second dorsal; body deep or elongate, rather strongly to very strongly compressed.

c. Body elongate; scales linear, embedded, giving the skin a leathery appearance; premaxillaries not protractile, except in very young ..... Oligoplites, p. 219

cc. Body deeper, moderately to very deep; scales small, round, not as above; premaxillaries protractile.

d. Back not much elevated; chest and abdomen deep; ventral outline much more strongly convex than the dorsal; lateral line unarmed; anterior rays of second dorsal and anal not produced ..... Chloroscombrus, p. 220

dd. Back notably elevated; ventral outline not more strongly convex than the dorsal.

e. Pectoral fins rather long and pointed (except in very young); lateral line with a high arch anteriorly, armed with bony scutes posteriorly (obsolete in Selene).

f. Body moderately elongate and not excessively compressed, the depth less than half the length of body; lateral line posteriorly strongly armed ..... Caranx, p. 220

ff. Body deep, ovate, very strongly compressed; the depth greater than half the length of body.

g. Dorsal and ventral outlines both strongly convex; anterior rays of second dorsal and anal bearing long, threadlike filaments; bony scutes in straight part of lateral line well developed ..... Alectis, p. 224

gg. Dorsal outline much more strongly convex than the ventral; anterior rays of the second dorsal and anal produced or not, never bearing long, threadlike filaments.

h. Anterior profile of head straight, oblique; anterior rays of the second dorsal and anal notably produced (except in very young); lateral line without definite bony scutes ..... Selene, p. 224

hh. Anterior profile of head nearly vertical, more or less concave in advance of eyes; none of the rays of the dorsal or anal produced; straight part of lateral line with small bony scutes ..... Vomer, p. 226

ee. Pectoral fins always short, rarely exceeding length of postorbital part of head; lateral line not definitely arched anteriorly, unarmed ..... Trachinotus, p. 227

85. Genus SELAR Bleeker

Body elongate, little compressed; the back not elevated; eye very large; shoulder girdle with a deep furrow at its juncture with the isthmus and a fleshy projection above the furrow.

111. Selar crumenophthalmus (Bloch). Big-eyed scad; Goggle-eye jack; Goggler.

Scomber crumenophthalmus Bloch, Naturg. Ausl. Fische, 1793, VII, p. 77, Pl. CCCLXIII; Guinea.
Trachurops crumenophthalmus Bean, 1891, p. 87; Jordan and Evermann, 1896–1900, p. 911, Pl. CXLI, fig. 385.

Head 3.35; depth 3.25; D. VIII–I, 26; A. II–I, 21. Body elongate, little compressed, the back little elevated; head long and low; snout rather pointed, 3.4 in head; eye very large, 3.35, with a well-developed adipose membrane in adult; mouth large, oblique; lower jaw projecting; maxillary reaching anterior margin of pupil, 2.32 in head; teeth small, villiform, present on jaws, vomer, palatines, and tongue; gill rakers scarcely half as long as eye, 26 on lower limb of first arch; scales very small; lateral line without definite arch, armed with scutes, these increasing in size posteriorly; first dorsal with rather high, slender spines; second dorsal and anal similar, moderately elevated

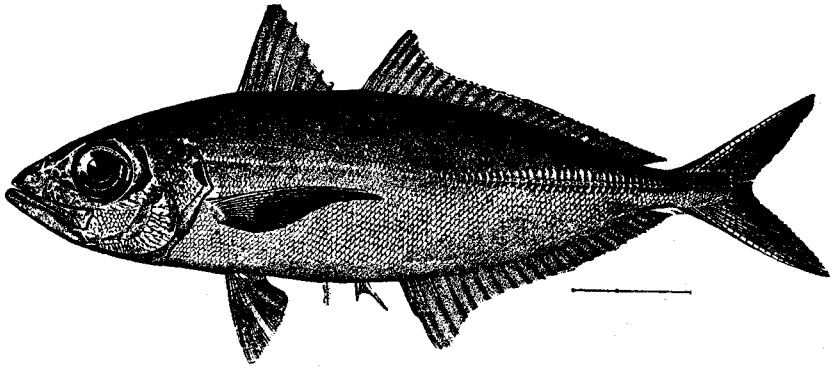

FIG. 126.—*Selar crumenophthalmus*

anteriorly, each with a low sheath of scales at base; caudal forked; ventrals rather long, reaching to or slightly beyond vent; pectorals long, falcate, about equal to length of head, 4 in length of body.

Color bluish above; silvery below; snout and tip of lower jaw dusky; fins mostly more or less dusky; second dorsal and caudal edged with black.

This species is represented in the present collection by a single specimen, 180 millimeters (7 inches) in length.

This fish has been recorded only once from Chesapeake Bay, and it was seen only once during the present investigation. It is probable that only stragglers enter the bay. The species is reported to reach a length of 2 feet. One of us (Hildebrand) observed numerous examples on the coasts of Panama, where this fish is common and of some commercial value. The maximum length in that vicinity appeared to be only about 15 inches.

