Family LXI.—SERRANIDÆ. The sea basses

Body rather robust, compressed; teeth in jaws usually well developed, not depressible; *maxillary without a supplemental bone;* scales moderate or rather large. A single genus of this family is included in the fauna of Chesapeake Bay.

105. Genus CENTROPRISTES Cuvier. Sea basses

Body robust, slightly compressed; mouth large; maxillary without a supplemental bone; canines small; no teeth on tongue; preopercular margin serrate, the lower teeth somewhat antrorse; gill rakers rather long and slender; dorsal fin short, the spines with fleshy filaments at tips; caudal fin round or slightly double concave; anal rays III, 7; ventrals close together, inserted under or slightly in advance of pectorals. A single species is included in the fauna of Chesapeake Bay.

136. Centropristes striatus (Linnæus). Blackfish; Sea bass; "Black Will."

Labrus striatus Linnæus, Syst. Nat., ed. X, 1758, p. 285; "America."

Centropristis striatus Bean, 1891, p. 91; Jordan and Evermann, 1896-1900, p. 1199, Pl. CXC, fig. 500; Evermann and Hildebrand, 1910, p. 161.

Head 2.5 to 2.65; depth 2.4 to 2.95; D. X, 11; A. III, 7; scales 48 to 50. Body elongate, moderately compressed; back elevated; head rather thick; snout moderately pointed 3.35 to

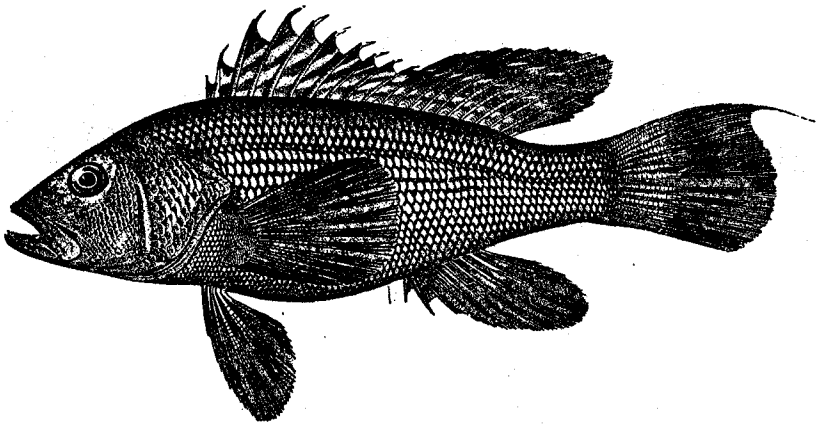

FIG 143.—*Centropristes striatus.* From a specimen 11¼ inches long

4.35 in head; eye 3 to 4.9; interorbital 6.65 to 9.75; mouth large, oblique; maxillary reaching about opposite middle of eye, 2.3 to 2.45 in head; teeth pointed, in bands on jaws, vomer, and palatines, no distinct canines; preopercular margin finely serrate; gill rakers scarcely longer than pupil, 17 or 18 on lower limb of first arch; scales moderate, ctenoid, reduced on head and cheeks, extending somewhat on the base of fins; lateral line complete, following the curvature of the back; dorsal fin continuous, the spines strong, the soft part elevated and notably higher than the spines in the adult; caudal fin round, large individuals with one of the upper rays produced; anal fin with three strong graduated spines, the soft rays very long in the adult; ventral fins moderate, inserted under base of pectorals; pectoral fins long, reaching beyond tips of ventrals, 1.35 to 1.45 in head.

Color of fish in the aquarium at Woods Hole, Mass., weighing from ¾ to 3 pounds, blue-black; centers of scales pale blue or white, forming longitudinal stripes along back and sides; several bluish streaks in front of or below eye present or absent; dorsal blue-black, with several pale stripes extending along both spinous and soft part, the stripes more numerous on the latter; caudal dusky or dark blue, streaked or mottled with pale markings; anal almost entirely pale or streaked with dark blue; ventrals bluish gray, the rays pale; pectorals grayish. Females are lighter than males, usually gray-blue instead of blue-black. The male develops an adipose hump on the nape, which in the breeding season is often bright blue; this hump sometimes evident in males only 12 inches

long. Large males frequently are colored bright blue between the eyes. Color of Chesapeake Bay fish about 6 inches long: Blackish; centers of scales pale blue or white, often forming light longitudinal streaks; a blue streak on border of lower outline of orbit; other blue streaks branching from the first one; dorsal reddish or bronze, with white spots forming 3 longitudinal stripes on spinous dorsal and 4 or 5 on soft dorsal; caudal with reddish bars at base, distally dusky, the lower rays pale or reddish; anal and ventrals bluish white or dusky; pectorals plain, sometimes tinged with yellowish brown. Young 2 to 3 inches in length brownish above, a dark brown or black lateral stripe from eye to base of caudal; frequently with indefinite dark crossbars on sides; brick-red markings below eye; spinous dorsal dusky, sometimes with a dark spot at base of posterior spines; soft dorsal with brick-red spots forming three or four rows; caudal and anal with reddish markings; ventrals plain; pectorals salmon.

Numerous specimens of this species, ranging from 60 to 225 millimeters (2⅜ to 9 inches) in length, were preserved. This fish is recognized by its dark color, nonfilamentous spines of the dorsal, and the round caudal with only one of the upper rays somewhat produced in the adult. The young, as indicated in the description, differ rather prominently from the adults in color. They also differ in having the soft parts of the dorsal and anal fins proportionately much lower, and the caudal fin round, without a produced upper ray.

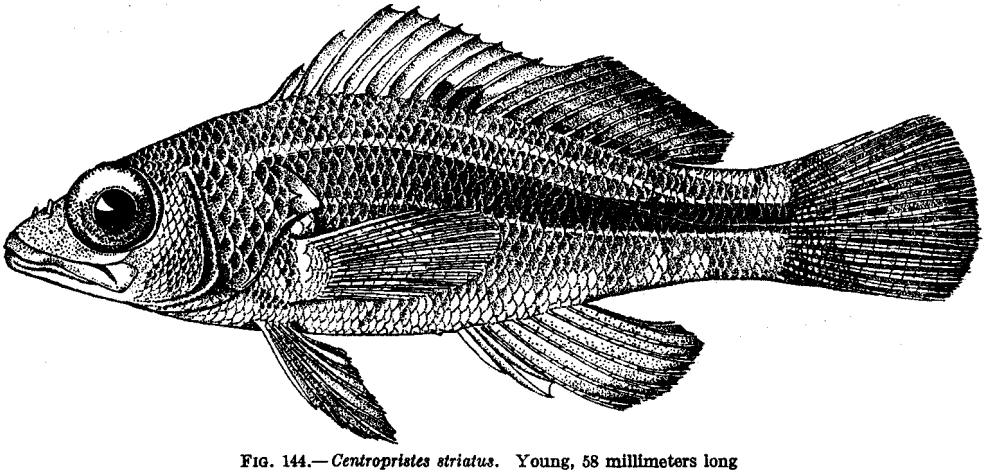

FIG. 144.—*Centropristes striatus*. Young, 58 millimeters long

The food of this fish in Chesapeake Bay, according to the contents of 19 stomachs, consists of crustaceans, fish, mollusks, and plants, named in the order of their apparent importance. Adults had fed chiefly on crabs and fish, and the young on shrimp, isopods, and amphipods.

Spawning occurs in May on the North Carolina coast, probably late in May near the mouth of the Chesapeake, and from the middle of May until the end of June off the New Jersey, Long Island, and southern New England coasts. The eggs are pelagic, about 1 millimeter in diameter, and hatch in about 75 hours at a temperature of 60° F. (Wilson, 1891, p. 210.)

The sea bass is usually most common on rocky and coral bottom and around the piling of wharves, etc. In several States it supports special fisheries. It is a voracious feeder and takes the hook readily, being taken in commercial quantities chiefly with hook and line. In Chesapeake Bay, however, it is of small commercial importance. During 1920 it ranked twenty-fifth in quantity and twenty-third in value, the catch being 5,100 pounds, worth $492. The entire catch is credited to Virginia, and in this State the sea bass ranked the same as for the entire Chesapeake region, namely, twenty-fifth in quantity and twenty-third in value. Eighty per cent of the fish were caught with hand lines and 20 per cent in pound nets.

This species is taken only in the southern parts of the bay, the northernmost pound net for which records were secured being located at Solomons, Md., where small numbers are taken throughout the summer. A few fish are caught with hook and line in upper Tangier Sound, but the annual catch for Maryland is probably not more than a few hundred pounds. It is most common near the

entrance of the bay, and the principal catches are made in the vicinity of Cape Charles, Ocean View, and Buckroe Beach, Va. The season extends from May until October, with no definite period when they are especially abundant.

The chief sea-bass grounds are off the coasts of North Carolina, Delaware, New Jersey, and western Long Island. To the eastward the fish are more scattered, but they are of some commercial importance in the following localities: Amagansett and Montauk, Long Island, off Block Island, and in the vicinity of Buzzards Bay. The sea bass is of chief importance along the New Jersey coast, where it is taken from May to November, not only by commercial fishermen but by a large number of anglers from the vicinity of New York. The magnitude of this sport fishing during the summer is remarkable, for no less than 100 seagoing power boats of various sizes carry as many as 4,000 or more persons daily to the fishing banks.

The sea bass is a well-flavored fish and finds ready sale in the Norfolk, Va., markets, where most of the Chesapeake catch is sold. The largest fish of which we have record weighed 7½ pounds and was caught on the Cholera Banks, off Long Island, on July 4, 1913. Examples weighing more than 6 pounds are rare, but 3 to 5 pound fish are rather common along the New Jersey coast during the summer. Its size in Chesapeake Bay, however, seldom exceeds one-half pound.

Habitat.—Massachusetts to northern Florida; rarely northward to Maine.

Chesapeake localities.—(*a*) Previous records: Cape Charles city, Norfolk, and Cape Henry. (*b*) Specimens in collection: From many localities from the southern part of the bay from Solomons, Md., to Cape Charles and Lynnhaven Roads, Va.

Family LXII.—PRIACANTHIDÆ. The big-eyes

Body oblong, compressed; head deep; snout short; eye very large; mouth rather large, very oblique to nearly vertical; teeth pointed, in bands on jaws, vomer, and palatines; preopercular margin serrate; pseudobranchiæ large; branchiostegals 6; lateral line continuous, not extending on caudal; scales small, firm, ctenoid, extending forward on head; dorsal fin continuous, with about 10 spines; anal fin with 3 spines; ventral fins thoracic, with I, 5 rays. Two genera of this family of tropical fishes occur as stragglers in Chesapeake Bay.

KEY TO THE GENERA

a. Scales small, 80 to 100 in lateral series; body elongate, the depth less than half the length; soft dorsal and anal, each with 12 to 15 rays ..... Priacanthus, p. 253

aa. Scales larger, 35 to 50 in a lateral series; body deep, the depth about half the length; soft dorsal and anal, each with 9 to 11 rays ..... Pseudopriacanthus, p. 254

106. Genus PRIACANTHUS Cuvier. Big-eyes

Body oblong, the depth less than half the length; preopercle with a well-developed, flat spine at angle; lateral line extending strongly upward and backward from upper angle of gill opening to anterior dorsal spine, then following curvature of back; scales small, 80 to 100 in a lateral series; dorsal with X, 13 or 14 rays; anal III, 13 to 15.

137. Priacanthus arenatus Cuvier and Valenciennes. Big-eye

Priacanthus arenatus Cuvier and Valenciennes, Hist. Nat. Poiss., III, 1829, p. 97; Brazil. Jordan and Evermann, 1896-1900, p. 1237, Pl. CXCV, fig. 511.

Head 3.2; depth 2.6; D. X, 14; A. III, 15; scales 98. Body elongate, rather strongly compressed; ventral outline anteriorly much more strongly convex than the dorsal; head deep; snout short, 3.85 in head; eye very large, 2.1; interorbital 5.1; mouth moderate, nearly vertical; lower jaw projecting; maxillary broad, reaching only a little past anterior margin of eye, 1.85 in head; teeth small, pointed, in narrow bands on jaws, vomer, and palatines; preopercular margin finely serrate, the angle produced into a short, flat, serrated spine; opercle with an indentation slightly above and behind preopercular spine; gill rakers long and slender, 21 on lower limb of first arch; scales small, ctenoid; dorsal fin continuous, the spines slender, pungent, the soft part not much higher than the spines; caudal fin with slightly concave margin; anal fin with three slender graduated spines, the soft part

similar to that of dorsal; ventral fins very long, reaching beyond origin of anal, inserted under base of pectorals, the inner ray attached to the abdomen by membrane; pectoral fins very short, 1.7 in head.

