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A
HISTORY OF THE FISHES
OF
MASSACHUSETTS.

A

HISTORY

OF THE

FISHES OF MASSACHUSETTS.

BY

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To

GEORGE BARRELL EMERSON, LL.D.,
FORMERLY PRESIDENT OF THE BOSTON SOCIETY OF NATURAL HISTORY.

This attempt

TO ELUCIDATE THE HISTORY OF THE FISHES OF MASSACHUSETTS

IS DEDICATED

WITH THE DEVOTED FRIENDSHIP OF

THE AUTHOR.

IV.

A History of the Fishes of Massachusetts.

BY DAVID HUMPHREYS STORER, M. D., A. A. S.

As one of the Commissioners on the Zoölogy of Massachusetts, in the year 1839, I prepared a Report on the Ichthyology of the State. From the brief time occupied in its preparation, it was necessarily imperfect, and, not being accompanied by figures, was comparatively useless, except to scientific men. Since the appearance of that communication, much information has been obtained respecting several of the most common and valuable fishes, and quite a number of new species have been ascertained to exist in our waters.

Having carefully re-described all the species, I trust the following paper will present an accurate history of the fishes of our State. Considering this as the completion of my former Report, I have kept in view the primary object of the commission, — to ascertain the value of our Fauna in an economical point of view, rather than to prepare labored scientific descriptions.

To all who have aided me since this paper was commenced, or rather since my attention was first directed to our ichthyology, I would return my grateful acknowledgments. The following gentlemen, to whom in my previous Report I remarked I was under peculiar obligations, I cannot pass by unnoticed : —

Thomas Kidder, Esq., of the General Inspection Office, Boston, for his polite attention in furnishing me with all the statistical information in his power regarding the quantities of fish inspected in the State ;

C. R. Vickery, Esq., of Taunton, for his very acceptable remarks respecting the fisheries of Taunton River ;

Hiram Hosmer, M. D., of Watertown, for his numerous and valuable facts concerning the fisheries of Charles River ;

Elisha Bartlett, M. D., of Lowell, for his interesting account of the fisheries of the Merrimack River ;

J. B. Forsyth, M. D., of Chelsea, formerly of Sandwich, for much useful information respecting the fishes taken along "the Cape" ;

Jonathan Johnson, Jr., of Nahant, for several very rare species, and many valuable observations concerning more common fishes.

To Captain Nathaniel Blanchard, a veteran fisherman of Lynn, and Leroy M. Yale, M. D., of Holmes's Hole, I am most deeply indebted ; — to the *former*, for his constant and unwearied efforts to serve me amid the fatigues of his arduous occupation, during the entire period I was engaged in the State Survey, and for many judicious remarks and valuable details imparted to me, respecting the fishes and fisheries of the northern shore of Massachusetts Bay ; and to the *latter*, for his *invaluable aid*. To him I am not only obliged for specimens of nearly *one fifth* of all the species I have described, and which, but for him, I could not have procured, but also for many specimens of more common species, and much valuable information respecting them. Since these observations were made, my excellent friend, Dr. Yale, while in the faithful discharge of his professional duties, contracted a malignant disease, the attack of which he survived but a few days. By his death, science has lost an enthusiastic votary, and his profession a most honorable member.

During the last six or eight years, no individual has rendered me such essential assistance as Captain Nathaniel E. Atwood, of Provincetown. For nearly thirty years a practical fisherman, thoroughly acquainted with the habits of most of our fishes, and willing and ready to do all in his power to advance my wishes, he has placed me under obligations which I cannot express. For several fishes never before described, and for much acceptable information respecting each of our marketable species, I am indebted to him, the best practical ichthyologist in our State.

To Professor Agassiz my thanks are due for many valuable suggestions in the preparation of this work, and to his accomplished draughtsman, Mr. Sonrel, for the admirable plates which illustrate it.

In my nomenclature, I have been guided, as far as possible, by the principle which would give the credit of a species to the author who first placed it under its appropriate genus. This plan, I am led to understand, is about being adopted by our most eminent naturalists.

In addition to the works mentioned in my "Synopsis of the Fishes of North America," the following have been consulted in the preparation of this paper : —

- Richardson.* Report on North American Zoölogy. London. 1837.
Schomburghk. History of Barbados. London. 1848.
 Zoölogy of Beechey's Voyage to the Pacific. 4to. London. 1839.
 Magasin de Zoölogie, par Guérin de Méneville. 8vo. Paris.
Agassiz. Lake Superior. 8vo. Boston. 1850.
Storer, H. R. Observations on the Fishes of Nova Scotia and Labrador, in Boston Journal of Natural History, Vol. VI. 1850.
Perley. Catalogue of the Fishes of New Brunswick and Nova Scotia. Fredericton. 1837.

CLASS I. OSSEOUS FISHES.

SKELETON bony, the osseous matter being deposited in fibres. Sutures of the cranium distinct, with maxillary or intermaxillary bones, always one, and generally both, present. Gill-membrane with rays.

ORDER I. ACANTHOPTERYGII. SPINE-RAYED.

They are known by the spines which represent the first rays of the dorsal fin, or which alone sustain the anterior fin of the back, when they have two. Sometimes, instead of an anterior dorsal fin, they have nothing but a few free spines. Their anal fin has also some spines instead of the first rays, and there is, in general, one to each ventral.

FAMILY I. PERCIDÆ.

Comprehends fishes with an elongated body, covered with hard or rough scales, in which the operculum or preoperculum, and frequently both, have indented or spinous edges, and in which the jaws, the front of the vomer, and almost always the palatines, are furnished with teeth.

GENUS I. PERCA, Cuv.

Two dorsal fins distinct, separated; the rays of the first spinous, those of the second flexible; tongue smooth; teeth in both jaws, in front of the vomer, and on the palatine bones; preoperculum notched below, serrated on the posterior edge; operculum bony, ending in a flattened point directed backwards. Branchiostegous rays. Scales roughened, and not easily detached.

PERCA FLAVESCENS, *Cuv.**The American Yellow Perch.*

(PLATE II. FIG. 1)

- Bodianus flavescens*, *Yellow Perch*, MITCHILL, Trans Lit. and Phil. Soc. of N. Y., I. p. 421.
La Perche jaunatre d'Amérique, *Perca flavescens*, CUV. et VAL., Hist. Nat. des Poissons, II. p. 46.
Perca flavescens, *American Perch*, RICH., Fauna Boreal. Americ., III. p. 1, pl. 74.
 " " *Common Perch of Massachusetts*, STORER, Massachusetts Report, p. 5.
Bodianus flavescens, *Yellow Perch*, KIRTLAND, Rep. on Zool. of Ohio, pp. 168, 190.
Perca flavescens, *Yellow Perch*, KIRTLAND, Bost Journ. Nat. Hist., v. p. 337, pl. 27, fig. 2.
 " " *American Yellow Perch*, DEKAY, N. Y. Report, p. 3, pl. 1, fig. 1.
 " " AYRES, Bost. Journ. Nat. Hist., IV. p. 256.
 " " *American Yellow Perch*, LINSLEY, Cat of Fishes of Conn.
La Perche à opercules grenues, *Perca serrato-granulata*, CUV. et VAL., II. p. 47.
Perca serrato-granulata, GRIFFITH'S CUV., X. pl. 39, fig. 1.
 " " DEKAY, N. Y. Report, p. 5, pl. 22, fig. 64.
 " " *Common Perch*, THOMPSON, Hist. Vermont, p. 129.
La Perche à tête grenue, *Perca granulata*, CUV. et VAL., VII. p. 48, pl. 49.
Perca granulata, JARDINE, Nat. Lib., I. p. 92, pl. 1.
 " " DEKAY, N. Y. Report, p. 5, pl. 48, fig. 220.
 " " LINSLEY, Cat. of Fishes of Conn.
La Perche à museau pointu, *Perca acuta*, CUV. et VAL., II. p. 49, pl. 10.
Perca acuta, *Sharp-nosed Perch*, RICH., Fauna Boreal. Americ., III. p. 4.
 " " " *Yellow Perch*, DEKAY, N. Y. Report, p. 6, pl. 68, fig. 222.
La Perche grêle, *Perca gracilis*, CUV. et VAL., II. p. 50.
Perca gracilis, RICH., Fauna Boreal. Americ., III. p. 4.
 " " *Slender Yellow Perch*, DEKAY, N. Y. Report, p. 6.
Perca flavescens, STORER, Mem. of Amer. Acad., New Series, II. p. 269.
 " " STORER, Synopsis, p. 17.
 " " AGASSIZ, Lake Superior, p. 291.

Color. Above of a greenish-yellow; sides golden-yellow, crossed by seven transverse dark bands, all broader above than below, and those upon the middle of the body broadest. Abdomen white; lower jaw tinged with pink. Centre of operculum of a deep green. Head darker than rest of body. Pupils back; irides golden. Dorsal and caudal fins yellowish-brown; pectorals yellow; ventrals and anal a bright scarlet.

Description. The length of the head is less than one fourth of the entire length. Top of head broad and flattened; that portion of it between and in front of eyes is naked, and covered by a smooth membrane; the portion back of eyes is bony, and roughened by raised, radiating striæ. The preoperculum is scaled, and serrated along its entire edge, save a small portion of its superior posterior angle, which is naked and smooth. The operculum is a subtriangular bone, covered at its upper part by a few scales, but otherwise almost entirely scaleless, and exhibiting numerous raised lines diverging to its outer edge, which presents in some instances a few serrations, and terminates posteriorly in a sharp angle or spine. The subopercle is scaled above, naked beneath, and minutely denticulated along its edge. The scapular bones are

slightly corrugated by striæ. The humeral bones are strongly denticulated. Eyes of moderate size, preceded by several mucous pores. The anterior nostril much in advance of the posterior, which is the larger. The lateral line commences at the humeral bone, and, assuming the curve of the body, is continued to the base of the tail.