Habitat.—Both coasts of tropical America; stragglers ranging northward on the Atlantic to Massachusetts.

Chesapeake localities.—(*a*) Previous record: Cape Charles city, Va. (*b*) Specimen in collection: Lynnhaven Roads, Va., taken in a pound net, September 27, 1921.

86. Genus SERIOLA Cuvier. Amber fish

Body elongate, moderately compressed; back not greatly elevated; head rather long; snout more or less pointed; mouth moderately large; premaxillaries protractile; maxillary very broad, with a wide supplemental bone; teeth in villiform bands on jaws, vomer, palatines and usually on tongue; lateral line with a long, low arch, unarmed, in a slight keel on caudal peduncle in adult; first dorsal with six to eight slender spines, connected by membrane; second dorsal long, more or less elevated anteriorly; anal similar to second dorsal, only much shorter; no finlets; ventral fins long; pectoral fins broad, shorter than ventrals.

112. Seriola dumerili (Risso). Amber fish; Rubber jack; Rudder fish; Shark pilot.

Caranx dumerili Risso, Ichthyol., Nice, 1810, p. 175, Pl. VI, fig. 20; Nice.
Scomber zonatus Mitchill, Trans., Lit. and Phil. Soc., N. Y., 1815, p. 427; New York.
Seriola zonata Jordan and Evermann, 1896–1900, p. 902, Pl. CXXXIX, fig. 381.
Seriola lalandi Cuvier and Valenciennes, Hist. Nat. Poiss., IX, 1833, p. 208; Jordan and Evermann, 1896–1900, p. 903, Pl. CXL, fig. 382.
Seriola dumerili Jordan and Evermann, 1896–1900, p. 903.

Head, 3.25 to 3.65; depth, 3.15 to 3.85; D. VI to VIII–I, 34 to 39; A. II, 18 to 20; scales about 150 to 180. Body elongate, not greatly compressed; head rather large; snout long, tapering, 2.45 to 2.85 in head; eye, 4.4 to 5.8; mouth large, terminal, a little oblique; maxillary broad, reaching about middle of eye, 1.95 to 2.25 in head; teeth small, in broad villiform bands on jaws, vomer, palatines, and tongue; gill rakers about the length of eye, 10 to 12 on lower limb of first arch; lateral line anteriorly scarcely arched, unarmed, in a keel on caudal peduncle; first dorsal composed of low, weak spines; second dorsal very long, elevated anteriorly; caudal fin broadly forked, the lobes of about equal length; anal fin shaped like the second dorsal, but much shorter; ventral fins large, longer than the pectorals, inserted nearly under base of pectorals; pectoral fins short, 1.9 to 2.25 in head.

Color grayish or purplish, with golden reflections, above; a bronze stripe along sides from snout to caudal; pale or white below; fins pale or dusky, pectoral, dorsal, and caudal yellowish. Young

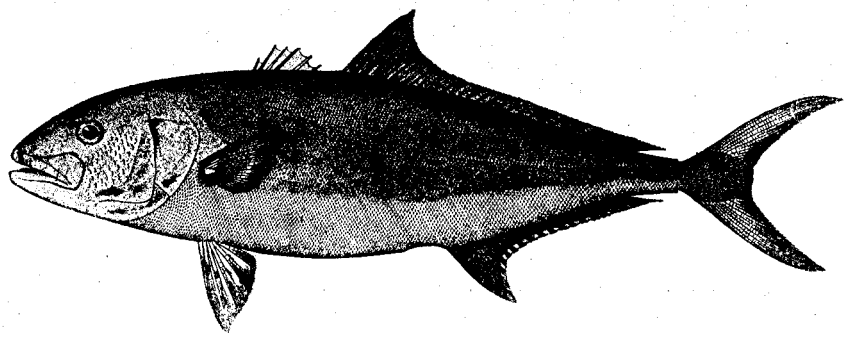

FIG. 127.—*Seriola dumerili*

with dark bars along sides, these bars disappearing with age. Color in alcohol bluish gray above, pale underneath; dorsal fins dark; other fins mostly pale or dusky. The longitudinal band, when present, is dark.

This fish was observed only twice during the present investigation and no specimens were preserved, because of their large size. It is here described from specimens collected at Beaufort, N. C., ranging in length from 205 to 440 millimeters (8 to 17¼ inches). One of us (Hildebrand) has examined a large number of specimens of this genus from various localities and has found great difficulty in separating species. It seems probable that too many species have been recognized. One of the specimens observed in the Chesapeake was recognized as *S. zonata*, the banded form, and two larger specimens, each weighing 16 pounds, were thought to be *S. lalandi*. It seems highly probable that *S. zonata* merely represents the young of *S. dumerili* and *S. lalandi*. The three are considered identical in this work.