Color in life bright red; brownish silvery in spirits; ventrals and anterior rays of anal whitish, tipped with black; fins otherwise mostly plain translucent.

A single specimen, 185 millimeters (7⅜ inches) in length, was secured. This specimen was saved by fishermen at Buckroe Beach as a curiosity, although they stated that the species had been seen previously by them. It is readily recognized by the bright red color, very large eye, nearly vertical mouth, and small scales.

Habitat.—Massachusetts southward to Brazil; chiefly from tropical waters, probably drifting northward during the summer in the Gulf Stream.

Chesapeake localities.—(*a*) Previous records: None. (*b*) Specimen in collection: From Buckroe Beach, Va., captured October 5, 1921.

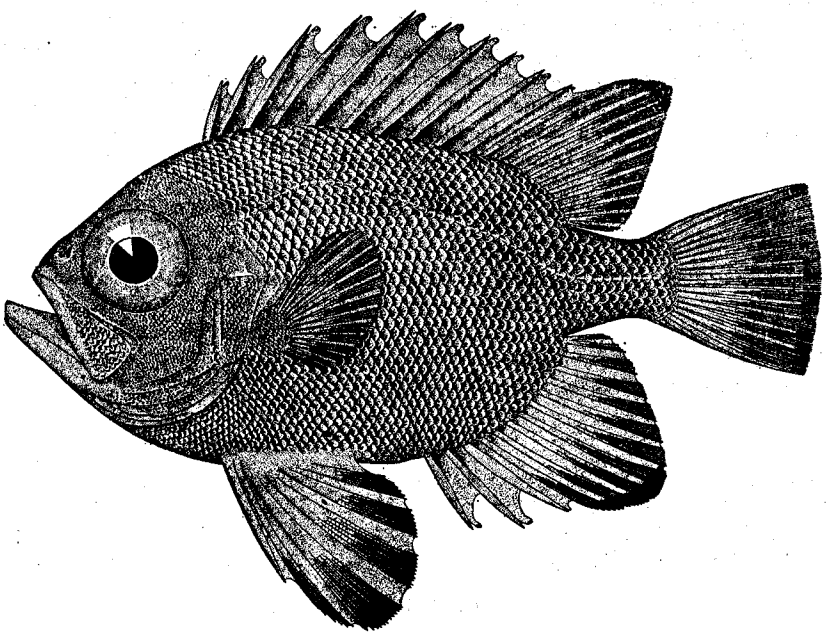

FIG. 145.—*Pseudopriacanthus altus.* From a specimen 5⅛ inches long

107. Genus PSEUDOPRIACANTHUS Bleeker. Short big-eye

This genus differs from Priacanthus principally in the larger scales, 25 to 50 in lateral series; deeper body, the depth about half the length; and the shorter dorsal and anal fins, dorsal rays X, 11, anal rays III, 9 to 11.

138. Pseudopriacanthus altus (Gill). Short big-eye.

Priacanthus altus Gill, Proc., Ac. Nat. Sci., Phila., 1862, p. 132; Narragansett Bay, R. I.
Pseudopriacanthus altus Jordan and Evermann, 1896-1900, p. 1239, Pl. CXCV, fig. 512.

Head 2.45; depth 1.7; D. X, 11; A. III, 10; scales 47. Body short and deep; head short; snout very short, 3.85 in head; eye large, 2.1; interorbital 5.1; mouth rather large, nearly vertical; maxillary reaching anterior margin of pupil, 1.85 in head; teeth pointed, in narrow bands on jaws, vomer, and palatines, the outer series in jaws slightly enlarged; preorbital very narrow, serrate; preopercular margin serrate, with two slightly enlarged spines at angle; gill rakers slender, about 20 on lower limb of first arch; scales strongly ctenoid, reduced on head; present on cheeks and maxillary; dorsal fin long, continuous, its origin slightly posterior to eye, the spines strong, the soft part somewhat

higher than the spines; caudal fin round; anal fin with three graduated spines, the soft part similar to that of dorsal; ventral fins long, reaching beyond origin of anal, inserted under base of pectorals; pectoral fins short, 2 in head.

Color in life red; dorsal red, the spinous part edged with yellow, a few blackish dots on the soft rays; caudal fin pale, with blackish reticulations; anal red, edged with black; ventrals red at base, the rest of fins dusky or black; pectorals plain red. Color in spirits light brownish, with the dark marking on fins remaining as in the fresh specimen.

A single specimen 70 millimeters (2¾ inches) in length was taken, and it forms the basis for the foregoing description. The species is readily recognized by the deep body, very short snout, vertical mouth, large eye, moderately large scales, and the red color. The small specimen at hand differs somewhat from described specimens in having two enlarged spines at angle of preopercular margin, instead of having no spines at this place. It also differs in the much longer ventral fins and in the very deep body. These differences, however, may all be due to age.

This fish is principally a West Indian species that sometimes strays northward and occasionally is taken in considerable numbers on the coast of Massachusetts. Apparently it is very rare in Chesapeake Bay, and it was unknown to the fishermen who captured the specimen in hand. The largest individual of this species recorded was only 11 inches long.

Habitat.—West Indies to Massachusetts; occurring northward only as a straggler.

Chesapeake localities.—(*a*) Previous records: None. (*b*) Specimen in collection: From Ocean View, Va., captured September 26, 1922.

Family LXIII.—LOBOTIDÆ. The tripletails

Body oblong, compressed; back elevated; anterior profile more or less concave; head moderate; snout short; eye small, anteriorly placed; mouth moderate, oblique; lower jaw projecting; teeth in the jaws pointed, small, none on vomer and palatines; preopercle serrate; scales of moderate size, rather strongly ctenoid; dorsal fin long, continuous, with 12 strong spines, the soft part elevated; caudal fin rounded; anal fin with three graduated spines, the soft part similar to that of dorsal and opposite it. This family consists of a single genus.

108. Genus LOBOTES Cuvier. Tripletails

The characters of the genus are included in the family description. A single species of wide distribution occurs on the Atlantic coast of the Americas and is not uncommon in Chesapeake Bay.

139. Lobotes surinamensis (Bloch). Tripletail; Flasher; "Lumpfish"; "Strawberry bass."

Holocentrus surinamensis Bloch, Naturg. Ausl. Fische, IV, 1790, p. 98, Pl. CCLXIII; Surinam.

Lobotes surinamensis Uhler and Lugger, 1876, ed. I, p. 135; ed. II, p. 115; Jordan and Evermann, 1896-1900, p. 1235, Pl. CXCIV, fig. 510; Fowler, 1912, p. 58.

Head 2.9; depth 2.05; D. XII, 16; A. III, 12; scales 48. Body deep, compressed; back elevated; anterior profile concave over the eyes; head moderate; snout tapering, 4.15 in head; eye 5.05; interorbital 3.45; mouth moderate, oblique; lower jaw projecting; maxillary reaching middle of eye, 2.65 in head; teeth in jaws small, pointed; preopercular margin strongly serrate, the serræ at angle much enlarged, longer than pupil; scales moderate, strongly ctenoid, extending more or less on the base of all the soft fins; dorsal with strong spines, the soft part much higher than the spines; caudal fin round; anal fin with three strong, graduated spines, the soft part shorter but similar in shape to soft dorsal; ventral fins long, reaching vent, inserted slightly behind base of pectorals; pectoral fins short, 1.95 in head.

Color brownish black, with darker blotches below base of dorsal and anal; pectoral fins pale; other fins all brownish to blackish; caudal with a broad, pale margin. (The pale pectoral and pale margin of the caudal are probably characteristic of young fish only.) The color becomes darker after death. Large fish examined by us in Norfolk fish markets were black everywhere on body and fins. Young fish are sometimes marked with yellow and brown. A specimen observed at Key West had the yellow and brown colors of an autumn leaf.

A single specimen, 175 millimeters (6⅞ inches) long, was preserved, and it forms the basis for the foregoing description. This species is easily recognized by the deep, compressed body and

the high, soft rays in the dorsal and anal fins, giving the fish the appearance of having three tails.

The lumpfish is taken in very limited numbers in the lower parts of the bay—that is, at Cape Charles and Lynnhaven Roads to Buckroe Beach, Va. No records of the yearly catch of this species are available. It is estimated, however, that the catch for 1922 did not exceed 1,000 pounds, all taken in pound nets.

A few fish are caught throughout the summer and fall, September and October yielding the largest number. Virtually the entire catch is marketed in Norfolk, where the species is known either as lumpfish or strawberry bass. The size of the fish observed in the market ranged from 5 to 25 pounds. A fish 738 millimeters (29 inches) long weighed 25 pounds.

Although widely distributed, this fish is not abundant anywhere. It is said to attain a maximum length of 3 feet.

Habitat.—Massachusetts to Uruguay.

Chesapeake localities.—(*a*) Previous records: "Occasionally caught in the lower part of the Chesapeake Bay" (Uhler and Lugger, 1876); observed in the Norfolk fish markets (Fowler, 1912). (*b*) Specimen in collection: Lynnhaven Roads, Va.; also observed at Cape Charles, Norfolk, Buckroe Beach, and Ocean View, Va.

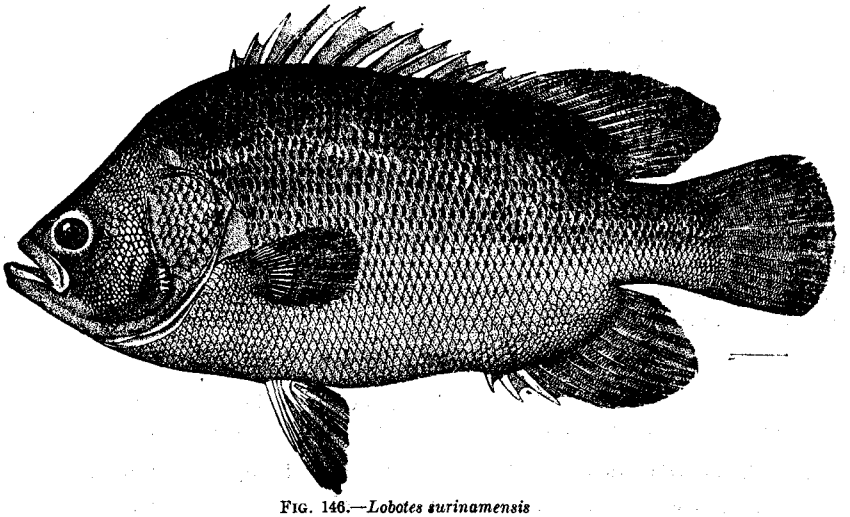

FIG. 146.—*Lobotes surinamensis*

Family LXIV.—LUTIANIDÆ. The snappers

Body elongate, compressed; head rather large; mouth usually large, terminal or with the lower jaw slightly projecting; teeth rather strong, present on jaws and usually on vomer, palatines, and tongue; premaxillaries protractile; maxillary long, without a supplemental bone; nostrils rather close together, neither with a tube; opercles without spines; gills 4; gill membranes free from the isthmus; pseudobranchiæ large; lateral line present; scales ctenoid, adherent; air bladder present; dorsal single or double, with 10 to 12 strong spines; caudal fin merely emarginate to deeply forked; ventral fins thoracic, with I, 5 rays.

109. Genus LUTIANUS Bloch. Snappers

Body elongate, compressed; back more or less elevated; head long; snout pointed; mouth large; jaws with bands of teeth, the outer ones usually enlarged, the upper jaw usually with two to four canines anteriorly; pointed teeth also present on vomer, palatines, and tongue; preopercular margin serrate; gill rakers rather few; scales ctenoid, wanting on head or present only at nape; soft dorsal and anal scaly at base; dorsal spines 10 or 11, not separated from the soft rays; caudal fin emarginate or slightly forked; anal fin with III, 7 to 9 rays.

140. Lutianus griseus (Linnæus). Gray snapper; Mangrove snapper.

Labrus griseus Linnæus, Syst. Nat., ed. X, 1758, p. 283; Bahamas.
Lutjanus caris Bean, 1891, p. 91.
Neomænis griseus Jordan and Evermann, 1896-1900, p. 1255; Evermann and Hildebrand, 1910, p. 161.

Head 2.6 to 2.65; depth 2.35 to 2.6; D. X, 14; A. III, 8; scales 48 to 51. Body elongate; back moderately elevated; profile straight or slightly concave over snout; head moderate; snout rather pointed, 3.25 to 3.4 in head; eye 3.7 to 4.25; interorbital 5.4 to 5.8; mouth large, terminal; maxillary reaching to or a little beyond anterior margin of pupil, 2.5 to 2.55 in head; teeth present on jaws, vomer, palatines, and tongue; upper jaw with one or two pairs of canines; lower jaw with the outer series enlarged; vomerine teeth in an anchor-shaped patch, with a definite, median, backward projection; preopercular margin finely serrate; gill rakers rather few and short, eight or nine on lower limb of first arch; scales of moderate size, present on base of soft part of vertical fins, the rows above lateral line not parallel with it; dorsal fin continuous, without definite notch, the soft part higher than the spines; caudal fin concave, the upper lobe longest; anal fin with three spines, the second and third of about equal length, the soft part shorter but similar to that of dorsal; ventral fins moderate, inserted a little behind base of pectorals; pectoral fins rather short, 1.35 to 1.5 in head.