The first dorsal fin arises nearly on a line with the pectorals; its height is equal to one third of its length. The rays are very stout, their naked extremities projecting above the transparent membrane connecting them; fin rounded posteriorly. I have seen several specimens in which the fourth and sixth rays of this fin were about one half the height of the third and fifth rays, and the connecting membrane was continued directly above their extremities, as if they were absent. The membrane stretching from the last ray of the first dorsal fin extends to the first of the second dorsal.

The second dorsal is subquadrangular, rounded above; it is more than half the length of the first. The first ray is very minute, and, as well as the second, is spinous; the third ray is simple: all the soft rays are articulated.

The pectorals arise just beneath the humeral bone. They are quite long; fan-shaped; their rays are bifurcated and articulated.

The ventrals are subtriangular; they arise at a distance back of the pectorals equal to one third their height; their outer ray is a strong spine, the others are multfid.

The anal is higher than long, and arises about opposite the middle of the second dorsal; its first two rays are spinous, the first less than one half the height of the second.

The caudal is deeply emarginate.

The fin rays are as follows:—B. 7. D. 13. 2-13. P. 15. V. 1-5. A. 2-8. C. 18. Length 12 to 15 inches.

In this species, as in many others, I have represented two scales, one from the lateral line, and one from above it, whose characters will sufficiently distinguish them.

Remarks. This species is universally distributed throughout the State. In the spring and autumn, it is frequently found in the market, and is readily sold. When young, it usually swims in extensive shoals, while the larger ones remain in the deepest water, and by themselves. It does not take its food timidly, but seizes it instantly without nibbling. It is not only caught with the hook in summer, but also through the ice in winter, with pickerel, and in pretty large quantities in brooks while netting for alewives. Individuals are seldom taken which measure more than twelve or fifteen inches in length. Mr. Ayres has seen a specimen weighing two and a half pounds, and

Dekay has caught them weighing nearly three pounds. This species has been repeatedly transported from one pond to another with complete success. Dr. Mitchill transferred them a distance of forty miles.

It has been noticed in Maine, Massachusetts, STORER; New Hampshire, H. R. STORER; Vermont, THOMPSON; Connecticut, AYRES; New York, MITCHILL, DEKAY; Pennsylvania, HALDEMAN; Ohio, KIRTLAND; and in all the ponds and streams of the great lakes, RICHARDSON, AGASSIZ; New Brunswick and Nova Scotia, PERLEY.

GENUS II. LABRAX, Cuv.

Distinguished from the Perch by the scaly opercula, terminating with two spines, and by a tongue covered with prickles.

LABRAX LINEATUS, Cuv.

The Striped Bass.

(PLATE I. FIG. 4.)

Sciæna lineata, BLOCH, pl. 304.

Perca Mitchilli, *Striped Bass or Rock-fish*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 413, pl. 3, fig. 4.

Rock Bass, MEASE, Trans. Lit. and Phil. Soc. of N. Y., I. p. 502.

Le Bar rayé (ou Rock-fish) des Etats-Unis, *Labrax lineatus*, CUV. et VAL., II. p. 79.

Labrax lineatus, GRIFFITH'S CUV. X. p. 103.

" " RICH., Fauna Boreal. Americ., III. p. 10.

" " STORER, Report, p. 7.

" " AYRES, Bost. Journ. Nat. Hist., IV. p. 257.

" " DEKAY, N. Y. Report, p. 7, pl. 1, fig. 3.

" " LINSLEY, Cat. of Fishes of Conn.

" " STORER, Mem. of Amer. Acad., New Series, II. p. 273.

" " STORER, Synopsis, p. 21.

Color. The upper part of the body is silvery brown, with a greenish-blue tinge; the sides are lighter; the abdomen of a beautiful, clear silvery color; the opercula are more or less golden. Eight or more longitudinal black bands pass from behind the operculum towards the tail; the upper bands are lost just back of the termination of the second dorsal fin; the three or four central ones extend to the caudal fin; while the lower ones reach only the posterior portion of the anal, or are even lost anterior to that fin. Sometimes these bands are all entire; in other specimens, more or less of them are interrupted at intervals; while in others still, instead of being straight throughout, frequent undulations or curves are observed. It sometimes happens that all the bands on one side of the fish are perfect, while all on the other side of the same specimen are broken or irregular. Pupils black, irides golden.

Description. The form of this species is cylindrical. Length of head to entire

length of fish is as 1 to 4. The scales on the body are large and quadrangular, less than one third of scale attached, marked by concentric lines upon their sides; numerous very delicate striæ diverge from the centre of the attached base to the entire extent of the free edge. Sixty-two scales along the lateral line; ten scales in an oblique line from the origin of the dorsal to the lateral line. The whole head is covered with scales, including the intermaxillary bones, save the suborbital bones and the portion in front of and between the nostrils. The scales are largest on sides of body; smaller towards tail and on anterior back, smallest on top of head. The eyes are circular, their diameter equal to about one third the distance between them. The nostrils are situated anterior to eye, at a distance about equal to diameter of eye; the posterior is circular and the longer; the anterior is larger. The lower jaw is the longer. Teeth in jaws numerous and very small; the largest are at the middle of the upper jaw. Teeth upon the palatine bones. Tongue rough at its base and upon its sides, smooth in its centre. The *operculum* at its posterior angle is armed with two spinous processes, the lower of which is the larger and more acute; they are margined with a dark-colored membrane. The *preoperculum* at its posterior edge is very delicately and minutely serrated; these serrations are larger at its inferior margin.

The *lateral line*, which is very distinct, arises just above the superior spinous process of the operculum, and is continued in a straight course through the middle of one of the longitudinal bands, to the centre of the tail, upon the rays of which it is lost.

The first dorsal fin arises on a line with the posterior half of the pectorals; it is twice as long as high; the first ray is one sixth the height of the fourth and fifth, which are the longest rays in the fin.

The second dorsal is not as long as the first. The first ray is spinous; the second ray, which is the longest, is two thirds as high as the length of the fin.

The pectorals are situated just beneath the inferior spine of the operculum; their length to their height is as 1 to 5.

The ventrals are situated just back of the pectorals; their first ray is spinous, and three fifths as long as the second ray, which is the longest of the fin; the rays are multifold. They are of the same length as the pectorals.

The anal arises on a line with the middle of the second dorsal; its first three rays are spinous; the first of these is one fourth the height of the third. This fin is shorter than the second dorsal; it is one fifth longer than high.

The caudal at its base is equal in depth to the length of the pectorals; it is as wide again at its extremity, when expanded, as its depth at base. Fin quite deeply forked.

In each of the fins, the scales are more or less continued upon them.

The fin rays are as follows:—D. 9. 1–12. P. 18. V. 1–5. A. 3–11. C. 18. Length, 3 to 4 feet.

Remarks. This fine species is taken in considerable numbers upon our coast. It is generally found upon shoals near the land, where frequently a dozen or more may be seen at a time beneath the water, quietly lying upon the rocky bottom. Large quantities of small bass are caught with nets near Chelsea and Nantasket beaches. Captain Atwood writes me, that at Provincetown a few are caught in the summer with hook and line, by men standing upon the shore; and that in the months of September and October, when this fish is passing by, on its way to the South, large quantities are sometimes taken with nets, in the following manner. Several men put off from the Race in a boat, with a net from seventy to eighty fathoms long and from three to four fathoms deep; when the boat is at a short distance from shore, a line attached to the net is thrown ashore, and secured by some of the fishermen there in waiting, and a portion of the net is dragged from the boat. As soon as the fish are seen swimming along, near the bottom, the rest of the net is let out of the boat, which is now rowed ashore, while the other extremity of the net is drawn thither by the rest of the gang. In this way hundreds are taken at a haul; but as a large number of men is required, and considerable time is necessarily expended, this business is not very profitable, and is not attended to, unless it be at times of leisure from other pursuits. At Buzzard's Bay they are speared by torch-light to some extent, in the month of May.

In the winter, this species goes up into the rivers and arms of the sea. It is most common in Boston market in autumn and winter. At some seasons of the year it is taken in large numbers in seines, while at others the market is partially supplied by those taken with the hook, and consequently its price varies, from three to twelve cents per pound. It is most readily taken by the hook, when it is baited with the Squid (*Loligo illecebrosa*). The larger individuals feed voraciously upon this animal, and are hence called "Squid-hounds." The flesh of this species, particularly of the larger ones, is rather coarse, but meets with a ready sale when fresh. In 1836, a small number of barrels (67) was packed and inspected. Bass of considerable size are often taken in Boston harbor. In July, 1837, I saw a specimen weighing 36 pounds, which had been taken from one of the city bridges over Charles River; and I have been told that another, weighing 77 pounds, had been taken from the same bridge. The largest individual I have known to be taken by any of our fishermen weighed 34 pounds.

New Brunswick, PERLEY. Maine, New Hampshire, and Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUVIER, DEKAY.

LABRAX RUFUS, *Dekay*.*The White Perch.*

(PLATE I. FIG. 1.)

Bodianus rufus, *Red Perch*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 420*Le petit Bar d'Amérique*, *Labrax mucronatus*, CUV. et VAL., II. p. 86, pl. 121.*Labrax mucronatus*, *Small American Bass or White Perch*, STORER, Report, p. 8.*Labrax rufus*, *Ruddy Bass*, DEKAY, Report, p. 9. pl. 3, fig. 7.*Labrax mucronatus*, AIRFS, Bost. Journ. Nat. Hist., IV. p. 257." " *White Perch*, LINSLEY, Cat. of Fishes of Conn.*Labrax rufus*, STORER, Mem. of Amer. Acad., New Series, II. p. 274.