This fish apparently seldom enters Chesapeake Bay and is known only from the lower sections of the bay, where only a few fishermen appear to have seen it. A 16-pound fish taken at Lynnhaven Roads with a pound net and displayed in the Norfolk fish market caused much comment because of its size and rarity. Various names were suggested for it, including "salmon," but no one seemed to recognize the fish. On the same day (June 16, 1921) another 16-pound fish was taken in a pound net off Back River. Evidently a small school, composed of fish of about equal size, entered the bay at this time. No others were seen during 1921 and 1922.

Some of the rudder fishes reach a large size and are valued as food. This species reaches a maximum weight of 100 pounds. At Key West amber fish weighing 20 to 70 pounds occur irregu-

larly during the winter and are sold in the local markets (Schroeder, 1924, p. 7). The amber fish is considered a fine game fish.

Habitat.—Both coasts of the Atlantic, ranging from Massachusetts southward to Brazil on the American coast.

Chesapeake localities.—(*a*) Previous records: None. (*b*) Specimens in collection: None. Observed at Lynnhaven Roads, Va., July 15, 1916, and June 16, 1921, and at Back River, Va. June 16, 1921.

87. Genus OLIGOPLITES Gill. Leatherjackets

Body oblong, compressed, dorsal profile anteriorly with a keel; head short, compressed; snout pointed; mouth large, oblique; lower jaw usually projecting slightly; premaxillaries not protractile except in very young; maxillary long and very narrow; teeth in bands on jaws, vomer, palatines, and tongue; scales small, linear, embedded in the skin and placed at different angles to each other; lateral line anteriorly with a low arch or broad angle, unarmed; dorsal spines 3 to 5, connected at base by low membranes; second dorsal and anal similar, somewhat elevated anteriorly, with deep notches between their posterior rays; anal preceded by two strong spines; pectoral fins short. A single species of the genus ranges northward on the Atlantic coast of the United States.

113. Oligoplites saurus (Bloch and Schneider). **Leatherjacket.**

Scomber saurus Bloch and Schneider, Syst. Ichthy., 1801, p. 321; Jamaica.
Oligoplites saurus Jordan and Evermann, 1896-1900, p. 898, Pl. CXXXVIII, fig. 378.

Head 4.75 to 4.9; depth 3.4 to 3.6; D. V–I, 19 to 21; A. II–I, 20 or 21. Body moderately elongate, strongly compressed; caudal peduncle rather slender, its depth 4.3 to 4.5 in head; head

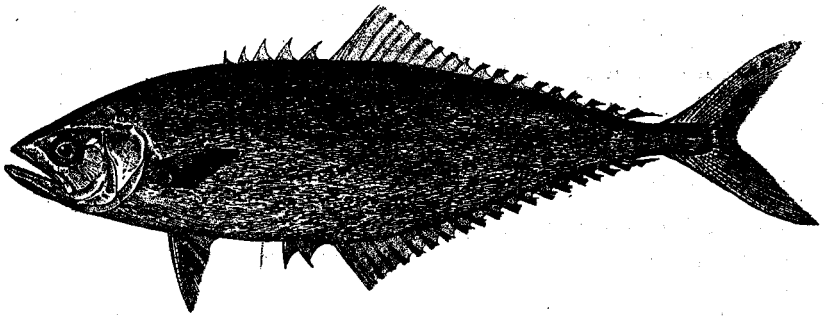

FIG. 128.—*Oligoplites saurus*

rather short, its upper surface without evident pores; snout pointed, its length 3.7 in head; eye 4.25 to 4.35; interorbital 3.6 to 3.7; mouth large, oblique; lower jaw projecting very slightly; maxillary very narrow, reaching to or a little beyond posterior margin of pupil, 1.7 to 1.8 in head; teeth small, villiform, in bands on jaws, vomer, palatines, and tongue; gill rakers rather short, 12 on lower limb of first arch; branchiostegal rays not connected across isthmus by a membrane; origin of dorsal over tips of pectorals, the spines short, pungent; soft dorsal and anal similar, somewhat elevated anteriorly, the short rays posteriorly deeply notched, scarcely forming separate finlets; caudal broadly forked, the lobes about equal; ventral fins moderate, inserted about equidistant from tip of snout and origin of second anal; pectoral fins short, 1.55 to 1.6 in head.

Color bluish above; sides bright silvery; fins all plain in spirits, mostly yellowish in life.

Only two specimens, 230 and 260 millimeters (9 and 10¼ inches) in length, were taken. This fish is the only one of the genus that ranges northward on the coast of the United States. It is recognized by its leathery jacket, sharply pointed snout, and short, pungent dorsal and anal spines. The feeding and spawning habits are unknown. The stomachs of the two specimens at hand, both taken in a pound net, contained fish remains and plant tissue. One specimen, taken in May, had the ovary well distended with eggs. In the other one, taken in September, the ovary was collapsed. Apparently it is only a straggler in Chesapeake Bay and so rare that it was unknown to the fishermen who saw the specimens. We find no record of its previous occurrence in the bay.

This fish reaches a length of about 12 inches. In the tropics, where the species is common, it has limited value as a food fish.

Habitat.—Both coasts of tropical America, ranging northward on our coast to Woods Hole, Mass.