Color in alcohol dark brown above, becoming pale underneath; rows of scales on sides marked by definite dark longitudinal stripes; fins light brown to pale; margin of membranes of spinous dorsal black; soft dorsal and base of caudal with small brown spots. The color in life, according to published accounts, is dark green above, coppery red below; spinous dorsal dusky, with red margin; soft dorsal dusky with white edge anteriorly; caudal olivaceous or reddish black; anal reddish with white margin; ventrals pale or whitish, sometimes with faint red markings; pectorals pale.

This fish is able to change its color to agree with its surroundings. In southern Florida, where we have studied its habits, it was noted that at times fish became pale gray above with light red markings below, while again the color might be dark gray-green above and on sides, with bright red predominating on lower part of body. The longitudinal stripes are most prominent when the fish is darkest.

Six small specimens, ranging in length from 105 to 111 millimeters (4⅛ to 4⅜ inches), were secured. This is the only snapper taken in Chesapeake Bay. It is characterized by the absence of both a black spot on the sides and crossbars and by the presence of dark longitudinal stripes along the rows of scales, which run obliquely upward and backward above the lateral line and are not parallel with it.

The gray snapper is a food fish of importance in southern Florida, the West Indies, and Panama. It occurs as a straggler in the southern part of Chesapeake Bay, where only the young are taken. One specimen was caught 2 miles from the mouth of a small creek, the east branch of the Carrotman River, a most unusual locality for a fish that enters Chesapeake Bay as a straggler. The species ascends streams and not infrequently is taken in brackish water. It is reported to reach a maximum weight of 18 pounds.

Habitat.—Massachusetts to Brazil; occurring north of Florida only as a straggler.

Chesapeake localities.—(*a*). Previous records: Cape Charles city, Old Point Comfort, and Ocean View, Va. (*b*) Specimens in collection: Lower Rappahannock River, lower York River, Cape Charles, Buckroe Beach, and Lynnhaven Roads, Va.

Family LXV.—POMADASIDÆ. The grunts

Body more or less elongate, compressed; back usually elevated; head rather large; snout pointed or blunt; mouth usually terminal, large or small, low and more or less horizontal; premaxillaries protractile; maxillary without a supplemental bone, slipping under preorbital; teeth in jaws only, pointed or conical, no canines; preopercle usually serrate; gills 4, a slit behind the fourth; lateral line concurrent with the back, usually not extending on caudal fin; scales moderate, firm, ctenoid; dorsal fin long, with 10 to 14 rather strong spines, depressible in a groove; caudal fin more or less concave; anal fin with three spines, the soft part similar to that of dorsal; ventral fins thoracic, with I, 5 rays. The fishes of this family are chiefly from tropical waters. Only one species is common and of commercial importance in Chesapeake Bay.

KEY TO THE GENERA

a. Mouth small; maxillary not nearly reaching eye; anal fin long, with III, 10 to 13 rays; soft dorsal and anal scaleless.....Orthopristis, p. 258

aa. Mouth large; maxillary reaching under eye; anal fin short, with III, 7 or 8 rays; soft dorsal and anal densely scaled.

b. Dorsal normally with 12 spines; body rather deep; back elevated.....Hæmulon, p. 260

bb. Dorsal normally with 13 spines; body more elongate; back little elevated..Bathystoma, p. 260

110. Genus ORTHOPRISTIS Girard. Pigfishes

Body moderately elongate, compressed; back elevated; head rather deep; snout usually long; mouth small, low; teeth in the jaws small, pointed, in bands; preopercle usually finely serrate; scales small, series above lateral line not parallel with it; dorsal fin long, not deeply notched, the spines rather slender, usual number of rays XII or XIII, 12 to 15; caudal fin not deeply forked, lunate; anal spines 3, notably shorter than those of dorsal. A single species is included in the fauna of Chesapeake Bay.

141. Orthopristis chrysopterus (Linnæus). Pigfish; Hogfish.

Perca chrysoptera Linnæus, Syst. Nat., ed. XII, 1766, p. 485; Charleston.

Orthopristis fulvomaculatus Uhler and Lugger, 1876, ed. I, p. 124; ed. II, p. 106.

Orthopristis chrysopterus Bean, 1891, p. 90; Jordan and Evermann, 1896-1900, p. 1338, Pl. CCX, fig. 541; Smith and Bean, 1899, p. 187; Evermann and Hildebrand, 1910, p. 161; Fowler, 1918, p. 18, and 1923, pp. 7 and 34.

Head 2.7 to 3.05; depth 2.3 to 2.65; D. XIII, 15 to 17; A. III, 12 or 13; scales 71 to 77. Body elongate, compressed; back elevated; head moderate; snout long, tapering, 2.2 to 3 in head; eye 3.6 to 5; interorbital 3.85 to 4.7; mouth moderate, terminal, a little oblique; maxillary reaching vertical from first nostril, 3 to 3.4 in head; teeth in the jaws small, pointed, in broad bands; gill rakers short, 12 on lower limb of first arch; scales rather small, ctenoid, firm, in oblique rows above lateral line and horizontal rows below it, extending on base of caudal, ventrals, and pectorals, also forming a low sheath on base of dorsal and anal; dorsal fin continuous, rather low, the spines rather slender, pungent, origin of fin over or slightly in advance of base of pectorals; caudal fin deeply concave, the upper lobe longest; anal fin with three rather strong, graduated spines, the soft part similar to that of dorsal; ventral fins moderate, inserted a little behind base of pectorals; pectoral fins rather long, 1.2 to 1.55 in head.

Color of fresh specimen bluish with purplish reflections above, becoming paler to silvery below; sides of head and back with golden or brassy markings, variable, forming more or less distinct lines; dorsal clear, with bronze spots; caudal and pectorals plain translucent; anal whitish to dusky, base and middle parts sometimes tinged with yellow; ventrals white to slightly dusky. Color in alcohol largely brownish, the purplish reflections frequently remaining; small specimens paler in color than large ones. Stripes are visible only in the young among the preserved specimens.

Many specimens of the pigfish, ranging from 60 to 285 millimeters (2⅜ to 11¼ inches) in length, were preserved. This fish is recognized by the rather deep, compressed body, the long, pointed snout, and the bluish-purplish ground color of the back, with more or less distinct lighter to yellowish stripes. The young are proportionately deeper than the adults and the snout is less strongly produced. The differences in color, due to age, has been mentioned in the description.

The food of this fish in Chesapeake Bay, according to the contents of 43 stomachs, consists mainly of annelids, with crustaceans, mollusks, insect larvæ, fish, and vegetable débris entering in minor quantities.

Spawning takes place in the spring. Fish examined late in May had their sexual organs well developed, and during June spawning fish were observed. The extent of the spawning season is not known, for adult fish were absent from our collections during the summer. By early fall, when large fish were again caught, all were found to be spent.

During 1920, the hogfish ranked eighteenth among the various fishes from Chesapeake Bay, both in quantity and value, the catch being 31,725 pounds, worth $2,348.

The entire catch is credited to Virginia, where the hogfish ranked seventeenth in both quantity and value. Of the entire amount, 50 per cent were caught with hand lines, 26 per cent in pound

nets, 21 per cent in haul seines, and 3 per cent in gill nets. The counties with the largest catches were Norfolk, 12,010 pounds; Warwick, 5,310 pounds; and Princess Anne, 5,000 pounds.

The fishing season extends from April to October, the most productive months being May, June, September, and October. The hogfish is virtually unknown above Solomons, Md., and is seldom caught within the waters of that State. In the vicinity of Crisfield, Md., however, it may be taken with hook and line and gill nets, but the catch usually is very small. In the lower part of the bay it is most common in the vicinity of Cape Charles, Buckroe Beach, and Ocean View, Va. During the late fall small, unmarketable fish, 4 to 6 inches long, are exceedingly abundant, and a catch of 50 or more of these fish within a few hours by a hook-and-line fisherman fishing for "spots" is not unusual.

This fish is much esteemed in the Chesapeake region, and during 1921 and 1922 the retail price averaged about 20 cents a pound. The size of the fish observed in the markets usually ranges between one-third and 1 pound. The maximum recorded weight is 2 pounds. The names most

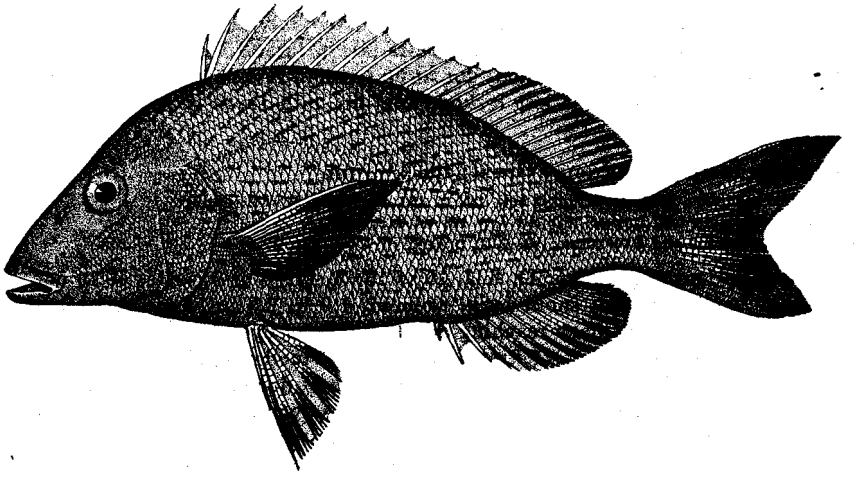

FIG. 147.—*Orthopristis chrysopterus.* From a specimen 9¾ inches long

generally used in the vicinity are "hogfish" and "pigfish." The pigfish is not taken in commercial quantities north of Chesapeake Bay. Southward, however, and particularly in North Carolina, it is a food fish of great importance.

Unlike many fish that are in prime condition just prior to their spawning period, the hogfish is notably thin when in full roe. In the fall, several months after spawning, it has gained considerably in weight. The weights of the following fish, taken in May, may be compared with those listed in the table for fish caught in October: 6½ inches, 2 ounces; 7 inches, 2.8 ounces; 8 inches, 3.7 ounces; 10½ inches, 7.2 ounces.

Habitat.—New York to Mexico.

Chesapeake localities.—(*a*) Previous records: From various sections of the southern part of Chesapeake Bay; one record from the Potomac River at Gunston, Va. (*b*) Specimens in collection: From many localities, from Love Point, Md., southward to Cape Charles and Cape Henry, Va.

Comparison of lengths and weights of hogfish caught during October

Number of fish weighed and measured	Length	Weight	Number of fish weighed and measured	Length	Weight
	Inches	*Ounces*		*Inches*	*Ounces*
1	3½	0.4	23	6¼	2.1
2	4¼	.6	15	6½	2.3
7	4½	.8	13	6¾	2.7
5	4¾	.9	10	7	3.0
9	5	1.0	2	8	4.9
14	5¼	1.3	1	8¼	5.6
23	5½	1.5	2	10	9.3
7	5¾	1.7	1	11¼	12.0
13	6	1.8			

111. Genus HÆMULON Cuvier. Grunts

Body oblong, compressed; back more or less elevated; mouth large, horizontal; maxillary long, curved, extending to below eye; teeth in jaws in narrow, villiform bands; preopercle serrate; chin with a central groove behind symphysis; scales above lateral line in series, not parallel with it; soft parts of vertical fins densely scaled; dorsal fin more or less notched, usually with 12, rarely with 11, spines; caudal fin more or less forked; anal fin with three spines, the second enlarged; mouth red within.

142. Hæmulon plumieri (Lacépède). Grunt; Black grunt.

Labrus plumieri Lacépède, Hist. Nat. Poiss., III, 1802, p. 480, Pl. II, fig. 2; Martinique.
Hæmulon formosum Uhler and Lugger, 1876, ed. I, p. 123; ed. II, p. 105.
Hæmulon plumieri Jordan and Evermann, 1896–1900, p. 1304, Pl. CCV, fig. 532.