" " STORER, Synopsis, p. 22.

Color. A silvery gray, darker above the lateral line. The sides and gill-covers exhibit metallic reflections. Lips, intermaxillaries, and tongue minutely dotted with black. Dorsals, pectorals, and caudal brown; ventrals and anal rose-colored at their base; throat also rosaceous. Pupils black; irides silvery.

Description. Body much compressed, a perceptible convexity in front of the first dorsal fin. The depth of the body across from the first dorsal is to the length about as $3\frac{1}{2}$ to 10. The length of the head to the whole length of the body is as 1 to 4. The gill-covers, intermaxillary bones, and the space between the eyes are scaled; the portion in front of the eyes and nostrils is naked. The eyes are circular; their diameter is to the distance between the eyes as 3 to 5. The nostrils are situated just in advance of the superior anterior angle of the eye; the posterior is oval, the larger, and placed obliquely, pointing backwards; the anterior is circular. The upper jaw is protractile; both jaws are armed with numerous very minute teeth. The tongue has a row of very delicate teeth upon its sides. The preoperculum is serrated posteriorly and inferiorly, the serrations upon the inferior edge being much the larger. The operculum has at its posterior edge a sharp spinous process, and above this, separated by an emargination, is an obtuse point.

The scales upon their exposed surface are covered with minute dots, like those of the lips and tongue; they are denticulated at their edge. Seven scales are found in an oblique line from the lateral line to the origin of the first dorsal fin. The lateral line, which is very distinct, commences just beneath the subscapular bone, and, rising a little at first, pursues nearly a straight course, from a line opposite the commencement of the first dorsal, to the tail, including 55 scales.

The first dorsal fin arises opposite the anterior half of the pectorals, and is entirely composed of spinous rays; the first of these is the shortest, and the fourth the longest; the fin is about half as long as high. The membrane of the last ray of this fin is continued to the base of the first ray of the second dorsal, which is nearly quadrangular,

and is composed of soft rays, with the exception of the first, whose height is about two thirds that of the next. This fin is longer than high.

The pectorals are quite broad when expanded; in height they are equal to the length of the second dorsal.

The ventrals are just back of the pectorals; their height is equal to that of the pectorals.

The anal arises on a line with the fifth ray of the second dorsal. Its height and length are equal. It terminates on the same plane with the second dorsal. The second spinous ray is very stout.

The caudal is considerably emarginated; the depth at its base is equal to half the depth of extremity when expanded.

The fin rays are as follows: — D. 9. 1–12. P. 15. V. 1–5. A. 3–9. C. $17\frac{3}{5}$. Length 12 to 15 inches.

Remarks. This species is brought to Boston market in the spring and autumn, from the mouths of the neighboring rivers, and the ponds to which the sea has access.

By the fishermen it is known as the "White Perch." Its usual weight is about half a pound. December 12th, 1837, I saw a specimen in Boston market which measured fifteen inches in length, and weighed one pound and three quarters, and its stomach contained a specimen of the shiner, *Leuciscus chrysoleucas*, more than five inches long.

Found in New Brunswick, PERLEY; Maine, Massachusetts, STORER; Connecticut, AYRES, LINSLEY; New York, MITCHILL, CUVIER, DEKAY; South Carolina, DEKAY.

Although the *Labrax pallidus* of Dekay was introduced in my "Synopsis" as belonging to this State, I am inclined to think the two species above described to be the only ones we possess; and that perhaps the *pallidus* and *rufus* may prove to be one and the same.

GENUS III. CENTROPRISTES, CUV.

A single dorsal fin; branchiostegous rays seven; all the teeth small and crowded; no canines. Their prooperculum is dentated, and the operculum spinous.

CENTROPRISTES VARIUS, Storer.

The Black Sea-Bass or Perch.

(PLATE II. FIG. 4.)

Perca varia, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., i. p. 415, pl. 3, fig. 6.

Centropristes nigricans, GRIFFITH'S CUV, x. p. 117.

Le Centropriste noir, *Centropristes nigricans*, CUV. et VAL., III. pp. 37, 44.

- Centropristes nigricans*, Règne Animal, ed. VAL., pl. 9, a, fig. 1.
 " " *Black Perch, Black Sea-Bass*, STORER, Report, p. 9.
 " " *Black Sea-Bass*, DEKAY, Report, p. 24, pl. 11, fig. 5.
 " " LINSLEY, Cat. of Fishes of Conn.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 237.
 " " STORER, Synopsis, p. 35.

(*Lutjanus trilobus*, LACÉP.?)

Color. Of a dark brown, almost black, above; lighter beneath; of the head, sea or bronze green. In some specimens, after death, there is a greenish tinge upon the abdomen, and a bluish one upon the top and back of head. The dorsal and anal fins are white; the former crossed by black bars, the latter marked by fuliginous blotches. The pectorals are of a leaden color, varied with dark brown; the membrane of the ventrals is white, while the rays are nearly black.

Description. Body elongated, compressed; convex in front of the dorsal fin. Greatest depth of body equal to one fourth the length of the fish. Length of head to the posterior angle of the operculum equal to rather more than one third the length of the fish. Head, between and in front of eyes, without scales. Scales upon the sides of the body large; small upon the preopercle, and at the base of the tail. Eyes of moderate size. Nostrils double, situated just anterior to the superior anterior angle of the eyes; the anterior is tubular; the posterior much the larger. Jaws equal in length, armed with a great number of minute, sharp, card-like teeth; upper jaw protractile. Lips fleshy. The whole posterior edge of the preoperculum is denticulated; the inferior edge is serrated. A flat, sharp spine is situated at the posterior angle of the operculum, below which is a broad, fleshy elongation projecting beyond it, the posterior portion of which is destitute of scales. By the union of the opercle and interopercle, a slight notch is produced. Humeral bone denticulated. The lateral line, which is of a dark color, arises at the lower edge of the humeral bone, and assumes the curve of the body.

The dorsal fin arises on a line with the base of the pectorals; its first ten rays are spinous. At the posterior portion of each of these spines, suspended from the upper edge of the connecting membrane, is a small fleshy tentacle. The first ray is shortest, the fourth longest. The eleven fleshy rays are higher than the spinous ones, articulated and bifid; this portion extends farther back than the anal fin.

The pectorals arise just below the fleshy projection of the operculum; they are fan-shaped, quite broad when expanded, and rounded posteriorly.

The ventrals are just in front of the pectorals; the middle rays are longest; their length equal to that of the pectorals.

The anal fin commences back of the soft rays of the dorsal; the first three rays are spinous. Fin higher than long.

The caudal is slightly convex at its centre, and its upper portion projects beyond the lower. It is scaled quite high upon its rays, which are bifid and articulated.

The fin rays are as follows:—D. 10–11. P. 17 or 18. V. 1–5. A. 3–7. C. 17 or 18. Length about one foot.

Remarks. This species, which is known among our fishermen as the “Black Bass” and “Black Fish,” is taken in large numbers in the months of May, June, and July at Holmes’s Hole, and carried to the New York market, where it is considered one of the most valuable fishes, and meets with a ready sale. While visiting Gay-Head in August, 1846, I learned that this species had become much less abundant there than formerly. Thirty years since, it was not an uncommon circumstance for sixty sail of vessels to be fishing about Gay-Head at a time. And even fifteen years ago, this species was quite numerous; but several years since it disappeared almost entirely. They are beginning to reappear again within the last two or three years, but are quite small. They are taken about ledges in deep water, and weigh from five to eight pounds. They seldom wander into Massachusetts Bay; the few that are met with in Boston market are brought from New Bedford. July 1st, 1846, a specimen was taken at Nahant.

Massachusetts, STORER. New York to Florida, DEKAY.

This is evidently Mitchill’s *Perca varia*, and I have therefore retained his specific name.

GENUS IV. POMOTIS, CUV.

A few denticulations, more or less obvious, on the borders of the preoperculum. Palatines and tongue smooth, and without teeth. Minute teeth on the jaws, vomer, and pharyngeals. Branchial rays, six. A membranous elongation at the angle of the operculum.

POMOTIS VULGARIS, Cuv.

The Bream.

(PLATE III. FIG. 1.)

Le Pomotis Commun, Pomotis vulgaris, CUV. et VAL., III. p. 91, pl. 49, et VII. p. 465.

Pomotis vulgaris, Règne Animal, ed. VAL., pl. 10, fig. 3.

“ “ *Northern Pomotis*, RICH., Fauna Boreal. Americ., III. p. 24, pl. 76.

“ “ JARDINE, Nat. Lib., I. p. 162.

“ “ *Fresh-water Sun-fish, Pond Perch, Bream*, STORER, Report, p. 11.

“ “ AYRES, Bost. Journ. Nat. Hist., IV. p. 258.

“ “ *Sun-fish, Roach*, KIRTLAND, Report on Zoöl. of Ohio, p. 191.

“ “ *Harlequin Roach*, KIRTLAND, Bost. Journ. Nat. Hist., III. p. 470, pl. 23, fig. 2.

“ “ THOMPSON, History of Vermont, p. 130.

“ “ *Common Pond-fish*, DEKAY, Report, p. 31, pl. 51, fig. 166.

“ “ LINSLEY, Cat. of Fishes of Conn.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 292.

“ “ STORER, Synopsis, p. 40.

“ “ AGASSIZ, Lake Superior, p. 293.

Color. Greenish-brown above, with irregularly distributed rusty blotches; in some specimens a certain regularity is observed in the arrangement of these blotches, producing longitudinal bands along the sides. Beautiful, undulating, longitudinal deep-blue lines across gill-covers. Opercular membrane black, with a bright scarlet blotch at its posterior portion. Abdomen whitish. Dorsal, anal, and caudal fins dark brown. Ventrals and pectorals yellowish.