Chesapeake localities.—(*a*) Previous records: None. (*b*) Specimens in collection: Lynnhaven Roads, Va., taken in pound nets, September 8, 1921, and May 25, 1922.

88. Genus CHLOROSCOMBRUS Girard. Bumpers

Body ovate, strongly compressed, the ventral outline much more strongly curved than the dorsal, both carinate; mouth strongly oblique, slightly superior; maxillary broad, emarginate behind, with a large supplemental bone; teeth small, present on jaws, vomer, palatines, and tongue; gill rakers long and slender; head mostly naked, the rest of the body covered with small, smooth scales; lateral line with a strong arch anteriorly and with or without bony scutes posteriorly; first dorsal composed of feeble spines; second dorsal and anal low, longer than the abdomen; caudal deeply forked; ventrals small; pectorals long and falcate.

114. Chloroscombrus chrysurus (Linnæus). Bumper.

Scomber chrysurus Linnæus, Syst. Nat., ed. XII, 1766, p. 494; Charleston, S. C.
Chloroscombrus chrysurus Bean, 1891, p. 87; Jordan and Evermann, 1896–1900, p. 938, Pl. CXLV, fig. 394.

Head 3.6 to 4.3; depth 2.1 to 2.4; D. VIII–I, 26 or 27; A. II–I, 26 to 28. Body very deep, ovate, strongly compressed; outline of abdomen extremely convex, much more strongly curved than the dorsal outline; head short and deep; snout blunt, shorter than eye, 3.34 to 4 in head; eye 2.65 to 3.2; mouth nearly vertical; maxillary reaching anterior margin of eye, 2.45 to 2.75 in head; gill rakers about two-thirds length of eye, 28 to 33 on lower limb of first arch; lateral line anteriorly with a prominent arch, shorter than straight part, without developed bony scutes posteriorly; second dorsal and anal about equal in length, the first somewhat more strongly elevated anteriorly, each with a sheath of scales at base; pectorals long and falcate in adult, proportionately shorter in young, 2.9 to 3.6 in length of body.

Color bluish gray above; sides silvery; a small opercular spot present; a prominent, quadrate, black blotch on upper part of caudal peduncle; fins mostly yellowish in life; vertical fins edged with dusky.

This species was not seen during the present investigation and only one specimen has been recorded from Chesapeake Bay. The foregoing description is compiled from published accounts of the species.

This fish reaches a small size, rarely exceeding 8 inches in length. It is not valued as food, for it is said to be dry and bony. In Colon, Panama, however, it is not infrequently seen in the market. Although straying northward to Massachusetts, it is not common north of the coast of South Carolina. It appears to be extremely rare in Chesapeake Bay, as already indicated.

Habitat.—Massachusetts to Brazil.

Chesapeake localities.—(*a*) Previous record: Cape Charles city, Va. (*b*) Specimens in collection: None.

89. Genus CARANX Lacépède. Crevallies

Body oblong or ovate, compressed; dorsal profile anteriorly sometimes strongly convex; head rather large, compressed; snout usually blunt; mouth moderate or large, oblique, usually terminal; maxillary with a supplemental bone; premaxillary protractile; teeth in the jaws more or less unequal, in one or a few series; villiform teeth usually present on vomer, palatines, and tongue; deciduous or wanting in some species; gill rakers slender; scales small; lateral line usually arched anteriorly, posteriorly armed with bony plates; first dorsal with slender spines, second dorsal and anal similar, usually more or less elevated anteriorly; anal preceded by two rather strong, short spines; caudal broadly forked; pectorals long and falcate in adult.

KEY TO THE SPECIES

a. Breast naked, except for a small triangular patch of scales immediately in front of ventrals; opercular spot prominent ..... *hippos*, p. 221

aa. Breast fully scaled; opercular spot present or wanting.

b. Body rather slender, the depth 3.45 to 4 in length; gill rakers numerous, 24 or 25 on lower limb of first arch ..... *crysos*, p. 222

bb. Body moderately deep, the depth 2.25 in length; gill rakers fewer, 14 on lower limb of first arch ..... *latus*, p. 223

115. Caranx hippos (Linnæus). Jack; Crevalle; Runner; "Jenny Lind;" "Rudder fish."

Scomber hippos Linnæus, Syst. Nat., ed. XII, 1766, p. 494; Charleston, S. C.
Carangus hippos Uhler and Lugger, 1876, ed. I, p. 113; ed. II, p. 94.
Caranx hippos Jordan and Evermann, 1896–1900, p. 920, Pl. CXLI, fig. 387.