Head 2.7 to 2.8; depth 2.4 to 2.5; D. XII, 15 or 16; A. III, 8 or 9; scales 49 to 53. Body elongate, compressed; back elevated; snout long, pointed, 1.9 to 2.3 in head; eye 3.9 to 5.2; mouth large, terminal, horizontal; maxillary reaching about middle of eye, 1.9 to 2.05 in head; gill rakers rather short, 14 or 15 on lower limb of first arch; scales of moderate size, those above lateral line enlarged, the series very oblique, four rows between origin of dorsal and lateral line; scales extending on base of pectoral fins, the soft parts of the other fins densely scaled; dorsal fin long, scarcely notched; caudal fin forked, the upper lobe longest; anal fin with three spines, the second one the strongest, reaching slightly past the tip of the third when deflexed; pectoral fins moderate, 1.3 to 1.6 in head.

Color of preserved specimens grayish brown; scales on sides each with a large silvery area; sides of head with about 12 more or less wavy, horizontal, blue stripes, not extending beyond head; vertical fins dusky; paired fins mostly pale. The color in life, according to published accounts, is bluish gray, the scales with greenish bronze spots forming oblique lines; the horizontal stripes on head are bright blue.

This species was not obtained during the present investigation. It is known from Chesapeake Bay only from a record by Uhler and Lugger (1876). From South Carolina southward it is a food fish of importance, being especially abundant at Key West, Fla. The maximum recorded weight for the species is 3 pounds.

Habitat.—Virginia to Brazil, occurring only as a straggler north of the coast of South Carolina.

Chesapeake localities.—(*a*) Previous record: "Also lives in the salt waters not remote from the ocean, mouth of the Potomac River, etc." (Uhler and Lugger, 1876.) (*b*) Specimens in collection: None.

112. Genus BATHYSTOMA (Scudder) Putnam. Tom tates

This genus is very close to *Hæmulon*. Normally, however, it has 13 instead of 12 dorsal spines, the body is more elongate, and the back is lower.

143. Bathystoma rimator (Jordan and Swain). Tom tate; Red-mouthed grunt.

Hæmulon chrysopteron Uhler and Lugger, 1876, ed. I, p. 124; ed. II, p. 105; not of Linnæus.
Hæmulon rimator Jordan and Swain, Proc., U. S. Nat. Mus., VII, 1884, p. 308; Charleston, Key West, and Pensacola.
Bathystoma rimator Jordan and Evermann, 1896–1900, p. 1308, Pl. CCVI, fig. 534.

Body 2.8 to 2.9; depth 2.85 to 3.1; D. XIII, 13 to 15; A. III, 8 or 9; scales 50 to 59. Body quite elongate, compressed; back little elevated; head rather long; snout tapering, 2.3 to 3 in head; eye

3.25 to 3.75; mouth large, terminal, slightly oblique; maxillary reaching about middle of eye, 1.8 to 2.1 in head; teeth in jaws in villiform bands, the outer ones enlarged; preopercle finely serrate; gill rakers rather short and slender, 13 to 15 on lower limb of first arch; scales moderate, ctenoid, six rows between origin of dorsal and lateral line; vertical fins densely scaled; dorsal fin long, low; caudal fin forked; pectoral fins rather short, 1.3 to 1.4 in head.

Color brownish or grayish above, silvery below; sides with two yellow stripes (most distinct in young); base of caudal with a large black spot; dorsal and caudal dusky, other fins mostly yellow.

This fish was not taken during the present investigation. It is known from the Chesapeake only from a record by Uhler and Lugger (1876). It is common at Charleston, S. C., and southward. A maximum weight of 1 pound is reported.

Habitat.—Virginia to Trinidad, occurring only as a straggler north of the coast of South Carolina.

Chesapeake localities.—(*a*) Previous records: "Occurs occasionally in the lower part of the Chesapeake Bay" (Uhler and Lugger, 1876). (*b*) Specimens in collection: None.

Family LXVI.—SPARIDÆ. The porgies

Body oblong or ovate, usually notably compressed; back more or less elevated; mouth rather small, nearly or quite horizontal; premaxillaries little protractile; maxillary slipping under preorbital for most of its length; supplemental bone present; preorbital usually broad; teeth strong, those on anterior part of jaws frequently incisorlike, lateral teeth blunt molars, none on vomer or palatines; gills 4, a slit behind the fourth; gill membranes separate, free from isthmus; opercle without spines; lateral line complete, not extending on caudal fin, concurrent with outline of back; scales moderate, firm, finely serrate; dorsal fin long, continuous or notched, with 10 to 12 spines, depressible in a groove; caudal fin usually forked; anal fin with three spines, the soft part similar to that of dorsal; ventral fins subthoracic, with I, 5 rays.

KEY TO THE GENERA

a. Front teeth very narrow, not notched; dorsal spines rather high, slender, the second one more than half the length of head ..... Stenotomus, p. 261

aa. Front teeth broad, with or without a notch; dorsal spines shorter, the second less than half the length of head.

b. Body with dark crossbars.

c. Incisor teeth deeply notched; size small ..... Lagodon, p. 265

cc. Incisor teeth entire or only slightly notched; size large ..... Archosargus, p. 267

bb. Body without dark crossbars; black spot on caudal peduncle; incisor teeth broad, not notched ..... Diplodus, p. 268

113. Genus STENOTOMUS Gill. The scups

Body rather deep; back elevated; head pointed; eye small, placed high; incisor teeth rather narrow, not notched; gill rakers short, about nine on lower limb of first arch; top of head, snout, and orbital region naked, the rest of body scaly; antrorse dorsal spine present, attached to interneural bone by a long process; dorsal with 12 spines, the first less than half the length of the second. Two apparently closely related species are known, and both were taken in Chesapeake Bay. A key to the species is omitted because it is difficult to show specific differences briefly. The two species are compared and contrasted under *Stenotomus aculeatus*.

144. Stenotomus chrysops (Linnæus). Scup; Porgy; "Maiden"; "Fair maid"; "Ironsides."

Sparus chrysops Linnæus, Syst. Nat., ed. XII, 1766, p. 471; Charleston, S. C.
Stenotomus argyrops Uhler and Lugger, 1876, ed. I, p. 122; ed. II, p. 104.
Stenotomus chrysops Bean, 1891, p. 90; Jordan and Evermann, 1896–1900, p. 1346, Pl. CCXI, fig. 544.

Head 2.95 to 3.45; depth 1.95 to 2.25; D. XII, 12; A. III, 11 or 12; scales 49 or 50. Body rather deep, compressed; back elevated, reaching its highest point under anterior dorsal spines; dorsal profile straight to slightly concave over eyes, convex elsewhere to caudal peduncle; depth of caudal peduncle 2.55 to 3.6 in head; head rather short, deep; snout more or less pointed, 2.3 to 2.55

in head; eye 2.5 to 3.9; interorbital 3.1 to 4; mouth rather small, terminal, oblique; maxillary scarcely reaching eye, 2.8 to 3.25 in head; incisor teeth on anterior part of jaws narrow and not notched, followed by smaller incisorlike teeth; two more or less definite rows of molar teeth laterally; gill rakers very short, nine more or less developed on lower limb of first arch; scales firm, finely ctenoid, extending on base of caudal, forming a very low sheath on dorsal and anal; dorsal fin long, continuous, the spinous portion higher than the soft part, the spines very slender, the second one frequently somewhat produced and reaching beyond the tip of the third when deflexed; caudal fin forked; anal fin with three spines, shorter but stronger than the dorsal spines, the soft part similar to that of the dorsal; ventral fins rather long and narrow, one or two of the outer rays with a slight filament, inserted a little behind base of pectorals; pectoral fins long, reaching beyond tips of ventrals in adults, proportionately shorter in young, 2.85 to 3.45 in length.

Color bluish silvery above, plain silvery below; young with about six dark crossbars; fins mostly plain translucent; soft part of dorsal and sometimes the anal with brownish spots, these most distinct in the smaller specimens; axil usually with a dusky spot.

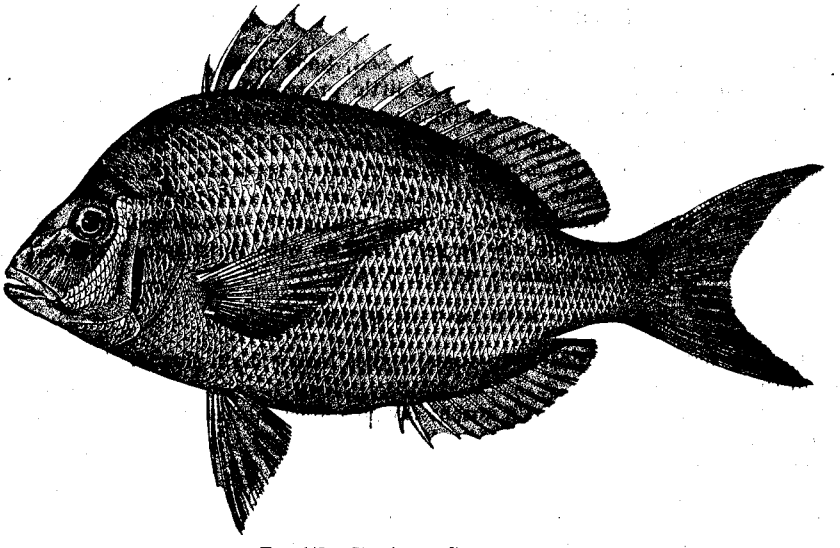

FIG. 148.—*Stenotomus chrysops*

Many specimens of this species, ranging from 70 to 260 millimeters (2¾ to 10¼ inches) in length, were preserved. The young differ from the adult in having distinct dark crossbars and proportionately shorter spines and rays in the fins. The narrow incisor teeth without notches, and the rather short to moderately long dorsal spines serve to separate the two closely related species of the genus from related forms.

The food of the scup, according to the contents of 24 stomachs, consists of crustaceans, mollusks, worms, insect larvæ, and small fish.

Spawning takes place in the spring, principally in May and June. The eggs are reported to be transparent, spherical, and about 0.85 to 0.9 millimeter in diameter, and to hatch in about 40 hours at a mean temperature of approximately 71° F.[21]

No ripe fish were observed in Chesapeake Bay, and it is not known whether spawning occurs there. The few large fish that appear in April and early in May are soon replaced by smaller ones (6 inches, or less, in length), which apparently are immature. Bean (1903, p. 559) states that off New York large spawning fish appear first in May. The chief spawning period in that vicinity occurs in June. Bigelow and Welsh (1925, p. 268) state that in southern New England spawning takes place chiefly in June, but that the period extends from May to August.

[21] For an account of the embryology and larval development of the scup, see Kuntz and Radcliffe, 1918, pp. 102 to 105, figs. 30 to 37.

The rate of growth, as given by Bean (1903, p. 560), is as follows: July 3, length ½ to 1½ inches; August 2, 1½ to 2 inches; September 6, 2 to 3 inches; September 29, 3 to 4 inches; November 1, 4 inches. In Chesapeake Bay we seined 30 scup, 63 to 92 millimeters (2½ to 3⅝ inches) in length, on September 23; 9 scups, 83 to 106 millimeters (3⅛ to 4½ inches), on October 6; and 5 fish, 115 to 123 millimeters (4½ to 4⅞ inches), on October 11. On May 23, at Cape Charles, 50 scups, 121 to 155 millimeters (4¾ to 6⅛ inches) in length, were taken with a 180-fathom seine, and on May 25, in Lynnhaven Roads, 25 fish ranging from 5 to 6 inches in length were caught in a pound net. No other young fish were observed. Taking Doctor Bean's records of the rate of growth as a guide, its seems fair to conclude that the fish taken in Chesapeake Bay in September and October were the result of the hatch of the preceding spring, and it seems probable then that the fish taken in May are approximately 1 year old.

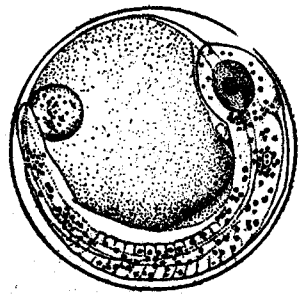

FIG. 149.—Egg with embryo

During 1920 the scup ranked twenty-fourth in quantity and twenty-second in value in Chesapeake Bay, the catch being 7,165 pounds, worth $585. As the scup is taken only in the lower part of the bay, the total catch is credited to Virginia, where the fish takes the same rank as for the entire bay. Nearly the entire catch was taken in pound nets in Elizabeth City and Northampton Counties.

This fish is taken in the Chesapeake from April until late October. The small annual catch is caught in the bay below the York River. The first fish generally appear early in April and are large in size, weighing 1 to 3 pounds. Later the fish are slightly more plentiful and smaller. The greater part of the catch, as already stated, is taken with pound nets. A catch as great as 25 pounds in one day is seldom made by one set of nets, and frequently not more than this amount is taken during an entire month. Scups are caught occasionally with haul seines at Ocean View in September and October. In 54 hauls made by three 300-fathom haul seines at Ocean View from September 20 to October 27, 1922, the scup was taken on only one day (October 8), when 25 fish, each about 9 inches long, were present in a catch. The scup takes the hook freely, but it is seldom caught by that method in the Chesapeake. Small unmarketable fish are rather common near the mouth of the bay from May until October. At Cape Charles, on May 23, 1922, for example, 50 scups, measuring from 5 to 6 inches in length, were caught in one haul with a seine 180 fathoms long. Frequently moderate numbers of fish of this size also are caught with pound nets and discarded.