Description. Body compressed, oval. The back curves very gradually as far as the posterior extremity of the dorsal fin, then abruptly gives place to the fleshy portion of the tail. Head less than one fourth the length of the body. Eyes large, circular. Nostrils double, the anterior tubular. Mouth small; teeth very minute and sharp. The edge of the preopercle very finely denticulated. The lateral line arises at the upper posterior edge of the operculum, and, assuming the curve of the body, is lost at the base of the caudal rays. Scales upon the body large, dentated at their bases; those at the base of the fins, small.

The soft portion of the dorsal fin is highest and rounded posteriorly. The extremities of the spines of the anterior portion of this fin project above the connecting membrane; attached to them are small tubercles. The first dorsal spine is shortest; the fourth and fifth spines are the longest.

The pectorals are long, when extended reaching the soft portion of the dorsal fin.

The anal terminates on a line with the dorsal.

The caudal is emarginate.

The fin rays are as follows: — D. 10–12. P. 13. V. 1–5. A. 3–10. C. 17. Length rarely exceeds eight inches.

Remarks. As Agassiz, in his work on Lake Superior, considers our species as distinct from that which is known in the Southern States by the same scientific name, I have omitted several references in my list of synonymes which were retained in my "Synopsis." It is a common species in the ponds of the various portions of the State, and is taken with the *Perca flavescens*, *Leuciscus chrysoleucus*, *Esox reticulatus*, &c. By many it is considered a very sweet fish, although it is but seldom brought to market. It is known by the names of "Bream," "Ruff," "Pumpkin-seeds," and "Kivers."

They build circular nests by removing the weeds from the bottom, and excavating the sand or gravel to so great an extent that they are often two feet in width and a half foot in depth. They are commonly placed near each other, and sometimes in so shallow water that the usual falling of the river in summer will leave them dry. In this way, besides the ordinary chance of falling a prey to the appetite of other fishes, a

large proportion of the species is yearly destroyed. In its care of the nest, it is very assiduous, and at this time it can be not only closely observed, but sometimes even handled, without its deserting its charge.

New Brunswick, PERLEY. Massachusetts, STORER. Vermont, THOMPSON. Connecticut, AYRES, LINSLEY. New Hampshire, H. R. STORER. New York, MITCHILL, DEKAY. Ohio, KIRTLAND. Kentucky, RAF. The Great Canadian Lakes, RICHARDSON.

POMOTIS APPENDIX, *Dekay*.

The Red-tailed Bream.

(PLATE III. FIG. 4.)

Labrus appendix, *Black-eared Pond fish*, MITCHILL, Supp. to Amer. Month. Mag, II p. 247.

Pomotis appendix, DEKAY, Report, p. 32.

“ “ LINSLEY, Cat. of Fishes of Conn.

Pomotis rubri-cauda, *Red-tailed Pomotis*, STORER, Bost. Journ. Nat. Hist., IV. p. 177.

“ “ LINSLEY, Cat. of Fishes of Conn.

Pomotis appendix, STORER, Mem Amer. Acad., New Series, II p. 294.

“ “ STORER, Synopsis, p. 42.

Color. When alive, of a general rusty brown, or in some specimens golden brown, more strongly marked above the middle of the body by ferruginous spots being densely distributed along the scales; these spots are more sparse and more distinct below the lateral line; the body, beneath and in front of the ventral fins, of a blood-red color; the throat is bluish-white. A bluish-white undulating line runs from the upper jaw just beneath the eye, across the operculum and beneath the opercular membrane to its posterior extremity; a second line of a similar character arises just above this, and, interrupted by the eye, again commences back of it, and passes over the opercular membrane; so that the membranous appendage of the operculum, which is broad, rounded posteriorly, and of a uniform black color, is between these lines. Beneath the undulating lines just spoken of are bluish-white blotches irregularly distributed upon the preoperculum, some of them passing downwards towards its lower edge. Pupils black, irides red. The dorsal fin is anteriorly of a dark-brown color; its posterior membranous portion is red. The ventrals are red at their base and black at extremities. The pectorals are of a yellowish-brown color. The anal is yellowish at its base and fuliginous at its margin. The caudal is of a blood-red color. After death, the body becomes of a bluish-gray color; the abdomen changes to orange; the extremities of the ventrals are purple; and the tail is rust-colored, livid posteriorly.

Description. Length of head, including the opercular membrane, equal to about one third the length of the body; - greatest depth of fish, exclusive of the dorsal and anal fins, equal to more than one third the length of the body. The head, between

and in front of the eyes, is naked. The eyes are circular; their diameter less than the distance between them. Gape of mouth large. The posterior nostril is the longer. The lateral line commences above, and in front of, the base of the opercular membrane, and assumes the arch of the body.

The dorsal fin commences above the posterior portion of the opercular membrane; its first and second spines are the shortest; the membranous portion is rounded above and posteriorly.

The pectorals are broad and rounded.

The rays of the ventrals are multifid.

The soft portion of the anal is rounded along its entire margin.

The caudal fin is somewhat emarginated.

The fin rays are as follows:— D. 10 to 11—9 to 11. P. 11 to 12. V. 1—5. A. 3—9 to 10. C. 18. Length about six inches.

Remarks. The specimens I have seen of this species were sent me from Concord, by Mr. Edward S. Hoar; they were taken with *P. vulgaris*. Although Mitchill, in his description of the *Labrus appendix*, makes no mention of the color of the fins, which is a striking character, it agrees in other particulars so nearly with the species before me, that I cannot but think they are identical; and therefore suppress here, as I have previously done in my Synopsis, my specific name of "*rubri-cauda*."

Massachusetts, STORER. New York, MITCHILL.

The Genus *Sphyræna*, which has usually been included in the Family *Percidæ*, will be introduced hereafter in a different group.

FAMILY II. TRIGLIDÆ.

Contains a numerous series of fish, to which the singular appearance of their head, variously bristled and covered with armor, gives a peculiar physiognomy. Their general character consists in having the suborbital bone more or less extended over the cheek, and articulated behind with the preoperculum.

GENUS I. PRIONOTUS, CUV.

Pectorals very large, with numerous rays. A band of even teeth on the palatines.

PRIONOTUS LINEATUS, *Dekay*.*The Banded Gurnard.*

(PLATE V. FIG. 4.)

- Trigla lineata*, Gurnard or Sea-Robin, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 430, pl. 4, fig. 4.
Le Prionote striè, *Prionotus strigatus*, CUV. et VAL., IV. p. 86.
Prionotus strigatus, Règne Animal, ed. VAL., pl. 20, fig. 2.
 " " *Sea-Robin, Gurnard, Grunter*, STORER, Report, p. 12.
 " " AYRES, Bost. Journ. Nat. Hist., IV. p. 258.
 " " LINSLEY, Cat. of Fishes of Conn.
Prionotus lineatus, *Banded Gurnard*, DEKAY, Report, p. 45, pl. 4, fig. 12.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 302.
 " " STORER, Synopsis, p. 50.

Color. The recent specimen is of a reddish-brown color above, and the entire surface, including the head, is covered with numerous black dots. The gill-covers and intermaxillaries in some specimens are orange. The dead fish is of a slate-color above the lateral line, with a few black dots irregularly distributed over its surface, the sides are lighter, with a reddish tint; abdomen white. Beneath the lateral line, and parallel to it, runs a broader brownish line, which arises under the humeral spine; this line is broken at its posterior extremity with interrupted points or spots. Beneath the anterior portion of this line are several broken brown bands. The first dorsal fin is of a light reddish tint, with a black blotch upon the upper portion of the membrane between the fourth and fifth, or third, fourth, and fifth rays. The anterior edge of the first three rays barred with black. The second dorsal is reddish. The pectorals are fuliginous beneath and reddish above; fuliginous also in centre of upper portion, with numerous transverse black lines, which are more obvious at the base of the fin. The ventrals are white.

Description. Head broader than the body; its length rather less than one third the length of the fish; its depth equal to more than half its length, and made up of seven distinct bony plates, which form a perfect helmet of defence. The whole upper part of the head, the occiput, the space between the eyes, and the portion anterior to the snout, are composed of one plate; this portion is roughened throughout its whole extent by irregular corrugations, and terminates posteriorly in two strong, very acute spines; at the upper anterior and posterior angles of the eyes, minute spines are also observed. This plate is emarginated anteriorly, deeply truncated posteriorly. The operculum is a distinct plate, of an irregularly triangular form, having two spines at its posterior extremity; the lower larger and pointing directly back, the upper pointing obliquely upwards; this plate is covered with elevated striæ radiating from the anterior portion towards the circumference, and is separated from the preopercle by a membrane,

which renders it movable; its margin is bordered by a wide membrane. The preoperculum is rather small and is triangular, slightly movable, and divided at its lower portion by a horizontal, serrated, bony ridge, which terminates posteriorly in a naked spine; beneath this ridge, the inferior portion is corrugated and granulated; from the base of the preopercle, radii diverge to its upper portion. Suborbital bones roughened like the top of the head; cheek-bones covered with elevated striæ, slightly serrated upon their whole lower margin, and strongly serrated anteriorly on each side of the snout. A strong ridge upon the humeral bone, serrated on its under edge, terminating in a naked spine. All the spines upon the head are much more acute in young specimens. In front of the emargination of the frontal bony plate is a naked membranous portion, equal in width to the distance between the eyes; in this space, half way between the eyes and the extremity of the snout, are situated the nostrils, the posterior of which is the larger. Eyes oblong; longest diameter equal to the distance between the eyes. Jaws armed with numerous, small, card-like teeth; upper jaw projecting beyond the lower. Tongue colorless, fleshy. The lateral line arises above the posterior angle of the operculum, and, curving slightly downwards to a line opposite the space between the dorsal fins, thence pursues a straight course to the tail.