Head 3.3 to 3.7; depth 2.2 to 2.55; D. VIII–I, 20 or 21; A. II–I, 16 or 17; lateral scutes 26 to 30. Body rather robust, compressed; upper profile anteriorly very strongly convex; head short and deep; snout very blunt, 3.65 to 4.5 in head; eye 3.3 to 4.25; interorbital 2.95 to 3.65; mouth slightly oblique, terminal; maxillary reaching about middle of eye in young, nearly or quite to posterior margin of eye in adult, 2.1 to 2.45 in head; teeth present on jaws, vomer, palatines, and tongue, some of the teeth on anterior part of lower jaw enlarged; gill rakers about half the length of eye,

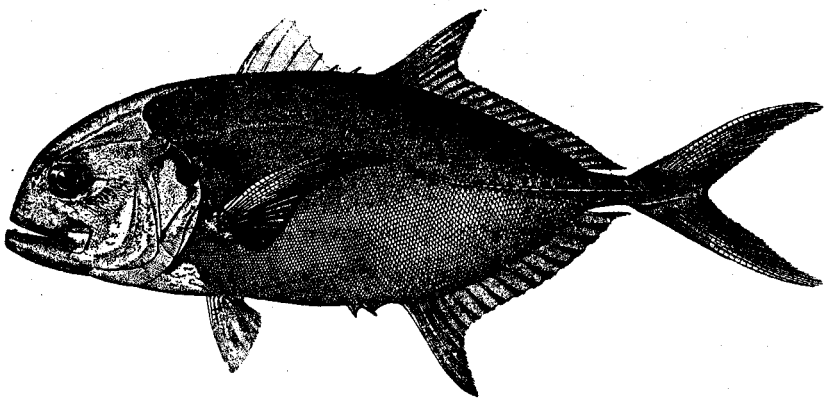

FIG. 129.—*Caranx hippos*

13 to 15, besides rudiments, on lower limb of first arch; scales small, cycloid, not present on breast, except for a small patch immediately in front of ventrals, not present on second dorsal and anal, except on elevated portions; lateral line with a long low arch anteriorly, usually slightly shorter than straight portion; lateral scutes strong posteriorly, forming a strong keel on caudal peduncle; first dorsal with slender spines; second dorsal and anal similar, moderately elevated anteriorly; caudal fin very broadly forked; ventrals moderate, inserted a little behind base of pectorals; pectorals long, falcate, 2.9 to 3.4 in length.

Color bluish green or greenish bronze above; lower parts pale silvery, sometimes with yellow blotches; a distinct black spot on opercle; fins usually more or less yellowish; spinous dorsal and elevated portion of soft dorsal distally dusky; ventral fins partly white; axil of pectoral dusky; the lower rays with a black blotch in adults, indistinct or wanting in young. Very young with five or six dark cross bars.

This species is represented by 15 specimens in the present collection, ranging from 115 to 195 millimeters (4½ to 7¾ inches) in length. The species differs from others of the genus in having the breast naked, except for a small triangular patch of scales just in advance of base of ventrals.

This fish is carnivorous and apparently highly predatory of other fish, fish remains only occurring in the contents of six stomachs examined. The spawning habits are entirely unknown.

Nothing is known of the rate of growth of the crevalle. Individuals taken during October at Ocean View, Va., with a single exception (203 millimeters), ranged in length from 129 to 175 millimeters (about 5 to 7 inches).

Small numbers of this species appear in the markets of Norfolk, Va., and vicinity in the late summer and during the fall. It is probable that the annual catch of marketable fish does not exceed 1,000 pounds, and nearly all are caught with pound nets.

The crevalle is confined to the lower sections of the bay and seldom is found above the mouth of the York River and Cape Charles city. It generally appears in July or August; during September and October small fish, 5 to 8 inches in length, are sometimes rather common at Ocean View and Lynnhaven Roads, Va. In September, 1921, about 400 small individuals were taken from a pound net on one day. While seining for spots and spotted squeteagues at Ocean View from September 27 to October 27, 1922, 40 small crevalles were caught in 30 hauls of an 1,800-foot net. This fish was taken in 11 of the 30 hauls, but it did not appear in the catch after October 15.

The rudder fish is not well known in the Norfolk markets, where it is sold with the related species, *C. crysos*, under the names "Jenny Lind" or "Rudder fish." The flesh of this fish is considered of medium quality.

The usual size of market fish ranges from one-third to 1 pound, but occasionally an individual of 2 or 3 pounds is taken. Along the southern coast and the Gulf of Mexico, where the species is common, fish weighing 10 pounds are not unusual, and the maximum size is said to be 20 pounds. The species is principally of southern distribution, the southern part of Chesapeake Bay being as far north as it is taken in considerable numbers. This species is of considerable importance as a food fish on the Gulf coast and southward. It is a common fish in the markets on both coasts of Panama, where it is esteemed as a food fish and brings a good price.

Small fish taken in Chesapeake Bay were of the following weights: 5½ inches, 1.3 ounces; 6 inches, 1.8 ounces; 6½ inches, 2.3 ounces; 7 inches, 2.9 ounces.

Habitat.—Widely distributed in warm seas; common on both coasts of tropical America, ranging northward on the Atlantic to Lynn, Mass.

Chesapeake localities.—(*a*) Previous record: "Enters Chesapeake Bay" (Uhler and Lugger, 1876). (*b*) Specimens in collection: Yorktown, Lynnhaven Roads, and Ocean View, Va.