The local catch of scup is marketed in the Chesapeake region, but the fish does not meet with the same high regard that it does in New Jersey and northward. A closely related species, *S. aculeatus*, is occasionally caught and marketed along with *S. chrysops*, as the fishermen do not separate the species.

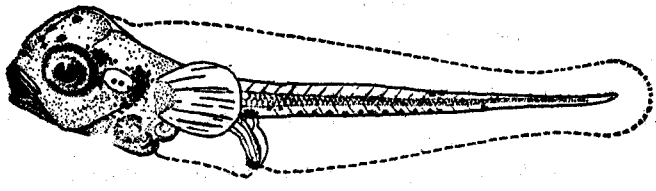

FIG. 150.—Larva, 3 days old, 2.8 millimeters long

Various names have been given to this species, but those most commonly used in the Chesapeake region are "maiden," "fair maid," and "ironsides"; the last name is in allusion to the hard, platelike scales.

This fish is an abundant and important food fish in the northern part of its range. South of Virginia it is not abundant and of no commercial importance. The scup is taken in commercial numbers along the Atlantic coast from Virginia to Cape Cod, Mass., the center of abundance being from New Jersey to Rhode Island. It is by far the most valuable food fish taken in Rhode Island, where in 1919[22] the catch amounted to 8,261,140 pounds, worth $817,846. In New York, in 1921,[23] it ranked third in quantity and fifth in value, the catch amounting to 1,297,375 pounds,

[22] Fishery Industries of the United States. Report of the Division of Statistics and Methods of the Fisheries for 1920. By Lewis Radcliffe. Appendix V, Report of the Commissioner of Fisheries for 1921 (1922). Bureau of Fisheries Document No. 908, p. 128. Washington.

[23] Fishery Industries of the United States. Report of the Division of Fishery Industries for 1922. By Harden F. Taylor. Appendix V, Report of the Commissioner of Fisheries for 1923 (1924). Bureau of Fisheries Document No. 954, p. 68. Washington.

worth $76,253. In New Jersey, during 1921, it ranked second in quantity and third in value, the catch amounting to 4,115,552 pounds, worth $200,046.

The usual size of market fish in the Chesapeake and along the Atlantic coast is from ½ to 2 pounds. The species attains a maximum weight of 4 pounds. The following weights were obtained from Chesapeake Bay fish: Four and three-fourths inches, 0.9 ounces; 5 inches, 1.1 ounces; 5¼ inches, 1.2 ounces; 5¾ inches, 1.4 ounces; 6 inches, 1.6 ounces; 6¼ inches, 2 ounces; 9 inches, 6.7 ounces; 13½ inches, 1 pound 2 ounces.

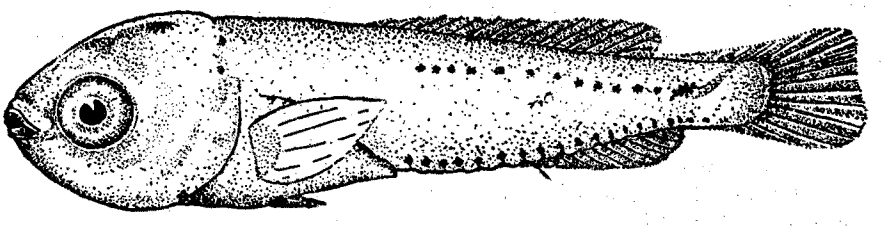

FIG. 151.—Young, 10.5 millimeters long

Habitat.—Maine to South Carolina; common from Virginia to Cape Cod.

Chesapeake localities.—(*a*) Previous records: Southern part of Chesapeake Bay (Uhler and Lugger, 1876) and Cape Charles city. (*b*) Specimens in collection: Lower York River, Cape Charles, Buckroe Beach, Ocean View, and Lynnhaven Roads, Va.

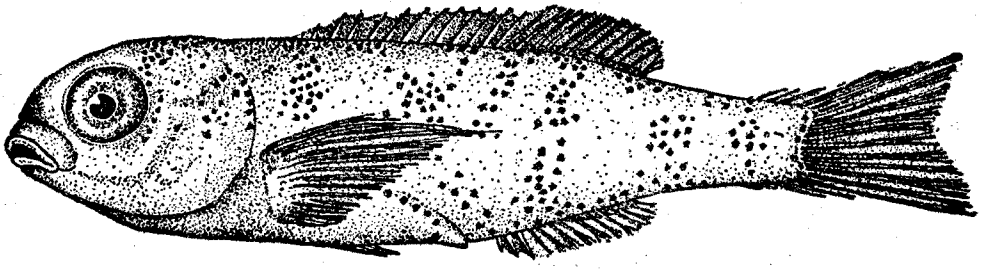

FIG. 152.—Young, 25 millimeters long

145. Stenotomus aculeatus (Cuvier and Valenciennes). Southern scup; Pinfish.

Chrysophrys aculeatus Cuvier and Valenciennes, Hist. Nat. Poiss., VI, 1830, p. 137; Charleston, S. C.
Stenotomus aculeatus Jordan and Evermann, 1896-1900, p. 1346, Pl. CCXII, fig. 545.

Head 3.3 to 3.4; depth 2.2 to 2.45; eye 3 to 3.3 in head; snout 2.55 to 2.8; interorbital 3.1 to 3.5; maxillary 3.1 to 3.15; caudal peduncle 2.8 to 2.95; fourth dorsal spine, 1.55 to 1.9; pectoral fin 3.35 to 3.9 in length; D. XII, 12; A. III, 11; scales 50 or 51.

Three specimens in the Chesapeake Bay collection, respectively 115, 125, and 150 millimeters (4½, 5, and 6 inches) in length, appear to be referable to this species. Comparing specimens of like size, they differ from *S. chrysops* in having a more slender body and caudal peduncle, slightly larger eye, broader interorbital, and lower dorsal spines. The second spine does not reach the tip of the third when deflexed, whereas in *S. chrysops* the second spine frequently reaches beyond the tip of the third when deflexed. No difference in color is noticeable in preserved specimens. No notes on color in life were obtained, as the species was not recognized in the field.

The following series of proportions is based on three specimens of *S. chrysops* of the same length as those of *S. aculeatus* at hand and will serve to show the differences mentioned:

Head 3.3 to 3.45; depth 1.95 to 2; eye 3 to 3.3 in head; snout 2.75 to 3.05; interorbital 3.55 to 4; maxillary 3.05 to 3.1; caudal peduncle 2.5 to 2.6; fourth dorsal spine, 1.25 to 1.45; pectoral fins 3.4 to 3.65 in length.

A somewhat greater difference than is brought out by the foregoing customary proportions may be obtained by dividing the depth of the body by the diameter of the eye, because the proportions resulting serve to emphasize that the eye is larger and the depth smaller in *S. aculeatus*. Com-

paring the same series of specimens as in the proportions already given, the eye is contained in the depth in *S. aculeatus* 4.1, 4.32, and 5 times, whereas in *S. chrysops* it is contained 5.6, 5.6, and 5.75 times.

The difference in the dorsal contour of the body given in current descriptions, namely, that the outline of the body in *S. aculeatus* declines more rapidly from the first dorsal spine backward than in *S. chrysops*, is not evident from the small specimens at hand.

The present species is of southern distribution, replacing *S. chrysops*. It has previously not been reported as far north as Virginia. It is said to be rather common from Cape Hatteras southward. However, it nowhere reaches the large commercial importance attained by its congener from the Chesapeake Bay northward.

Habitat.—Virginia to Texas, very rare or wanting at Key West, Fla.

Chesapeake localities.—(*a*) Previous records: None. (*b*) Specimens in collection: Cape Charles, Va. (extreme point of cape), May 21, 1922, seine.

114. Genus LAGODON Holbrook. Pinfishes

In externally visible characters this genus is close to Probatocephalus, differing principally in the deeply notched teeth. The essential character of the genus is in the form of the skull, which is described in current works as follows: Supraoccipital and temporal crests nowhere coalescent; interorbital area not swollen; frontal bone in the interorbital area thin, concave in transverse section; temporal crest low, separated from supraoccipital crest by a flattish area, extending forward on each side of supraoccipital crest to the groove of premaxillary spines. The genus contains a single species.

146. Lagodon rhomboides (Linnæus). Pinfish.

Sparus rhomboides Linnæus, Syst. Nat., ed. XII, 1766, p. 470; Charleston, S. C.

Lagodon rhomboides Uhler and Lugger, 1876, ed. I, p. 122; ed. II, p. 104; Bean, 1891, p. 90; Jordan and Evermann, 1896–1900, p. 1358, Pl. CCXV, fig. 552.

Head 3.1 to 3.4; depth 2.15 to 2.35; D. XII, 11; A. III, 11; scales 62 to 66. Body oblong, variable in depth, compressed; back elevated; head moderate; snout rather pointed, 2.75 to 3.1 in head; eye 3.25 to 4.1; interorbital 2.9 to 3.55; mouth rather small, nearly horizontal, terminal; maxillary scarcely reaching eye, 2.95 to 3.3 in head; each jaw with eight broad, deeply notched incisors anteriorly on edge of jaws, followed by two rows of low, broad, blunt teeth; gill rakers short and slender, 12 on lower limb of first arch; scales rather small, firm, ctenoid, extending on base of caudal and forming a scaly sheath on soft part of dorsal and anal; dorsal fin long, continous, rather low, the spines rather slender, extremely sharply pointed, preceded by an antrorse spine, origin of fin a little in advance of base of pectorals; caudal fin forked; anal fin with three rather strong, sharply pointed spines, second and third of about equal length, the soft part of fin similar to that of dorsal; ventral fins moderate, inserted about half an eye's diameter behind base of pectorals; pectorals long, pointed, reaching well beyond tips of ventrals, 2.9 to 3.55 in body.

Color dark green above; silvery below; a dark spot at shoulder; 4 to 6 dark crossbars on sides, varying in distinctness among individuals; sides with several light-blue and yellow longitudinal stripes (fading and nearly disappearing in spirits); dorsal plain, with faint yellowish-brown spots and with yellowish brown on distal parts of spinous portion; caudal and pectorals pale yellow; anal plain translucent on basal half, the rest of fin yellowish brown; ventrals pale, with yellowish-brown streak at middle of fin.

This fish is represented in the present collection by many specimens, ranging in length from 20 to 185 millimeters (4/5 to 7¼ inches). The young are less brightly colored than the adults, the longitudinal stripes being absent and the dark crossbars quite distinct. The species is recognized chiefly by the deeply notched incisor teeth, the rather slender and very sharp fin spines, the antrorse spine preceding the dorsal fin, and by the coloration.

The food of this fish, according to Smith (1907, p. 300), is quite varied, consisting of fish, worms, crustaceans, mollusks, and seaweed. The contents of 13 stomachs taken from fish caught in Chesapeake Bay contained the following foods, named in the order of their apparent importance: Vegetable débris, crustaceans, mollusks, and annelids.

The pinfish apparently does not spawn in Chesapeake Bay. According to present evidence it is a winter spawner. Bean (1903, p. 562) states that spawning takes place in the Gulf of Mexico in winter or early spring. Smith (1907, p. 300) records that specimens examined at Beaufort, N. C., in June and July had no obvious reproductive organs, but that eggs were noted in a female on August 6, and a ripe male was taken on November 20. The capture of young fish in Chesapeake Bay in the spring is further evidence that spawning may occur durng the winter. The collection of numerous larval pinfish by one of us (Hildebrand) at Beaufort, N. C., during the winter of 1925–26 proves beyond a doubt that at Beaufort, at least, spawning takes place during late fall and winter. The following two catches of young pinfish were seined in Chesapeake Bay: May 22, 1921, creek tributary to Lynnhaven Bay, three fish, 23 to 29 millimeters (⅞ to 1⅛ inches) in length; May 22, 1922, Cape Charles, Va., many specimens, 20 to 27 millimeters (⅘ to 1 inch) in length. The only midsummer catch of pinfish consisted of seven fish, ranging in length from 96 to 105 millimeters (3¾ to 4⅛ inches), and was taken with a seine in the lower York River on July 10. During October the majority of the fish caught were from 136 to 160 millimeters (5⅓ to 6¼ inches) long. One catch of pinfish, taken on October 10 in a 300-fathom haul seine, consisted of 850 pin-

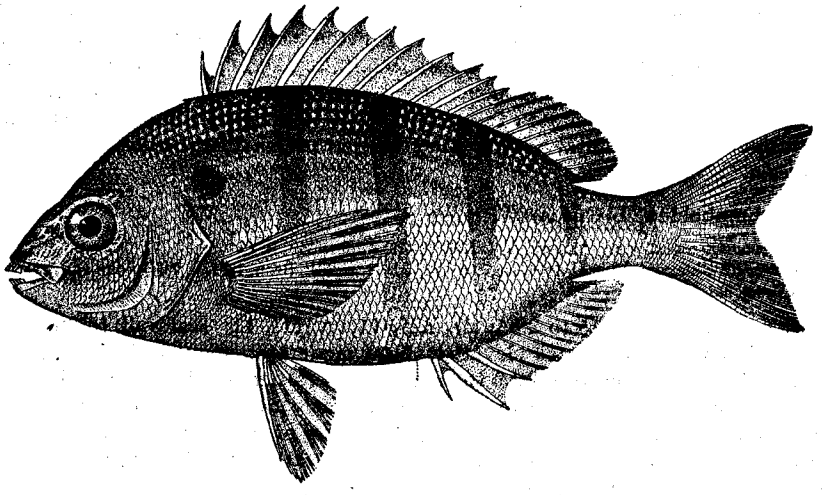

FIG. 153.—*Lagodon rhomboides.* From a specimen 6 inches long

fish, 170 to 185 millimeters (6¾ to 7¼ inches) in length. As the average length of the individuals of this lot was 1 inch or more greater than of other fish caught during October, it seems probable that they were older fish.