The first dorsal fin is situated in a groove which partially receives it when closed, and arises just back of a line with the termination of the occipital spines; it is longer than high. Its first ray is spinous, and serrated upon its entire anterior edge; the second and third rays are serrated at their upper anterior portion; the third and fourth rays are the longest. It is composed of ten spinous rays; the three posterior are exceedingly small, and look like isolated spines, between the fins.

The second dorsal is one third longer than high; its rays are bifid, and their tips slightly project beyond the connecting membrane.

The pectorals are very broad when expanded, and are one third the length of the body. On a line with the base of the pectorals, beneath them, are three fleshy appendages, somewhat similar in their appearance to the fin rays, though larger, and of equal size throughout their entire length; the upper, which is the longest, is equal to half the length of the pectorals.

The ventrals are situated beneath the base of the pectorals; their longest rays are equal to two thirds the length of the pectorals; the connecting membrane is emarginated between the tips of the rays. The first ray is spinous, and shorter than the others.

The anal fin arises back of, and terminates posteriorly to, the second dorsal, which fin it equals in length.

The caudal is composed of stout articulated rays, and is nearly straight at its extremity.

The fin rays are as follows:—D. 9 to 10 – 12 to 13. P. 12 to 13. V. 6. A. 10. C. $12\frac{1}{4}$. Length, a foot to 18 inches.

Remarks. This pretty species, which is much more common than the *P. Carolinus*, is frequently taken in the Vineyard Sound while fishing for Scapaug (*P. argyrops*), but is not used as an article of food.

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUVIER, DEKAY.

PRIONOTUS PALMIPES, *Storer.*

The Web-fingered Gurnard.

(PLATE V. FIG. 1.)

Trigla Carolina, LIN., p. 528, CUV. et VAL.

Trigla palmipes, *Web-fingered Gurnard*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 431, pl. 4, fig. 5.

Le Prionote de la Caroline, *Prionotus Carolinus*, CUV. et VAL., IV. p. 90.

Prionotus Carolinus, *Web-fingered Gurnard*, STORER, Report, p. 14.

“ “ AYRES, Bost. Journ. Nat. Hist., IV. p. 258.

“ “ *Web-fingered Gurnard*, DEKAY, N. Y. Report, p. 46, pl. 5, fig. 15.

“ “ LINSLEY, Cat. of Fishes of Conn.

“ “ STORER, Mem. of Amer. Acad., New Series, II. p. 303.

“ “ STORER, Synopsis, p. 51.

Color. When first taken, the body above is of a reddish-brown color, with irregular blotches and shadings of a darker brown appearing like indistinct transverse white bands across the dorsum; beneath nearly white. Branchial membrane fuliginous; margined anteriorly and posteriorly with white. The connecting membrane of the first dorsal is transparent, slightly dusky, marked by oblique white lines, and has a large dark-brown spot, the greater portion of which is between the fourth and fifth rays; in young specimens this spot is confined *entirely* to the space between the fourth and fifth spines. The second dorsal is of a dull white color, marked by interrupted longitudinal orange bands. The pectorals are reddish-brown above, slate-colored beneath, with the exception of the two posterior rays, which are white. The pectoral appendages are reddish-brown at their base, and orange at extremities. The ventrals are reddish-white above, white beneath. The anal is of the same general color as the second dorsal.

Description. Length of head rather less than one fourth the length of the entire fish; width of head more than half its length. The armature of the head is very similar to that of *P. lineatus*, and yet there are striking differences; the several bones

are less deeply furrowed and ridged, appearing more like shagreen; at the anterior angle of the eye are three distinct spines. The occipital spines are not so acute as in *P. lineatus*, but are the terminations of carinæ in two arrow-shaped plates of bone; in *P. lineatus*, there is a small spine at the posterior angle of the eye; in this species are two elevated ridges which run posteriorly; these ridges are not prominent in the immature fish. Nostrils of moderate size; the anterior the larger. Eyes high up on the head. Sides of snout strongly serrated. Jaws armed with numerous card-like teeth; the upper jaw the longer. The lateral line, arising between the occipital spine and the posterior superior edge of the operculum, is very indistinct throughout its whole course, but more so at its origin, and is continued in a straight line to the middle of the base of the tail.

The first dorsal fin is situated in a deep groove. The whole anterior edge of the first three rays is serrated, and the upper portion of the fourth.

The second dorsal is nearly straight upon its margin.

The pectorals are large, broad, rounded, and about one third the length of the body. Just in front of and beneath the pectorals are three fleshy appendages, widened at extremities; the posterior the largest. The anal commences just back of, and terminates upon the same plane with, the second dorsal.

The caudal is lunated.

The fin rays are as follows: — D. 9 or 10 – 13. P. 13 or 14. V. 6. A. 12. C. $12\frac{1}{4}$. Length 15 to 18 inches.

Remarks. This species is much more rare than the *P. lineatus*. It was well described by Mitchill, who makes no mention of its infrequency in the waters of New York; but Dekay remarks, that in the course of twenty years he had not met with more than six or eight specimens. As one of its names implies, it is a Southern species. Individuals are not unfrequently taken in the Vineyard Sound, during the entire summer, while fishing for Tautog. It is caught in deeper water than *P. lineatus*. Dr. Yale informed me that he had eaten this species, which, when skinned and boiled, is quite palatable. Occasionally this species is captured north of Cape Cod. In September, 1840, I received from Captain Nathaniel Blanchard of Lynn a specimen twelve inches in length, taken in a net at Green Island; and Henry Sheafe, Esq., of this city, the next year sent the Boston Society of Natural History two specimens which were captured at Phillips's Point, Lynn. I have also seen two or three other individuals in the market, which have been caught in Massachusetts Bay. The specimen here described is the largest of those I had the good fortune to procure while on a visit at Tisbury, in August, 1846. Mr. Ayres, in his enumeration of the Fishes

of Brookhaven, L. I., contained in the fourth volume of the "Boston Journal of Natural History," when speaking of this species, says: "When at rest, they lie on the bottom, with their broad pectorals sometimes spread and sometimes closed; in swimming, however, the pectorals are closed and flat upon the body. If alarmed by the approach of a boat or any other object, they bury themselves so completely in the sand, that a very close observation is necessary to detect them. This concealment is effected by a rapid lateral movement of the body, which displaces the sand from beneath, and causes it to fall upon their sides and back, covering them entirely, except the eyes and top of the head. Probably they often resort to this manœuvre when approached by the large fish which feed upon them."

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUVIER, DEKAY. Carolina, CUVIER.

Although this species was supposed by Cuvier to be the *Trigla Carolina* of Linnæus, I am compelled to reject his specific name, as his description is altogether too indefinite to identify the fish. He makes no mention of the characteristic palmation of the pectoral appendages.

PRIONOTUS PILATUS, *Storer*.

(PLATE VI. FIG. 1.)

- Prionotus pilatus*, STORER, Proceedings of Bost. Soc. of Nat. Hist., II p 77, 1845.
 " " STORER, Mem. of Amer. Acad., New Series, II. p. 522.
 " " STORER, Synopsis, p. 270.

Color. Upper part of body a reddish-brown; head a lighter red; body beneath yellowish-white; throat color of pectorals; pectorals dark blue; ventrals color of abdomen. First dorsal fuliginous, crossed by two transverse white lines, one near its base, and the other through its centre; the upper membranous portion between the fourth and fifth rays is marked by a large black blotch. The second dorsal of the same color as the first, with undulating whitish lines crossing the connecting membrane from its base to its margin, presenting a marbled appearance. Anal fin of a dirty white color. Caudal fin colored like the pectorals, but rather lighter.

Description. Body oblong, cylindrical. Head one fourth the length of the body; depth of head nearly equal to two thirds its length. Width of snout equal to nearly twice the distance between the eyes. Eyes moderate, oblong, their longest diameter equal to one sixth the length of the head. Nostrils small, nearer to the tip of the snout than to the eyes. Jaws, palatines, and pharyngeals armed with numerous small, card-like teeth. Upper jaw the longer.

The lateral line commences just beneath the occipital spine, and pursues nearly a straight course to the caudal fin.

The first dorsal arises between the posterior projections of the occiput; the first spinous ray is serrated throughout its entire anterior portion; the second is serrated only on its right side; the third only on its left; the remaining rays are smooth; the third and fourth rays are longest. Fin one half as high as long.

The second dorsal rather more than a third as long as the first dorsal; its rays are bifid and slightly projecting at their extremities.

The pectorals when expanded are equal in their depth to one half their length.

Anterior to and beneath the pectorals are three fleshy appendages, tapering at their extremities, the anterior two thirds the height of the posterior.

The longest rays of the ventrals are nearly two thirds as long as the pectorals; the anterior ray is short and spinous, the other rays are multifid at their extremities.

The anal fin commences on a line just back of the second dorsal, and terminates opposite the extremity of that fin.

Caudal fin deeply emarginated; the outer rays projecting beyond the others.

The fin rays are as follows:—D. 10 – 13. P. 13. V. 6. A. 12. C. 12 $\frac{1}{4}$.

I have seen but one specimen of this species, which was taken in Massachusetts Bay. Massachusetts, STORER.

In the "Proceedings of the Boston Society of Natural History," Vol. II. p. 77, I stated that the *Prionotus punctatus* had been found in our waters. Thinking it possible I may have been mistaken, and that the specimen belonging to the Boston Society of Natural History was not taken in Massachusetts Bay, as it was said to have been, I prefer not to admit it in this communication.

GENUS II. DACTYLOPTERUS, LACÉP.