116. Caranx crysos (Mitchill). Crevalle; Hard tail; Runner; "Jenny Lind"; "Rudder fish."

Scomber crysos Mitchell, Trans., Lit. and Phil. Soc., N. Y., I, 1814, p. 424; New York.
Caranx chrysus Bean, 1891, p. 87.
Caranx crysos Jordan and Evermann, 1896–1900, p. 921, Pl. CXLII, fig. 388.

Head 3.45 to 4; depth 2.65 to 3.1; D. VIII–I, 23 to 25; A. II–I, 19 or 20; lateral scutes 38 to 45. Body elongate, compressed; dorsal profile anteriorly rather strongly convex; head rather short; snout somewhat pointed, 3.1 to 3.95 in head; eye 3.65 to 4.45; interorbital 2.65 to 3.1; mouth oblique, terminal; maxillary reaching to or scarcely to middle of eye, 2.3 to 2.5 in head; teeth present on jaws, vomer, palatines, and tongue, some of the outer teeth in the jaws enlarged, those on anterior part of lower jaw not especially larger than the others; gill rakers somewhat longer than half the eye, 24 or 25 on lower limb of first arch; scales small, cycloid, fully covering breast, also present on soft dorsal and anal; lateral line with an arch anteriorly, equal to about two-thirds the length of the straight part; lateral scutes very strong posteriorly; first dorsal with slender spines; second dorsal and anal little elevated anteriorly, very low posteriorly, each with a wide sheath of scales at base; ventral fins rather small, inserted slightly behind base of pectorals; pectoral fins long, falcate, 2.75 to 4.15 in length of body.

Color greenish bronze above, shading into bronze silvery below; a more or less distinct opercular spot usually present; spinous dorsal dusky; second dorsal, caudal, and soft part of anal yellowish and more or less dusky on distal parts; ventrals mostly white with tinge of yellow; pectorals plain or slightly yellowish.

Fifteen specimens of this species, ranging in length from 145 to 360 millimeters (5¾ to 14¼ inches), were preserved. This fish has the breast fully scaled and it has a more slender body than the other species of the genus known from Chesapeake Bay. This species, like *C. hippos*, is carnivorous and preys on other fish. Four stomachs examined contained remains of fish only. The spawning habits of this fish are unknown.

This species is taken in the lower part of the bay under almost the same conditions as *C. hippos*, with which it associates. It appears, however, that small fish, 5 to 8 inches in length, are less common than *C. hippos* of similar size, while marketable sizes (½ to 1 pound) are taken in slightly greater numbers. As many as 40 fish of various sizes, all weighing less than 1 pound, were observed during September, 1921, among the day's catch of one pound net at Lynnhaven Roads, Va.

The small quantity taken is marketed in the vicinity of Norfolk, where this species and *C. hippos* were retailed together in 1921 and 1922 at about 20 cents a pound. The local names are "Jenny Lind" and "rudder fish."

This fish, like *C. hippos*, is principally of southern distribution. It is the common "runner" of the Gulf coast, where it is taken in large quantities and is esteemed as food. It does not reach as large a size as *C. hippos*, the maximum weight recorded being 3 pounds.

Habitat.—Cape Cod, Mass., to Brazil; rarely to Nova Scotia.

Chesapeake localities.—(*a*) Previous record: Cape Charles city, Va. (*b*) Specimens in collection: From Lynnhaven Roads and Ocean View, Va.

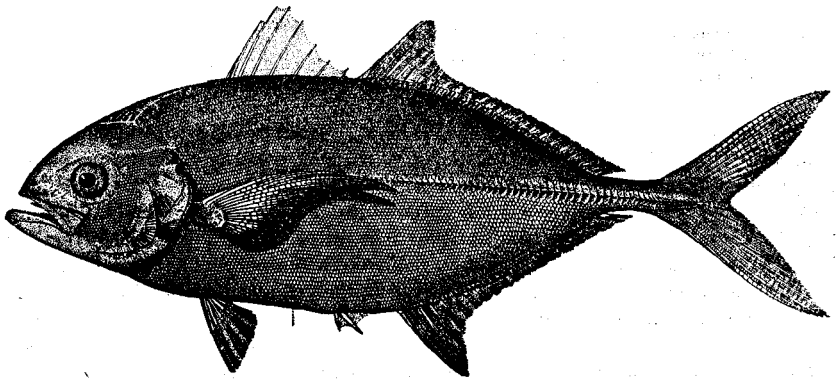

FIG. 130.—*Caranx crysos*

117. Caranx latus Agassiz. Jurel; Horse-eye jack; "Jenny Lind."

Caranx latus Agassiz, Pisc., Brasil., 1829, p. 105, Brazil; Jordan and Evermann, 1896–1900, p. 923, Pl. CXLII, fig. 389.