The pinfish in Chesapeake Bay inhabits only the southern section, where fish of marketable size are taken in small numbers during the summer and fall. Its commercial importance is very small, and the marketable catch of 1922 probably did not exceed 1,000 pounds, valued at about $40. Small fish, 4 to 7 inches long, are sometimes very common in the fall but are discarded by the fishermen. One day in October, 1922, about 5,000 fish of this small size were caught in a pound net at Lynnhaven Roads, Va.; and at Ocean View, Va., many were taken in haul seines throughout the month of October. Fishermen operating a set of two pound nets at Lynnhaven Roads caught and marketed 3,500 pounds of pinfish from May 7 to 11, 1918. These fish were somewhat larger than usual and represented an unusual run.

The fish caught in the Chesapeake are marketed chiefly in Norfolk, Va. The average size of fish observed in the markets is about one-third of a pound. The maximum size recorded for the species is 13 inches. (Schroeder, 1924, p. 26.) The following weights were obtained from 130 pinfish caught in Chesapeake Bay: Five inches, 0.9 ounce; 5¼ inches, 1.4 ounces; 5½ inches, 1.6 ounces; 5¾ inches, 1.9 ounces; 6 inches, 2.1 ounces; 6¼ inches, 2.4 ounces; 6½ inches, 2.8 ounces; 6¾ inches, 3.1 ounces; 7 inches, 3.4 ounces; 7¼ inches, 3.5 ounces.

Habitat.—Massachusetts to Texas; common from Virginia southward.

Chesapeake localities.—(*a*) Previous records: Lower part of Chesapeake Bay (Uhler and Lugger, 1876) and Cape Charles city, Va. (*b*) Specimens in collection: Lower York River, Cape Charles, Buckroe Beach, Ocean View, and Lynnhaven Roads, Va.

115. Genus ARCHOSARGUS Gill. Sheepshead

Body rather robust, deep, compressed; mouth moderate; jaws anteriorly with broad incisors, with entire or only slightly notched margins; jaws laterally with coarse molars; posterior nostril slitlike; gill rakers very short; dorsal fin long, continuous, preceded by an antrorse spine; spines strong, the soft part shorter than the spinous portion; caudal fin slightly forked; anal fin with three strong spines, the second enlarged; ventral fins subthoracic. The Virginia specimens with broad, black crossbars. A single species occurs in Chesapeake Bay.

147. Archosargus probatocephalus (Walbaum). Sheepshead.

Sparus probatocephalus Walbaum, Artedi Piscium, 1792, 295; New York.

Archosargus probatocephalus Uhler and Lugger, 1876, ed. I, p. 121; ed. II, p. 103; McDonald, 1882, p. 12; Bean, 1891, p. 90; Smith, 1892, p. 71; Jordan and Evermann, 1896–1900, p. 1361, Pl. CCXVI, fig. 554.

Head 3.05 to 3.25; depth 1.9 to 2.4; D. XI or XII, 11 to 13; A. III, 10 or 11; scales 44 to 49. Body deep, compressed; back elevated; head short, deep; snout short, 2.1 to 2.6 in head;

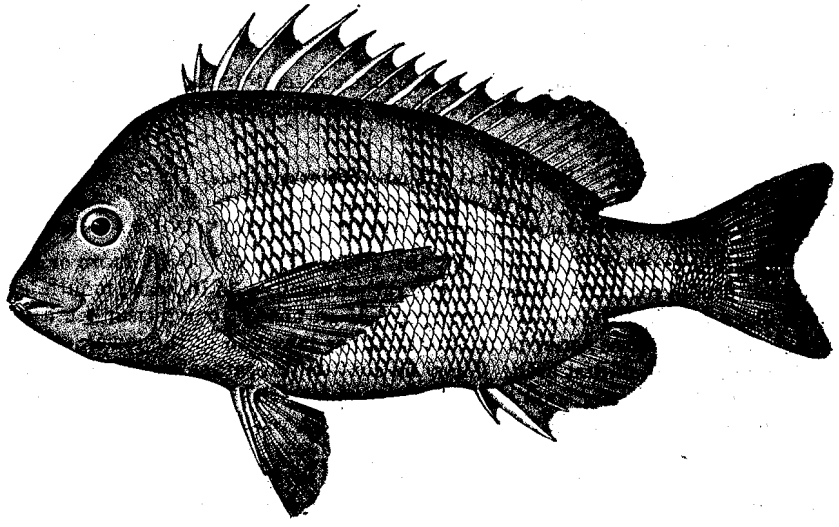

FIG. 154.—*Archosargus probatocephalus.* From a specimen 15 inches long.

eye 2.75 to 4.55; mouth moderate, nearly horizontal; maxillary reaching about to vertical from anterior margin of eye, 2.7 to 3.3; teeth in the jaws strong, anterior teeth incisorlike, the posterior teeth broad, strong molars; gill rakers short, six or seven on lower limb of first arch; scales finely serrate; dorsal fin with very strong spines, the spinous portion longer than the soft part; caudal fin with a shallow fork; anal fin with three spines, the second much enlarged, the soft part of fin similar to that of dorsal; pectorals long, 2.5 to 3.7 in length.

Color greenish yellow; sides with seven black crossbars; dorsal, anal, and ventral fins mostly dusky or black; caudal and pectoral fins greenish.

The foregoing description is based upon specimens from Beaufort, N. C., ranging in length from 20 to 240 millimeters (4/5 to 9½ inches). Only a few very small specimens were preserved from Chesapeake Bay, as the large individuals seen were too bulky to preserve conveniently and no intermediate sizes were taken. This species, the only one of the genus occurring in Chesapeake Bay, usually is easily recognized by its color, entire incisor teeth, and large size.

The sheepshead feeds mainly on mollusks and crustaceans, for the crushing of which its teeth are well adapted. Relative to spawning, Smith (1907, p. 301) says: "At the spawning season, which is in spring, the sheepshead swim in schools and appear to prefer sandy shores. The eggs are about

0.03 inch in diameter, and more than 1,500,000 are in a fluid quart. They float at the surface and hatch rapidly, only 40 hours being required in water of 76° or 77° F."

The sheepshead is taken in the Chesapeake in very limited numbers, from the Rappahannock River southward. In 1920 the catch was only 863 pounds, worth $129, all taken with pound nets.

Some years ago this fish was an important commercial species in the bay, but the catch gradually has diminished, until at the present time the species has almost entirely disappeared. The small catch is readily absorbed by the Norfolk markets, as the sheepshead is a food fish of fine flavor. The Chesapeake fish are large, the size usually ranging from 5 to 15 pounds. The maximum recorded weight for the sheepshead is 30 pounds, but it rarely exceeds 20 pounds.

In some sections of its range this fish furnishes much sport for the angler, as it is said formerly to have done in Chesapeake Bay, for it is a very game fish, being among the gamest of salt-water fishes. It is often common along breakwaters, stone jetties, piles, and other objects in the water that are overgrown with barnacles, oysters, etc. It is in such places where the angler must seek the species, and the most commonly used bait consists of small crabs.

Habitat.—Cape Cod, Mass., to Texas, rarely to the Bay of Fundy.

Chesapeake localities.—(*a*) Previous records: "Frequents the oyster localities of all parts of Chesapeake Bay" (Uhler and Lugger, 1876); lower Potomac, Cape Charles city and Norfolk, Va. (*b*) Specimens in collection: Lynnhaven Roads, Va.; observed in the Norfolk market and at Ocean View, Va.

116. Genus DIPLODUS Rafinesque. Spotted-tailed pinfish

Body ovate, compressed; back notably elevated; incisor teeth broad, not notched; molar teeth in several rows; gill rakers short; dorsal spines about 12; color silvery, with dark area on caudal peduncle.

148. Diplodus holbrookii (Bean). Spot-tailed pinfish; Sailor's choice.

Sargus holbrookii Bean, Forest and Stream, June 13, 1878; Charleston, S. C.
Diplodus holbrookii Bean, 1891, p. 90; Jordan and Evermann, 1896-1900, p. 1362, Pl. CCXVII, figs. 555 and 555a.

Head 3.65; depth 2.1; D. XII, 14; A. III, 13; scales 55 to 57. Body more or less elliptical, compressed; dorsal profile regularly rounded; eye rather small, 4.35 in head; mouth large, almost horizontal; maxillary failing to reach front of eye, 3.35 in head; four incisor teeth in each jaw, directed obliquely forward, three series of molars in upper jaw, two in the lower; gill rakers very short, about 14 on lower limb of first arch; dorsal fin continuous, rather low, longest spine less than half the head; caudal fin forked; anal fin with three spines the second somewhat enlarged, the soft part of fin similar to that of dorsal; pectoral fins pointed, reaching origin of anal, about 3.35 in body.

Color dull blue above, lower part of sides and below silvery; a conspicuous black blotch or band on anterior part of caudal peduncle; opercular margin black; base of pectorals black. The young with about five narrow, vertical, dark stripes on back and sides, with an equal number of short intermediate stripes on back.

No specimens of this species were secured during the present investigation. It is known from Chesapeake Bay only from a record by B. A. Bean, based on seven specimens collected by W. P. Seal at Cape Charles city, Va., in 1890.

The species is not uncommon farther southward, and it is frequently seen along breakwaters and piers on the coast of North Carolina. One of us (Hildebrand) measured a specimen at Beaufort, N. C., 14 inches in length, which probably is the maximum size attained. This fish is nowhere taken in sufficient quantity to be of commercial importance.

Habitat.—Virginia to Cedar Keys, Fla.

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

Family LXVII.—KYPHOSIDÆ. The rudder fishes

Body elongate or ovate, compressed; head rather short; mouth small or moderate; outer teeth in jaws incisorlike, no molars; opercle entire; gill membranes free from the isthmus; the rakers rather long; gills 4, a slit behind the fourth; pseudobranchiæ well developed; scales small or moderate; dorsal fin continuous or divided, with 10 to 15 spines; anal fin with three spines; ventral fins thoracic, with I, 5 rays and an accessory scale at base; pectoral fin without spine.

117. Genus KYPHOSUS Lacépède. Rudder fishes

Body ovate or elongate; head short; snout blunt; mouth small; jaws with a row of incisor teeth and a narrow band of villiform teeth behind them; fine teeth present on vomer, palatines, and tongue; branchiostegals 7; lateral line continuous, present on base of caudal; scales moderate or small, ctenoid, covering most of head, vertical fins, and sometimes most of the paired fins; dorsal fin long, continuous, with 11 spines of irregular length, depressible in a groove; caudal fin forked; anal fin with three spines, the soft part similar to that of dorsal; ventral fins inserted behind pectorals.

149. Kyphosus sectatrix (Linnæus). Rudder fish.

Perca sectatrix Linnæus, Syst. Nat., ed. XII, 1766, p. 486.
Kyphosus sectatrix Jordan and Evermann, 1896–1900, p. 1387, Pl, CCXIX, fig. 559.

Head 2.8 to 3.5; depth 2.1 to 2.4; D. XI, 12 to 14; A. III, 11 to 13; scales 58 to 64. Body moderately deep, compressed; back elevated; head rather short, snout blunt, 3.1 to 4.15 in head; eye 2.6 to 3.1; interorbital 2.8; mouth moderate; upper jaw slightly projecting; maxillary reaching to or a little beyond eye, 2.9 to 3.3 in head; gill rakers rather slender, about 15 on lower limb of first arch; teeth incisorlike; scales moderate, ctenoid, anteriorly notably larger below the lateral line than above it; small scales covering vertical fins in adult; dorsal fin continuous, rather low, its origin slightly behind base of pectorals; caudal fin deeply emarginate to slightly forked; anal fin with three short spines, the soft part similar to that of dorsal; ventral fins inserted under origin of dorsal; pectoral fins short, 1.55 to 1.8 in head.