The rays under the pectorals are numerous and large; and instead of being free, as in the preceding genera, they are united by a membrane into a supernumerary fin, larger than the fish itself, and which supports it in the air for some length of time. The muzzle, which is very short, appears to be cleft like the lips of a hare; the mouth is situated beneath; there are, in the jaws only, certain rounded teeth, arranged like pavement; the head is flat, rectangular, and granulated; the preoperculum is terminated by a long and strong spine. All the scales are carinated.

DACTYLOPTERUS VOLITANS, *Cuv.**The Sea-Swallow.*

(PLATE VI. FIG. 5.)

- Trigla volitans*, *Flying Gurnard*, L., SHAW'S Gen. Zoöl., IV. p. 622, pl. 91.
Morcielago, PARRA, p. 25, pl. 14.
Polynemus sex-radiatus, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. pl. 4, fig. 10.
 " " MITCHILL, Supp. Amer. Month. Mag., II. p. 323 (?).
Le Dactyloptère commun, *Dactylopterus volitans*, CUV. et VAL., IV. p. 117.
Dactylopterus volitans, GRIFFITH'S CUV., X. p. 138.
 " " RICH., Fauna Boreal. Americ., III. p. 40.
 " " WILSON, Encycl. Brit., art. Ichthyology, p. 173.
 " " *Sea-Swallow*, DEKAY, Report, p. 49, pl. 17, fig. 46.
 " " LINSLEY, Cat. of Fishes of Conn.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 304.
 " " STORER, Synopsis, p. 52.
 " " *Bat-fish*, SCHOMBURGK, Hist. of Barbados, p. 667.

Color. The specimen now described is of a slate-color above, with indistinct darker blotches; top of head darker than back; upper jaw yellowish-white, with several dark-brown spots beneath the eyes. Abdomen yellow. Dorsal fin white, banded with brown; pectorals dull brown, irregularly spotted with darker blotches, lighter beneath, white at their inferior base; caudal yellowish, transversely banded with black.

My specimen, however, having been preserved in spirits, and its colors consequently being in a great measure destroyed, I shall avail myself of this portion of Dr. Dekay's description: "Light brown above, (darker on the summit of head,) with irregular darker spots. Sides silvery with flesh-color, which latter is predominant beneath. Dorsals gray, with brown spots on the membrane of the first, and the rays of the second annulated alternately with brown and lighter. The posterior pectorals blackish, with bluish iridescent spots; the anterior dark brown varied with black. Ventrals and anal flesh-colored. Caudal light brown, with irregular brownish bands."

Description. Body cylindrical anterior to vent; abdomen flattened posterior to vent; sides compressed at posterior extremities. Head flattened above. Back and sides covered with rows of fixed raised scales; the six or eight rows upon the sides are most elevated, sharp with minutely denticulated edges, and their summit with more marked denticulations. There are fifteen rows of scales, passing longitudinally on the sides, between the origin of the second dorsal and the abdomen. Posterior to the second dorsal, these rows are less marked than anterior to it; the rows back of the head and beneath the pectorals are much more numerous than posteriorly; these gradually approximate, and, as it were running into each other, are for the most part lost, so that at the termination of the second dorsal fin there remain but about twelve rows, and at

the fleshy portion of the tail but four; two of these elevated, bounding the edge of the back and abdomen, and the others, much less raised, between them.

The length of the head to the termination of the subscapular spine equal to more than one third the entire length of the fish. Head above bony, very broad, granulated throughout, deeply emarginated behind, concave between the eyes, and terminating posteriorly on each side in very pointed subscapular bones, which have an elevated ridge passing through their centres. Suborbital bones emarginated posteriorly; their posterior superior angle passing upward and backward to the centre of the orbit of the eye; their posterior inferior angle is continued backward in a sharp point to the preoperculum; the inferior edge of this inferior portion is slightly denticulated, the teeth looking forward.

A branch of the preoperculum marked with vertical striæ passes upward above the termination of the posterior superior angle of the suborbital bone; its posterior angle terminates in a long spine, which passes backward to the posterior half of the subscapular bone; this spine is strongly serrated upon its outer edge, denticulated upon its lower edge, and granulated along its base. The operculum small, triangular, scaled. The eyes are large and circular. The nostrils are double, and of nearly equal size; the anterior and inferior is tubular. The mouth is small; the lips are fleshy. The lower jaw is the shorter. Both jaws armed with several rows of small conical teeth; minute teeth exist also in the pharynx. Snout blunted.

Just anterior to the spinous rays of the first dorsal, and higher than they, are two membranous rays opposite to each other and connected at their bases.

The first dorsal is of a triangular form, the posterior rays being higher than the first. This fin, when closed, is received into a groove.

Between the first and second dorsal fins is a short, stout, triangular spine. Directly back of this spine arises the second dorsal, which is quadrangular, and has its rays connected together by an exceedingly delicate membrane. Its six anterior rays are simple.

The pectorals are very broad when expanded; and reach, when closed, the fleshy portion of the caudal fin. The shortest rays are the six which are separated at the anterior portion from the fin, save at the base, where they are connected to it by a membrane. The central rays of this fin are the longest.

The ventrals are beneath the pectorals; their height is about equal to that of the first six rays of the pectorals; the third and fourth rays are the longest.

The anal is situated beneath the second dorsal.

The caudal is deeply concave; with two elevated scales, looking like finlets, approximating each other at its base.

The fin rays are as follows : — D. 2-4-1-8. P. 30-6. V. 1-4. A. 6. C. 10 $\frac{1}{4}$. Length about 6 inches.

Remarks. The accompanying description and figure are prepared from a specimen sent me by Dr. Yale from Holmes's Hole ; it is the only individual I have seen.

This species was very well described by Dr. Mitchill in his supplement to his fishes in "The American Monthly Magazine and Critical Review," and still better by Dekay in his New York Report.

Newfoundland, CUVIER. Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY. Gulf of Mexico, PARRA. Caribbean Sea, CUVIER, SCHOMBURGK.

GENUS III. COTTUS,* ARTEDI.

Inhabiting only fresh water. But one small spine at the angle of preoperculum ; sometimes another still smaller, always hidden under the skin and perceptible to the touch only, at the lower margin of the suboperculum. Head very depressed, more or less truncated in front, generally broader than high, but always very uniform, being scarcely detached from the body unless by its more considerable breadth. Second dorsal always higher than first. Ventrals with three or four soft rays. Lateral line usually interrupted.

COTTUS GRACILIS, Heckel.

The River Bull-head.

(PLATE IV. FIG. 3.)

Uranidea quiescens, *Little Star-gazer*, DEKAY's Report, p. 61, pl. v. fig. 914.

Cottus gobio, AYRES, Bost. Journ. Nat. Hist., v. p. 121, pl. xi.

" " STORER, Synopsis, p. 52.

Cottus gracilis, HECK., GIRARD, Proceedings of Bost. Soc. Nat. Hist., III. p. 189.

Color. Light green mottled with irregular dark-brown blotches, which are larger on the posterior part of the body.

Description. Length of the head about one fifth that of the body ; much broader than the body ; flattened above back of the eyes. Preoperculum armed at its posterior superior angle with a sharp spine curving upwards, and below this upon its edge

* The genus *Cottus* has heretofore been composed of two separate groups, consisting of fluviatile and marine species. Mr. Girard, after having devoted much attention to the subject, has formed from these two distinct genera, and gives as his reason for not accepting Dekay's *Uranidea*, that, according to the principles of nomenclature, *Cottus* must be retained for the fresh-water group, having been at first applied to them. It remains, however, to be seen whether these changes will be accepted by succeeding ichthyologists.

with another very minute spine. Eyes prominent, obliquely oblong. Jaws equal, with numerous exceedingly minute teeth. Gape of mouth moderate.

Lateral line commences at the superior posterior angle of the operculum, and is continued in a straight line to just below the extremity of the second dorsal fin, where it curves, and ends at the centre of the caudal rays.

The first dorsal fin arises just back of the origin of the pectorals; its length is equal to about one third that of the second dorsal.

The second dorsal, which arises directly back of the first, is of equal height throughout, a little higher than the first dorsal, and is of a quadrangular form.

The pectorals are broad, higher than the length of the head.

The ventrals are composed of three rays of nearly equal length, and united at their base.

The anal fin commences back of the second dorsal, and terminates anterior to the termination of that fin.

The caudal fin is about the length of the head, and is straight at its extremity.

The fin rays are as follows:—D. 8–7. P. 14. V. 3. A. 12. C. 12. Length of fish $2\frac{1}{2}$ inches.

Remarks. The individual from which my description has been drawn up was sent me from Shirley, by Dr. C. D. Dowse.

Mr. Horatio R. Storer caught two specimens near the source of the Saco River, in the town of Bartlett, New Hampshire, among the White Mountains, where the water was about three inches deep. When first seen they were lying under little stones, with the head and expanded pectoral fins alone visible, and so motionless that he would have overlooked them, had he not been carefully examining the bottom in search of salamanders. When disturbed, they immediately darted under the stones, and were only secured by cautiously placing the hand before them so that they could not escape, on which they would dart directly into it. On account of their viscid secretion, they are retained by the hand with difficulty.

Massachusetts, STORER. New York, DEKAY. Connecticut, AYRES. New Hampshire, H. R. STORER.

GENUS IV. ACANTHOCOTTUS, GIRARD.

Always marine. Spines upon each of the opercular bones. Surface of head and often circumference of orbits either armed with spines, serrated, or notched. Mouth more deeply cleft than in Cottus. Lateral line uninterrupted.

ACANTHOCOTTUS VARIABILIS, *Girard*.*The Greenland Sculpin.*

(PLATE IV. FIG 1.)