Head 3.65; depth 2.25; D. VIII–I, 21; A. II–I, 17; lateral scutes 35. Body rather deep, compressed; upper anterior profile strongly convex; head short, deep; snout rather blunt, 3.4 in head; eye 3.8; interorbital 3.3; mouth oblique, terminal; maxillary reaching a little beyond middle of eye, 2.1 in head; teeth present on jaws, vomer, palatines, and tongue, some of the outer ones in the jaws enlarged; gill rakers, a little longer than half the eye, 14 on lower limb of first arch; scales small, cycloid, covering the entire breast, not especially numerous on soft dorsal and anal; lateral line anteriorly with a prominent arch, about three-fourths as long as the straight part; lateral scutes strong posteriorly, forming a prominent keel on caudal peduncle; first dorsal low, with slender spines; second dorsal and anal moderately elevated anteriorly, each with a low sheath of scales at base; caudal fin broadly forked; ventral fins small, inserted under base of pectorals; pectoral fins long, falcate, three in length of body.

Color greenish blue above, silvery below; no opercular spot (this spot, although wanting in the specimen at hand, is sometimes present); fins more or less yellowish in life; the distal parts of dorsals and caudal dusky.

A single specimen, 195 millimeters (7¾ inches) in length, was seen and preserved. This species has a deep body like *C. hippos*, but less robust. It is most readily distinguished from that species by the fully scaled breast and usually by the absence of a dark spot on the opercle.

This fish, like the others of the genus, is of southern distribution. It appears to be the rarest of the three species herein recorded from Chesapeake Bay, as only a single individual was seen. On the Atlantic coast of Panama it is the most common species of the genus, occurring in the markets almost daily. The size attained is rather small, probably not exceeding 1 pound.

Habitat.—Virginia to Brazil.

Chesapeake localities.—(*a*) Previous records: None. (*b*) Specimen in collection: From Ocean View, Va., taken in a 1,800-foot seine on October 23, 1922.

90. Genus ALECTIS Rafinesque. The threadfishes

Body strongly ovate in young, becoming much more elongate in adult, strongly compressed; head short and deep, its anterior profile convex; mouth rather large, maxillary reaching well past front of eye; teeth small, in bands on jaws, vomer, palatines, and tongue; scales minute, embedded; lateral line with bony scutes on straight part; first dorsal with six or seven short spines, becoming obsolete with age; second dorsal and anal similar, the anterior rays of each bearing filaments. The changes due to age are very marked in this genus. The body in large examples is much more elongate, the anterior profile is less steep, the outlines of the body are scarcely angulate at origin of second dorsal and anal, the filaments on these fins are much shorter, the ventral fins are much shorter and the pectoral fins are much longer.

118. Alectis ciliaris (Bloch). Threadfish; Hair fish.

Zeus ciliaris Bloch, Naturg. Ausl. Fische, III, 1787, p. 36, Pl. CXCI; East Indies.
Blepharichthys crinitus Lugger, 1877, p. 76.
Alectis ciliaris Jordan and Evermann, 1896–1900, p. 931.

Head 2.95; depth, 1.3; D. VI–I, 18; A. II–I, 16. Body ovate (proportionately deeper in young than in adult); profile rather steep anteriorly, slightly concave over snout, strongly convex over the head, angulated at origin of soft dorsal and anal; head deep; snout projecting but little in advance of forehead, 3.35 in head; eye 3.55; interorbital 2.95; mouth slightly oblique, terminal; maxillary broad, reaching nearly opposite anterior margin of pupil, 2.5 in head; teeth in villiform bands on jaws, vomer, palatines, and tongue; gill rakers scarcely half the length of eye, 13 on lower limb of first arch; lateral line with a high arch anteriorly, arched portion a little longer than straight part, posteriorly armed with bony scutes; spinous dorsal very low, some of the spines almost obsolete; second dorsal and anal similar, the anterior rays of each fin greatly produced, forming long filaments; caudal fin broadly forked; ventral fins long (varying greatly with age); pectoral fins rather long, falcate in adult (shorter in young), 2.85 in length of body.

Color bluish above; sides silvery, with traces of darker bars and blotches (disappearing in large individuals); upper margin of eye dark; produced portion of the dorsal and anal bluish black; ventrals mostly black; the fins otherwise plain or slightly yellowish.

A single specimen 185 millimeters (7¼ inches) long was secured and it forms the basis for the foregoing description. This species is the only one of the genus. It is readily recognized by the extremely long dorsal and anal filaments. Virtually nothing is known of the feeding and spawning habits. The single stomach examined contained a few fragments of bones and plant tissue.

The threadfish is of southern distribution, being reported as common in southern Florida and Cuba. On the coast of Panama it apparently is rather uncommon. Only stragglers stray northward on our coast. According to fishermen in the southern part of the bay the species is quite rare, only an occasional example being taken. It is not known from the more northern sections of the bay.

Although used for food in the localities where it is common, the species has only limited commercial value. The largest example seen by us was from Key West, Fla., and measured 22 inches in length, which quite probably is the maximum size attained.

Habitat.—Both coasts of tropical America, straying northward on the Atlantic to Massachusetts.