Color of adult in alcohol uniform dark brown; a faint pale streak below eye; a black margin on opercle above posterior angle. Young irregularly mottled with dark and pale areas.

A single small specimen, 32 millimeters in length, occurs in the Chesapeake collection. The foregoing description is based on this fish and 10 others from Beaufort, N. C., ranging in length from 33 to 130 millimeters (1¼ to 5 inches). This is a fish principally of tropical waters. It has not been recorded previously from Chesapeake Bay, although stragglers have been caught as far north as Massachusetts.

The rudder fish is said to be a good food fish and to possess game qualities. It receives its common name from the habit of following vessels, presumably for waste foods thrown overboard. Four specimens taken at Beaufort and examined by Linton had fed on crabs, small bivalve shells, and vegetable débris. The species is reported to be one of the leading food fishes in the Bermudas. It is not common at Key West, Fla., and apparently rather rare on the coast of the Isthmus of Panama. The maximum recorded weight is 9 pounds.

Habitat.—Massachusetts to Panama, occurring only as a straggler from North Carolina northward.

Chesapeake localities.—(*a*) Previous records: None. (*b*) Specimen in collection: From Fisherman's Island, Va., caught on July 23, 1916, in a tow net.

Family LXVIII.—GERRIDÆ. The mojarras

Body oblong or elongate, compressed; mouth small, extremely protractile, descending downward when protruded; a deep groove in upper surface of snout, receiving the long spine of the premaxillary; supplemental maxillary bone wanting; teeth in jaws small, in bands, none on vomer or palatines; gill membranes separate, free from the isthmus; scales rather large, cycloid; dorsal fin single, the spinous and soft parts about equally developed, usually with 9 or 10 spines; anal fin much shorter than the dorsal, with two or three spines; ventral fins thoracic, with I, 5 rays; air bladder present. A single genus of this family of tropical fishes comes within the scope of the present work.

118. Genus EUCINOSTOMUS Baird. Mojarras

Body comparatively elongate; preorbital and preopercle entire; anal spines 2 or 3, the second one not greatly enlarged; second interhæmal spine enlarged, forming a hollow cone entered by the posterior tip of the air bladder.

KEY TO THE SPECIES

a. Body rather slender, depth 2.6 to 3.2 in length; premaxillary groove on median line of snout open and linear ..... *californiensis*, p. 270

aa. Body somewhat deeper, depth 2.2 to 3 in length; premaxillary groove crossed by scales in front, leaving a naked pit behind ..... *gula*, p. 270

150. Eucinostomus californiensis (Gill). Mojarra.

Diapterus californiensis Gill, Proc., Acad. Nat. Sci., Phila., 1862, p. 245; Cape San Lucas.
Eucinostomus pseudogula, Jordan and Evermann, 1896-1900, p. 1368.

Head, 3 to 3.4; depth, 2.6 to 3.2; D. IX, 10; A. III, 7; scales 42 to 47. Body elongate, compressed; back somewhat elevated; head rather long; snout pointed, 3.05 to 3.8 in head; eye, 2.5 to 3.3; mouth small, terminal; maxillary reaching anterior margin of eye, 2.8 to 3 in head; premaxillary groove open and linear (i. e., not closed by scales anteriorly); teeth pointed, forming a band on each jaw; gill rakers short, seven on lower limb of first arch; scales moderate, firm, cycloid; dorsal fin continuous, the anterior spines somewhat elevated; caudal fin deeply forked; anal fin with three spines, the second and third of about equal length, the second somewhat the stronger; ventral fins inserted a little behind base of pectorals; pectoral fins rather long, 3.4 to 4.5 in length of body.

Color silvery, with bluish reflections on back; dorsal fin plain or more or less dusky, the spinous part usually with a black margin; other fins mostly translucent.

Four small specimens, ranging from 20 to 72 millimeters (4/5 to 2¾ inches) in length, were preserved. These specimens, together with ten others from Beaufort, N. C., ranging in length from 30 to 120 millimeters (1¼ to 4¾ inches), form the basis for the foregoing description.

Meek and Hildebrand (1923–1927, p. 584) came to the conclusion, after examining many specimens from both coasts of Panama and northward, that the representatives from the opposite coasts were identical; and as the name *californiensis* has priority over *pseudogula*, the first-mentioned name supercedes the last one.

This fish is rare in Chesapeake Bay, where it appears to occur only as a straggler. The species is mainly of southern distribution, being one of the most abundant of fishes on both coasts of Panama. It has not been recorded previously north of Beaufort, N. C. It is nowhere of much commercial importance, as the size attained is small. The maximum recorded length is 8 inches.

Habitat.—On both coasts of tropical America, on the Atlantic from Virginia to Brazil.

Chesapeake localities.—(*a*) Previous records: None. (*b*) Specimens in collection: From Lynnhaven Roads, Va., September 30, 1921, seined on a sandy beach.

151. Eucinostomus gula (Cuvier and Valenciennes). Mojarra.

Gerres gula Cuvier and Valenciennes, Hist. Nat. Poiss., VI, 1830, p. 464; Martinique.
Gerres argenteus Bean, 1891, p. 86.
Eucinostomus gula Jordan and Evermann, 1896-1900, p. 1370; Evermann and Hildebrand, 1910, p. 161.

This species was not taken during the present investigation and no specimens are at hand. It is reported to differ from *E. californiensis* in the deeper body, 2.2 to 3 in length, and in having the premaxillary groove on median line of snout closed by scales anteriorly, leaving a naked pit behind. Relative to the relationship of these two species, Meek and Hildebrand (1923–1927, p. 583) contribute the following: "This species, although usually easily separated from *E. californiensis* by the deeper body and premaxillary groove scaling, has representatives that make the separation extremely difficult." It is then pointed out by these authors that in some specimens the premaxillary groove is only partly closed, and in these specimens the body is no deeper than in others, having the groove open and linear, yet just as deep as some specimens having the groove completely closed by scales in front. The species, therefore, appear to intergrade.

This species, like the preceding, is of southern distribution, being common in tropical waters on the Atlantic coast of America. The maximum recorded size of this fish is 5 inches. It is nowhere of commercial importance.

Habitat.—Massachusetts to Brazil; occurring only as a straggler north of Beaufort, N. C.

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

Family LXIX.—SCIÆNIDÆ. The croakers and drums

Body elongate, more or less compressed; head rather large, the bones more or less cavernous; mouth large or small; teeth in one or more series on jaws, none on vomer, palatines, pterygoids, or tongue; barbels sometimes present on chin; no supplemental maxillary bone; premaxillaries protractile; gill membranes not united, free from the isthmus; branchiostegals 7; lateral line continuous, extending on caudal fin; scales large or small, present on head; dorsal fins continuous or separate; anal fin short, with one or two spines; caudal fin usually square or emarginate; air bladder usually large (absent in Menticirrhus); vertebræ about 10+14.

KEY TO THE GENERA

a. No barbels on lower jaw.
- *b.* Teeth very small, those in lower jaw deciduous, wanting in adult; body comparatively short and deep; mouth small, horizontal; preopercular margin entire; a dark spot behind upper angle of gill opening ---------- Leiostomus, p. 271
- *bb.* Teeth well developed, permanent in each jaw; no dark spot behind upper angle of gill opening.
  - *c.* Mouth horizontal; gill rakers short and thick; one (sometimes several) black spot at base of caudal ---------- Sciænops, p. 276
  - *cc.* Mouth more or less oblique to nearly vertical; gill rakers rather long and slender; no black spot at base of caudal.
    - *d.* Preopercle without bony serræ; snout shorter than eye; mouth very oblique ---------- Larimus, p. 278
    - *dd.* Preopercle serrate; snout not shorter than eye; mouth moderately oblique.
      - *e.* Head not very broad; interorbital space not spongy to the touch ---- Bairdiella, p. 279
      - *ee.* Head broad; interorbital space very cavernous, more or less spongy to the touch ---------- Stellifer, p. 282

aa. One to many barbels on lower jaw.
- *f.* Lower jaw with numerous barbels.
  - *g.* Preopercular margin strongly serrate; body covered with rather small scales, 64 to 72 in lateral series ---------- Micropogon, p. 283
  - *gg.* Preopercular margin entire; body covered with rather large scales, 41 to 45 in a lateral series ---------- Pogonias, p. 287
- *ff.* Lower jaw with a single, short, thickish barbel.
  - *h.* Anal fin with two spines, the second one somewhat enlarged ---- Umbrina, p. 289
  - *hh.* Anal fin with a single weak spine ---------- Menticirrhus, p. 290

119. Genus LEIOSTOMUS Lacépède. Spots

Body comparatively short, compressed; back elevated; head short, obtuse; snout blunt; mouth small, horizontal; teeth wanting in lower jaw (in adult); preopercle entire; gill rakers short; dorsal fins contiguous, the first rather high, consisting of 10 spines. A single species of this genus is known.

152. Leiostomus xanthurus Lacépède. Spot; "Croaker"; "Silver gudgeon"; Layfayette.

Leiostomus xanthurus Lacépède, Hist. Nat. Poiss., IV, 1803, p. 439, Pl. X, fig. 1; Carolina. McDonald, 1882, p. 12; Bean, 1891, p. 89; Smith, 1892, p. 72; Jordan and Evermann, 1896-1900, p. 1458, Pl. CCXXIII, fig. 569; Smith and Bean, 1899, p. 187; Evermann and Hildebrand, 1910, p. 162; Fowler, 1912, p. 59, 1918, p. 18, and 1923, p. 7; Welsh and Breder, 1923, p. 177.

Liostomus obliquus Uhler and Lugger, 1876, ed. I, p. 113; ed. II, p. 109. Not *L. obliquus* (Mitchell).

Head 2.95 to 3.6; depth 2.55 to 3.6; D. X–I, 30 to 34; A. II, 12 or 13; scales 72 to 77. Body rather deep, compressed; back strongly elevated in adult; head moderate; snout blunt, 2.75 to 3.4

in head; eye 3 to 3.95; interorbital 3 to 3.85; mouth horizontal; lower jaw shorter than the upper, included; maxillary reaching nearly opposite middle of eye, 2.65 to 3.2 in head; teeth in the jaws minute, in villiform bands, wanting in lower jaw in adult; chin and snout with several pores; no barbels; gill rakers short, 22 to 23 on lower limb of first arch; scales rather small, ctenoid, extending on the caudal fin and covering most of it in adults, a few scales also present on the base of the other fins; dorsal fins contiguous, the first composed of slender spines, the middle ones longest, notably higher than any of the rays in the soft part; caudal fin truncate in very young, notably concave in adult, the upper rays the longest; anal fin with two stiff spines, origin of fin under middle of soft dorsal; ventral fins moderate, inserted a little behind base of pectorals; pectoral fins long, reaching well beyond tips of ventrals in adult, failing to reach this point in young, 0.95 to 1.45 in head.

Color bluish gray with golden reflections above; silvery underneath; sides with 12 to 15 oblique yellowish (dusky in preserved specimens) bars, in fish ranging upward of 50 millimeters, and again becoming indistinct in very large fish; a large, yellowish black shoulder spot present, except in very young; fins mostly pale yellow; dorsal and caudal fins more or less dusky; anal and ventrals also partly dusky in large examples. Young fish, 40 millimeters and less in length, mostly pale; sides of head silvery; sides of body and back each with a row of dark blotches composed of dusky punctulations, besides other irregularly placed dusky points.

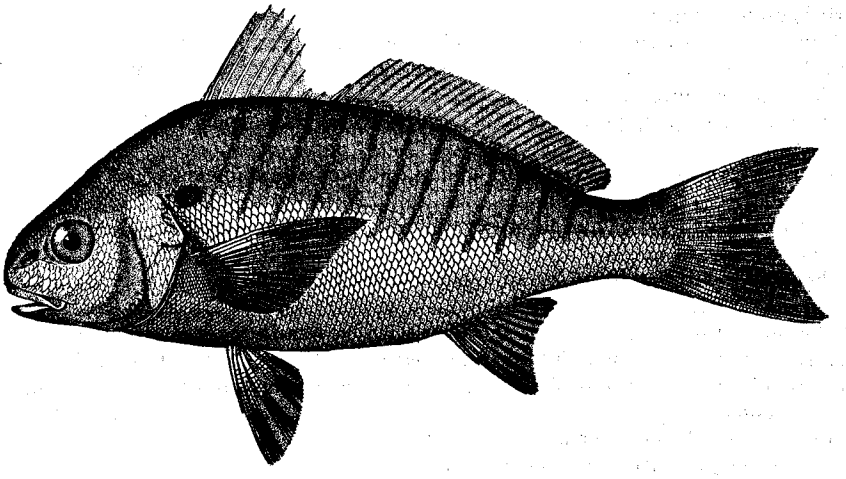

FIG. 155.—*Leiostomus xanthurus*. From a specimen 8 inches long

Many specimens of this species, ranging from 15 to 345 millimeters (⅝ to 13½ inches) in length, were preserved. The very young differ notably in color from the adult, as shown in the description. The young also are notably more slender, with the back proportionately much less strongly elevated. The comparatively short, compressed body, short, obtuse head, rather small horizontal mouth, and the oblique bars, and particularly the dark shoulder spot, distinguish this fish from related forms.