- Cottus scorpius*, FABRICIUS, Fauna Groenlandica, p. 156, No. 113.
Le Chaboisseau du Groenland, (*Cottus Groenlandicus*.) CUV. et VAL., IV. p. 185.
Cottus Groenlandicus, *Greenland Bull-head*, RICH., Fauna Boreal. Americ., III. pp. 46 and 297, and admirably figured, pl. 95.
 " " *Greenland Sculpin*, STORER'S Report, p. 16.
 " " *Greenland Bull-head*, DEKAY, Report, p. 54, pl. 4, fig. 2.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 305.
 " " STORER, Synopsis, p. 53.
Cottus quadricornis, SABINE, App. to PARRY'S First Voyage.
Cottus variabilis, AYRES, Proc. Bost. Soc. Nat. Hist., I. 1842, p. 69.
 " " AYRES, Bost. Journ. Nat. Hist., IV. 1843, p. 259.
Acanthocottus Groenlandicus, GIRARD, Proc. Bost. Soc. Nat. Hist., III. p. 185.
Acanthocottus variabilis, GIRARD, Bost. Journ. Nat. Hist., VI. p. 248.

Color. Upper part of the body dark brown, with large clay-colored blotches on the top of the head and upon the gill-covers, with a few smaller ones on the back and sides, and small circular yellow spots on the sides towards the abdomen. Large perfectly white ocelli upon the abdomen, beneath the pectorals. Abdomen yellow tinged with red, throat of a dull white color. The first dorsal fin of a dark-brown color, variegated with yellow; the second dorsal is brown, with several transverse yellowish bands; the pectorals are marked with irregular transverse brown bands and yellow spots; the rays of this fin are orange-colored; the ventrals are white, with three transverse dark-brown bars; the anal is marked like the second dorsal; the rays of the caudal are black, while their connecting membrane is yellowish.

Description. Body oblong; very stout anteriorly; tapering towards the tail.

The sides, both above and beneath the lateral line, are roughened by granulated tubercles which feel like spines when the finger is drawn towards the head.

The length of the head, measured to the posterior extremity of the occiput, is equal to about one fourth the length of the body; its width across the occiput equal to its length; its greatest depth equal to two thirds its length. The head is armed with several spines; those upon its top are blunted, those on the gill-covers are longer, with projecting, sharp points. The nasal spines are sharp and recurved; at the posterior superior angle of the eye is a strong, slightly recurved, short spine, stouter than the nasal spine. Upon the occiput are also situated two strong, blunt, and somewhat recurved spines; between these and the former is a quadrangular depression. The preoperculum has three spines, naked at their extremities, two of which are situated at its superior angle; the upper of these spines is much the largest, and points upwards; the second is smaller and nearly straight; the third and smallest, at its inferior angle, points directly downwards. The operculum

is armed with two spines; the larger at its superior angle; the second, much the smaller, at its inferior angle.

Eyes circular, their diameter equal to one sixth the length of the head. The gape of the mouth very large; the distance between the tips of the jaws, when distended, is equal to one third the length of the head; the upper jaw the longer; both jaws are armed with numerous, very small, card-like teeth; similar teeth on the vomer and pharyngeals. Nostrils tubular, just in front of the eyes.

The first dorsal fin commences on a line above the pectorals; it is rounded above, about as long again as high.

The second dorsal commences at the termination of the first; appearing almost to be united with it.

The pectorals are very broad when expanded; their length at base is less than the height of the first rays; roughened granulations may be perceived beneath several of the rays of these fins; the inferior rays are much the shorter and stouter.

The outer ray of the ventrals is very stout.

The anal commences just posterior to the second dorsal, and is shorter than that fin.

The caudal stout, with the rays bifurcated at their posterior extremities.

The fin rays are as follows:—D. 9 or 10—16 or 18. P. 17. V. 3. A. 13. C. 12½. Length about a foot.

Remarks. In a monograph of the Genus *Cottus*, which he published in the "Proceedings of the Boston Society of Natural History," Vol. III., Mr. Charles Girard considered the *Cottus variabilis* of Ayres as the young of the *Groenlandicus*. At a subsequent period, having received from Mr. Horatio R. Storer a species of *Cottus* from Labrador, he was enabled to decide that it was not the same as the species on our coast which is known as the *Groenlandicus*, and consequently has retained Ayres's specific name for the Massachusetts fish. So that what has been known by us as the *Groenlandicus* is now to be called *variabilis*, and the fish so called by Ayres is the young.

This beautiful fish is much less common than the *Virginianus*. Though the other species is said to be a favorite food of the Greenlanders, this is not used with us. It is frequently seen swimming upon the sandy bottoms of the numerous small coves of Massachusetts Bay, and is taken with the hook while fishing from the rocks for the Conner. Specimens of the young of this species were presented to me by Mr. Desor, who procured them at the South Shoals, fifteen miles from Nantucket, with the dredge, in eleven and a half, fifteen, and eighteen fathoms of water respectively, from a bottom abounding with barnacles and membranipora. It is exceedingly voracious, devouring all kinds of Crustacea, Mollusks, and Echini. In the stomach of one I found

three entire specimens of the *Portunus pictus* of considerable size; in others I have seen large quantities of the *Echinus granulatus*, and several species of Algæ.

Maine, Massachusetts, STORER. Connecticut, AYRES. New York, DEKAY.

ACANTHOCOTTUS VIRGINIANUS, Girard.

The Common Sculpin.

(PLATE IV. FIG. 2.)

Scorpius Virginianus, WILLOUGHBY, Hist. Pisc., App., p. 25, pl. 10, fig. 15 (?).

Cottus octodecimspinosus, *Eighteen-spined Cottus*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 380.

Le grand Chaboisseau à dix-huit épines de l'Amérique du Nord, *Cottus octodecimspinosus*, CUV. et VAL, IV. p. 181.

Cottus octodecimspinosus, *Sculpin*, RICH., Fauna Boreal. Americ., III. p. 46.

“ “ GRIFFITH'S CUV., X. pl. 43, fig. 4.

Cottus Virginianus, *Common Sculpin*, STORER, Report, p. 18.

“ “ *Common Bull-head*, DEKAY, Report, p. 51, pl. 5, fig. 13.

“ “ LINSLEY, Cat. of Fishes of Conn.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 305.

“ “ STORER, Synopsis, p. 53.

Acanthocottus Virginianus, GIRARD, Proc. Bost. Soc. Nat. Hist., III. p. 187.

“ “ H. R. STORER, Bost. Journ. Nat. Hist., VI. p. 250.

Color. While alive, some individuals of this species are of a greenish-yellow color, with four transverse dark-brown bars, which extend from the dorsum to the lower part of the sides; the anterior of these is nearly as wide at its base as the first dorsal fin at which it commences; the second is situated at the anterior half of the second dorsal; the third, which is narrower than the second, is at the posterior half of the second dorsal; the fourth band crosses the fleshy portion of the tail. In others the general color is of a greenish-brown, the bands are very indistinct and appear rather like large blotches. Abdomen white. The first dorsal is fuliginous, and crossed by distinct dark-brown bands. The second dorsal is crossed by three longitudinal bands of dark brown. The pectorals are of a light-yellow color; broad when expanded; the inferior rays are flesh-colored; these fins are crossed by six dark-brown concentric bands of different widths. The ventrals are yellowish-white; the intermediate membrane clouded by indistinct bands of dark brown. The anal is yellowish, crossed by indistinct dark bands. The caudal is yellowish-white, with five very distinct bands. Pupils bluish; irides reddish, with a coppery hue when alive.

Description. Length of head equal to one third the length of body; its greatest width equal to two thirds its length. Twenty spines are seen upon and about the head, ten on each side; all these are naked at their extremities. The nasal spines are small and recurved; the post-orbital spines are a little longer than the nasals; they are barely elevated above the top of the head, and point directly backwards; the occipital spines are erect and slightly recurved; they are rather stouter than the post-orbitals;

three spines are situated upon the preoperculum; that at the posterior angle is the largest of any upon the head; it is very stout, is naked throughout its greatest extent, and is partially covered by a loose membrane as a mere sheath, which is readily recurved to its very base; this spine extends backwards nearly to, and in some specimens as far as, and I have seen it continued even beyond, the posterior extremity of the opercular spine. Directly under the base of this spine is situated a second very small one, pointing obliquely backwards and downwards; at the inferior angle of the preopercle is a third spine, pointing downwards and forwards. Two spines are seen upon the operculum; the larger passes from its upper anterior portion to the posterior angle, pointing obliquely backwards; the other, which is quite small, is at the inferior angle, and points directly downwards. Just above the origin of the pectorals is a strong scapular spine, directed upwards and backwards. And above the commencement of the posterior fleshy membrane of the operculum is seen the humeral spine, which is but little longer than the occipital spines.

The head is flattened above and furrowed by ridges which are the continuations of the spines; a slight ridge passes from the nasal spines backwards to the eyes; another extends from the post-orbital to the occipital spines, and exterior to this is another ridge; the whole upper portion of the head is dotted with minute granulations. The gape of the mouth is large; the jaws, pharynx, and palatine-bones are armed with numerous sharp, compact teeth, like those of a card; the upper jaw is the larger. The eyes are very large and prominent. The nostrils are small; the posterior is just back of the nasal spine; the anterior is tubular, and on a line with the base of the nasal spine exterior to it. The lateral line is very prominent, resembling an interrupted series of tubercles. It commences at the scapular spine, and is continued to the caudal rays, being much less marked at its posterior extremity.

The first dorsal fin, which is composed of nine spinous rays, is longer than high. The third ray is the longest; the first ray is about half the height of the second; the extremities of the first six rays project beyond the connecting membrane. Dr. Dekay, in speaking of this fin, says, "the second ray longest." He omits mentioning the first very short ray; and it does not appear in his figure.