Chesapeake localities.—(*a*) Previous record: Southern part of Chesapeake Bay (Lugger, 1876). (*b*) Specimen in collection: Lynnhaven Roads, Va., October, 1921. Fishermen reported one fish off Back River, Va., in June, 1921.

91. Genus SELENE Lacèpéde. Moonfishes

Body ovate, very strongly compressed; head short and deep, its anterior profile steep but never vertical, forming a rather abrupt angle with dorsal outline; snout moderately projecting; teeth small, present on jaws, vomer, and tongue; palatines with a few teeth or none; lateral line anteriorly with a prominent arch, without definite bony scutes posteriorly; spines of first dorsal slender,

bearing filaments in young; soft dorsal and anal elevated anteriorly, some of the rays much produced in adult.

119. Selene vomer (Linnæus). Moonfish; Lookdown; Horsehead.

Zeus vomer Linnæus, Syst. Nat., ed. X, 1758, p. 266; America.
Argyreiosus vomer Uhler and Lugger, 1876, ed. I, p. 112; ed. II, p. 94.
Selene vomer Bean, 1891, p. 87; Jordan and Evermann, 1896–1900, p. 936, Pl. CXLIV, fig. 393, and Pl. CXLV, fig. 393a.

Head 2.15 to 2.4; depth 1.15 to 1.3; D. VIII–I, 21 or 22; A. II–I, 18 or 19. Body ovate, very strongly compressed, the outlines trenchant; back much elevated; anterior profile steep, oblique, nearly straight, forming an angle with dorsal outline; head short, very deep; snout moderately projecting, 1.55 to 1.9 in head; eye 4 to 5.85; interorbital 4.2 to 5.45; mouth moderate, oblique, slightly superior; maxillary broad, 2.7 to 3.4 in head; teeth small, present on jaws, vomer, and tongue; gill rakers slender, about two-thirds length of eye, 24 or 25 on lower limb of first arch; lateral line with a prominent arch anteriorly, equal to or a little shorter than straight part, without developed bony scutes posteriorly; first dorsal with eight spines, the anterior ones slender, bearing

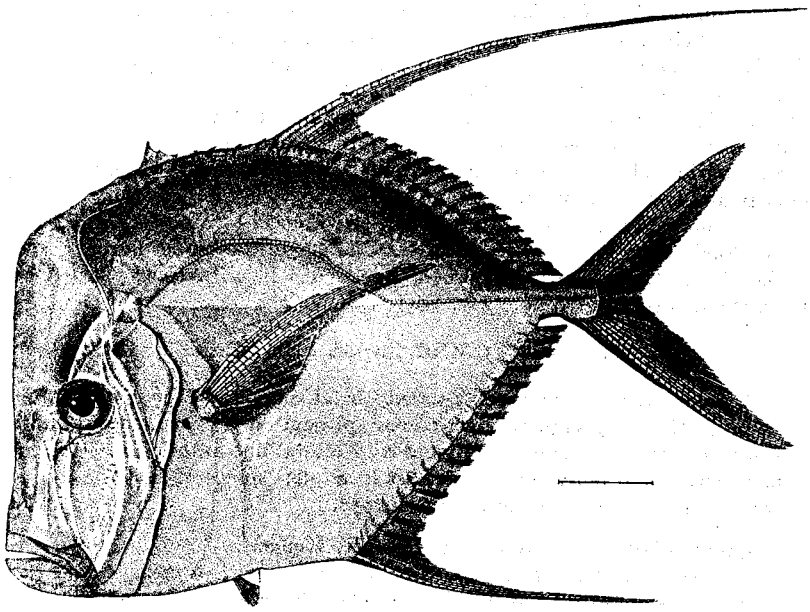

FIG. 131.—*Selene vomer*

long filaments in young; second dorsal and anal similar, the anterior rays much produced; caudal deeply forked; ventral fins very long in young, often reaching to or beyond base of caudal, very short in adult, about equal to length of eye in specimens 200 millimeters in length; pectoral fins long and falcate in adult, moderate in young, 2.05 to 3.25 in length of body.

Color in life of a specimen 175 millimeters long, bluish green, shading into bright silvery on sides; spinous and soft dorsals plain, the produced rays dusky; caudal yellowish, the lobes slightly dusky; produced rays of anal dusky white, anterior short rays yellowish, rest of fin plain; ventrals dusky brown; pectorals plain. A fish 144 millimeters long differed from the preceding as follows: Spinous dorsal dusky; no dusky markings on caudal; produced rays of anal dusky yellow. Young 90 millimeters long with a dusky yellow bar from spinous dorsal through eye, followed by four or five less distinct yellow bars; produced rays of dorsal black, anterior shorter rays dusky yellow, posterior rays plain; caudal tinged with yellow; produced rays of anal dusky yellow; ventrals black; pectorals plain.

This fish is represented in the present collection by 21 specimens, ranging in length from 60 to 235 millimeters (2⅜ to 9¼ inches). The moonfish is recognized by the very deep body, straight