The male of this species makes a croaking or drumming sound, but it is not a loud one, owing probably to the thinness of the walls of the air bladder and the feeble development of the drumming muscles.

The food of the spot, as shown by the contents of 157 stomachs removed from specimens taken in Chesapeake Bay, consists mainly of small and minute crustaceans and annelids, together with smaller amounts of small mollusks, fish, and vegetable débris.

The spot grows rather rapidly during the first summer. The following sizes were collected during the spring and summer: April, 23 to 25 millimeters (about 1 inch); May, 26 to 72 millimeters (1 to 2⅞ inches); June, 21 to 86 millimeters (⅞ to 3⅜ inches); July, 32 to 82 millimeters (1¼ to 3¼ inches). The wide range in the size of young fish taken in the Chesapeake throughout most of the year makes it difficult to determine a correct average rate of growth. As the spawning season quite probably is a protracted one, a considerable variation in size among the young would be

expected. The larger fish apparently come from those parent fish that spawned first (late fall), and the smaller fish result from the later (early winter) spawners. The monthly increase in length appears to be quite rapid during the summer and early fall. No spots less than 4 inches in length were collected from September to November. The predominating sizes trawled by the *Fish Hawk* in December, however, were only 85 to 95 millimeters (3⅓ to 3⅘ inches) in length; while late in January, out of a total catch of 383 spots taken in various parts of the bay, 354 ranged in length from 80 to 110 millimeters (3¼ to 4⅓ inches). Whether these small fish are runts that remained in Chesapeake Bay over the winter while the larger fish migrated out, or are younger fish, is not known. If they were younger fish one would be obliged to conclude that the species has a double spawning period. In that event the smaller and younger fish would be expected to occur earlier in collections. The absence of these smaller fish in catches made during September, October, and November, when thousands of spots, almost all over 4 inches long, were taken with fine-meshed collecting seines alongshore and in beam trawls offshore, together with the fact that spots with large roe have been observed only during the fall and early winter, however, tends to discredit such a theory.

Length frequencies of 1,321 spots, Leiostomus xanthurus

[Measurements in millimeters, grouped in 5-millimeter intervals]

Total length, millimeters	Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Jan.	
	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–31
15–19	1					8																
20–24			11		2	46		2														
25–29						76		2														
30–34						131		3														
35–39					3	80		12														
40–44					1	31		21		4												
45–49						6		22		5												
50–54					1	5		13		10												
55–59					1			10		13												
60–64								5		2												
65–69					2	2		7		7		1										
70–74					1	1		3		11		1										
75–79								1		3		2						1	3			10
80–84								2		6		8							6			46
85–89								2				5							16			75
90–94								1		2		14		2					13			75
95–99								1		1		8		3					2			68
100–104										2		19		5		3			3			46
105–109										1		4		3		2		2	4			28
110–114												6		3		19		3	3			7
115–119									2			6		7		17		4	2			4
120–124									1			2		4		11		3				6
125–129												1		2		13		3				7
130–134												1		5		15		2				
135–139									1			1		3		4						1
140–144												1		1		3		2				
145–149							1		1			2		1		11		1				1
150–154														5		4		1				
155–159						1								1		5		1				
160–164														1		5		1				
165–169									1					1		1		2				
170–174					1				2					1		6		1				
180–184																4		1				
185–189																						
190–194										2				1		2						
195–199										2						2						
200–204										1						1						
205–200										1				1		1						
210–214																2						
215–219																2						
250–254																1						
295–299																1						
Total	1		11		12	387	1	107	8	73		82		50		135		28	52			374

Collections of spots made at Beaufort in shallow water during the winter of 1926–27 consist almost exclusively of small fish, their average length being considerably below that of fish taken before cold weather came, which appears to indicate that the smallest young of the season have a tendency to remain in their early habitat, whereas the larger ones migrate to deeper and warmer

water. We have measured a considerable number of spots collected throughout most of the year at Beaufort, N. C., and find that, allowing for a somewhat longer growing season, the growth corresponds fairly well with that of Chesapeake Bay. It appears from the data collected that the Chesapeake Bay spot attains a length of about 5 inches at one year of age.

Spawning takes place in late autumn and probably during the winter, and apparently at sea, for in the fall a general exodus of large fish with maturing roe takes place from the bay, the height of this migration occurring during late September and throughout October. The gonads of 104 spots caught at Ocean View, Va., on October 16, 1922, ranging in length from 114 to 268 millimeters (4½ to 10½ inches), were examined for the status of development. The smallest fish in this lot that had ripening roe was a female 214 millimeters (8½ inches) in length. The ovaries and testes of the larger fish were in various stages of development, suggesting that the spawning season is a protracted one. A female and a male, respectively 214 and 224 millimeters (8½ and 8⅞ inches) long, had very immature gonads, which probably would not have ripened by the coming winter. Fish with large roe, however, have been observed only during autumn and early in the winter. In the spring the spot is thin and poor, as shown elsewhere, indicating that it probably has spent much energy in the process of reproduction. Nearly all spots that remain in the deeper parts of the Chesapeake during the winter are immature fish, less than 6 inches in length. In fact, there is

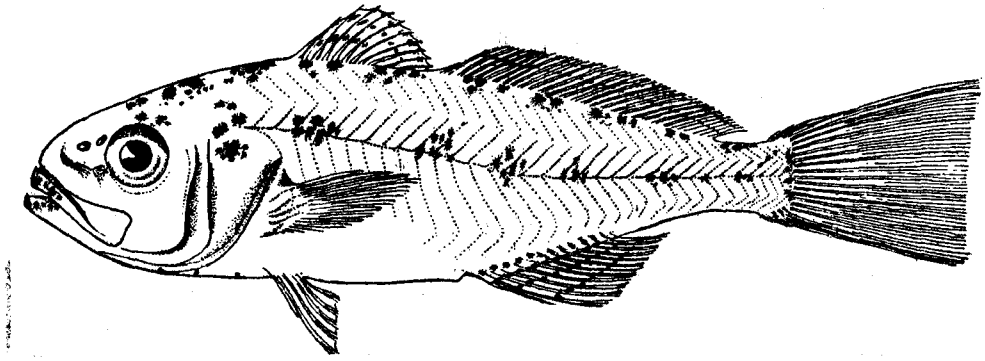

FIG. 156.—*Leiostomus xanthurus*. Young, 27 millimeters long

no evidence available (as already indicated) that spawning takes place within the bay. However, the young appear to enter when quite small.

The spot is one of the most important food fishes found in Chesapeake Bay. During 1920 it ranked seventh in quantity and sixth in value, the catch being 837,845 pounds, worth $63,138.

In Maryland it ranked eighth in quantity and ninth in value, the catch being 51,692 pounds, worth $3,138. Of this amount, 48 per cent was caught with pound nets, 46 per cent with haul seines, 3 per cent with purse seines, and 3 per cent with lines. Kent County is credited with the largest catch, namely 20,710 pounds, followed by Dorchester with 8,500 and Calvert with 5,010 pounds.

In Virginia the spot ranked sixth, both in quantity and value, the catch being 786,153 pounds, worth $60,000. Of this amount, 50 per cent was caught with pound nets, 33 per cent with haul seines, 12 per cent with gill nets, and 5 per cent with lines The bulk of the catch was taken in three counties, namely, Norfolk, 260,800; Princess Anne, 148,000; and Elizabeth City, 142,400 pounds.

The spot is caught in the Chesapeake from April until November, but the largest part of the catch is taken during September and October. Records obtained from a set of two pound nets at Lynnhaven Roads, Va., give the first catch of marketable spots in quantities of 10 pounds or more on the following dates: April 5, 1910, May 17, 1912, April 25, 1916, April 21, 1917, May 1, 1918, April 14, 1919, March 29, 1920, April 25, 1921, and April 4, 1922. The catch of marketable fish taken during April and May is usually very small. Large numbers of 6 and 7 inch spots often appear in April, but these are discarded by the fishermen as they are not in prime condition and have no marketable value. Large quantities of these small spots are destroyed annually by fishermen

who do not take the time at the pound nets to return them to the water alive. This wastage is notably evident in the vicinity of Buckroe Beach and the lower York River, Va.

Much the greater part of the annual catch of spots is caught in the lower part of the bay, particularly in the fall, when they are caught with large haul seines. In the vicinity of Ocean View, Norfolk County, Va., two large haul seines were operated in 1920 by stationary shore equipment. About 164,000 pounds of spots were caught with these two seines, constituting a large part of the entire catch from Chesapeake Bay. From September 23 to October 27, 1922, in 40 separate hauls with the same two seines, 270,420 spots, weighing about 169,000 pounds, were caught, making an average of 4,225 pounds per haul. The largest single haul of spots ever taken in Chesapeake Bay, as far as known, was made by Lambert brothers (owners of one of the above-mentioned seines) on October 23, 1922, which consisted of 90,000 spots, weighing 50,000 pounds.

Haul-seine fishing for spot is begun in July, and sometimes large catches are made during the summer, but usually only small numbers are caught before September. The haul seines generally vary in length from 100 to 300 fathoms, and the largest seines are operated in the vicinity of Ocean View, Va. The Ocean View seine is 1,800 feet long, 25 feet deep, with 1-inch bar mesh in the center and 1¼-inch mesh at the ends. Both leads and corks are placed about 18 inches apart. To use such a large seine it is necessary to find a large area of water that has the proper depth and a comparatively smooth, clean bottom. Two of the largest seines at Ocean View are operated by crews of about 22 men each. The seine is set out a short while before low tide in order that most of the hauling may be done on slack water. The entire seine is carefully arranged in a seine boat, which is towed by a power boat while making a haul. The boats are run from the beach in a perpendicular line until a 200-fathom hauling line has been paid out. Then the 300 fathoms of seine are put out in the shape of a half ellipse. To the end of the seine put overboard last a hauling line, 350 fathoms in length, is attached, and this is paid out in an oblique line until shore is reached. By experience the fishermen are able to judge these distances very closely. After the seine has been paid out and the boats have returned to shore hauling is commenced by means of a winch operated by electric power. For about an hour no work, excepting that of two men who coil the lines as the seine is slowly being drawn to shore, is required of the fishermen. After the staffs or ends of the seine reach shore, the entire crew is needed to complete the haul. By means of a hook attached to loops made on the lead line, the power winch continues to do the heavy work of hauling, but now on only one end of the seine. When one end has been brought ashore a certain distance the other end is worked similarly. After about two-thirds of the seine has been beached the fishermen haul in the remainder of it without the aid of the winch. The closer the seine gets to the shore, the more care must be exercised in "footing" the lead line and apportioning the strain on the seine. If the catch of fish is small the seine can be drawn upon the beach by the crew. Very often, however, a large catch is made, which necessitates scooping the fish out with small hand nets, each of which is operated by two men. An average haul was timed as follows:

1. Started to prepare equipment for making haul at 7.20 p. m.
2. Beginning of haul, seine boat left beach at 8.11 p. m.
3. Seine boat returned to beach after paying out seine at 8.23 p. m.
4. Seine and catch of fish landed at 10.15 p. m.

When a catch of spots is landed the fish are scattered on the sandy beach and thereby become coated with sand. They are then packed carefully in "trays" and hauled to market by auto truck, or, if held over night at the fishery, they are placed in a cold-storage room. A tray is a shallow wooden box that holds about 120 ½-pound spots. The process of packing the fish in trays is called "setting up."

A large part of the catch of spots is shipped to various parts of Virginia and Maryland and a small part to outside markets. The spot is the favorite fish of Norfolk and many parts of Virginia, and for this reason the market is rarely glutted. During the heavy runs in the fall many consumers buy a tray of spots to salt down for use in the winter, and many are held in cold storage and disposed of during the winter, when fish are scarce locally. Ocean View, Va., is famous for its fine spots, and the trade name "Ocean View spots" is commonly used in the markets. During October the fish are in prime condition and large numbers are caught by anglers, who preserve their catch by salting.