The second dorsal arises just back of the first, at the termination of a membrane extending from the first dorsal. It is nearly as long again as the first dorsal; its rays are articulated.

The pectorals are large and rounded.

The ventrals arise beneath the lower rays of the pectorals; simple. Rays free at extremities; first ray quite strong.

The anal commences back of the second dorsal, and is shorter than that fin.

The caudal is even at extremity.

In some specimens the membrane connecting the rays of the second dorsal, anal, and caudal fins extends to their extremities, causing the fins to appear even at their edges; while in others the extremities of the rays project like those of the pectorals and ventrals.

The fin rays are as follows:— D. 9 – 16. P. 17. V. 3. A. 14. C. 12. Length 10 to 18 inches.

Remarks. This is our most common species of *Cottus*. As the “Sculpin” or “Toad-fish” it is well known, and is the pest of the numerous boys and idlers who at certain seasons of the year are constantly fishing from the wharves and bridges for more marketable species.

Mitchill described this species in his “Fishes of New York,” under the name of *octodecimspinosus*; but as it has the same number of spines as the *Cottus scorpius*, its specific name alone cannot distinguish it; and as it was previously called by Willoughby *Virginianus*, from a specimen sent him by Lister from Virginia, I have no hesitation in prefixing his specific name to my description.

Newfoundland, RICHARDSON. Massachusetts, STORER. New York, MITCHILL, DEKAY. Virginia, WILLOUGHBY. Labrador, H. R. STORER. New Brunswick and Nova Scotia, PERLEY.

The *Acanthocottus æneus* I now omit, thinking I have previously mistaken for it a variety of *A. variabilis* of Girard.

GENUS V. BOLEOSOMA, DEKAY.

The form of the body is that of a dart; the head is very short, rounded like an arc of a circle, below which the mouth, generally small and slightly protractile, opens horizontally; the upper jaw sloping over the lower. The neck and the sides of the skull compressed. The opercular apparatus and the cheeks covered with scales.

BOLEOSOMA OLMSTEDI, *Agassiz.*

The Tessellated Darter.

(PLATE IV. FIG. 4.)

Etheostoma Olmstedii, STORER, Bost. Journ. Nat. Hist., iv. p. 61, pl. 5, fig. 2.

“ “ AYRES, Bost. Journ. Nat. Hist., iv. p. 257.

Percina minima, HALD., Journ. Acad. Nat. Scien., VIII. p. 330.

Boleosoma tessellatum, *Tessellated Darter*, DEKAY, N. Y. Report, p. 20, pl. 20, fig. 57.

Perca minima, DEKAY, N. Y. Report, p. 7.

- Etheostoma Olmstedii*, *Ground-fish*, LINSLEY, Cat. of Fishes of Conn.
 " " STORER, Mem. of Amer. Acad., New Series, II. p. 271
 " " STORER, Synopsis, p. 19.
Boleosoma Olmstedii, AGASSIZ, Lake Superior, p. 304.

Color. Yellowish-green, with blackish blotches upon the sides like interrupted bands. A large dark-brown blotch is seen upon the occiput, and back of this, upon the dorsum, six broad similarly colored transverse bands; the first, just over the pectorals; the second, at the anterior portion of the first dorsal; the third, between the first and second dorsal; the fourth, at the middle of the second dorsal; the fifth, at the termination of the second dorsal; and the sixth, at the base of the tail. These bands all usually disappear at death. Pupils black, irides golden. A narrow deep-black band runs from the tip of the upper jaw to the anterior superior angle of the eye, and a second band passes upwards from the lower anterior angle of the preoperculum to the middle of the lower edge of the eye, and thence to the upper edge of the orbit, interrupted by the globe of the eye. The preoperculum is golden. The first dorsal is almost colorless; the rays of the second dorsal, as well as those of the pectorals, ventrals, and caudal, are elegantly crossed transversely by reddish lines.

Description. Form cylindrical. The head is less than one sixth the length of the body; it is flattened above, between, and back of the eyes. The operculum is scaly above, and terminates posteriorly in a sharp spine. Jaws furnished with very minute teeth. The orbits of the eyes are very prominent.

The first dorsal fin commences some distance back of the opercular spine; it is rounded posteriorly.

The second dorsal, of a quadrangular form, commences just posterior to the first; the extremities of its rays bifurcated.

The pectorals are situated just back of the posterior portion of the opercula. Their length is equal to one fifth their height.

The ventrals are situated just back of the base of the pectorals.

The anal arises just posterior to the commencement of the second dorsal; it is rounded at its extremity.

The caudal is slightly emarginated.

The fin rays are as follows:— D. 9–13. P. 15. V. 6. A. 11. C. 15. Length three inches.

Remarks. This species is not uncommon in the small streams of the western portion of the State.

Massachusetts, STORER. Connecticut, OLMSTED, AYRES. New York, DEKAY. Pennsylvania, HALDEMAN.

GENUS VI. ASPIDOPHORUS, LACÉP.

Body octagonal, covered with scaly plates; head thicker than the body, with points and depressions above, flattened below; teeth in both jaws only, none on the vomer; snout with recurved spines; branchiostegous rays, six; body tapering to the tail; one or two dorsal fins distinct.

ASPIDOPHORUS MONOPTERYGIUS, Cuv.

The Aspidophore.

(PLATE VIII. FIG. 1.)

- Cottus monopterygius*, BLOCH, 178.
 " " *Single-finned Bull-head*, SHAW, Gen. Zoöl, iv. p. 265.
L'Aspidophore à une seule dorsale, Agonus monopterygius, BL., SCHN.
Aspidophoroide Tranquebar, LACÉP., CUV. et VAL., iv. p. 224; vi. p. 554.
Cottus (Aspidophorus) monopterygius, CUV., *Aspidophore with one dorsal*, RICH., Fauna Boreal. Americ., III. p. 50.
Aspidophoroides monopterygius, Bull-head, STORER, Report, p. 22, pl. 1, fig. 1.
 " " CUV., Règne Animal, ed. VAL., pl. 21, fig. 3.
Aspidophorus monopterygius, American *Aspidophore*, DEKAY, Report, p. 62, pl. 2, fig. 6.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 309.
 " " STORER, Synopsis, p. 57.

Color. Above, a light brown, with six indistinct transverse black bands extending from the head to the tail; those upon the anterior portion of the body the broader. Beneath lighter.

Description. Body elongated, gradually tapering to the tail; divided longitudinally by eight rows of scaly plates. Those which are situated just back of the head are much the largest. Above, from just back of the eyes to the dorsal fin, are two rows of these plates; two rows on each side for some distance, and two rows beneath; making the fish anterior to the dorsal fin octagonal, and posterior to that fin, hexagonal. The angles of the large scales upon the back form prominent ridges, and between them is thus formed a groove, which extends from the snout between the orbits of the eyes to the posterior extremity of the dorsal fin. Back of this fin is seen a dorsal ridge, instead of the furrow, which is continued to the tail.

The length of the head is equal to about one seventh the entire length of the body; width of head less than that of body. The whole head is bony; the eyes are very large; the orbital bones prominent. The snout has two recurved spines at its extremity, and a third and smaller one back of them, curving forwards. Mouth small; numerous minute teeth are observed in both jaws.

The dorsal fin is situated upon the posterior half of the body, at the extreme portion of the dorsal furrow.

In this specimen, as well also as in those I previously examined, it is almost impossible to make out the number of fin rays; but the following, if not perfectly accurate, is a near approximation:—D. 5. P. 10. V. 4. A. 4. C. 16. Length 5 inches.

Remarks. This species was first described by Bloch as the *Cottus monopterygius*, and afterwards more minutely by Cuvier as the *Aspidophorus monopterygius*, in the fourth volume of the "Histoire Naturelle des Poissons." Lacépède formed the genus *Aspidophoroides* to receive the species above described, it being the only known *Aspidophorus* with a single dorsal fin. At the time this genus was formed, the species of which we have been speaking was supposed to have been brought from the East Indies. Cuvier, however, in his description, says he has not received it from the East Indies in any of his numerous collections from that quarter of the world; and finally, Richardson, in his "Fauna Boreali Americana," observed, "that it has lately been discovered to be an inhabitant of the Greenland seas, so that this sub-genus belongs entirely to the Northern hemisphere, and chiefly to the higher latitudes." Early in May, 1838, Mr. Jonathan Johnston, Jr., sent me three specimens of this species, which he had taken from the stomachs of haddock just caught within two miles of Nahant. They were each more or less mutilated; from one of them, however, my friend Jeffries Wyman, M. D., was enabled to sketch the plate contained in my "Report on the Ichthyology of Massachusetts." In 1848, Captain Nathaniel E. Atwood sent me a specimen taken from a cod's mouth at Provincetown. This specimen, although somewhat injured when received, has furnished me with the accompanying figures, and given me an opportunity to revise my former description. Besides the specimens above referred to, Mr. William O. Ayres procured two others, in February, 1851, from the stomach of a halibut taken at Cape Cod; and Mr. Stimpson one in May, from the stomach of a haddock caught in Boston Bay. These are the only individuals I have ever known to be taken south of Greenland.

Massachusetts, STORER. Greenland, RICHARDSON.

GENUS VII. CRYPTACANTHODES, NOBIS.

Body elongated, very much compressed, and gradually tapering to the tail. Destitute of scales. Head broad, with no projecting spines; the scapular and humeral spines, and the inferior edge of the preoperculum, prominent to the touch. Numerous depressions in frontal, suborbital, inferior maxillary, and preopercular bones; branchiostegous rays, seven; mouth oblique; a single dorsal fin, composed of strong spinous

rays enveloped by a common membrane, runs nearly the entire length of the fish, and unites, as well as the anal, with the tail. No ventral fins.

C. MACULATUS, *Nobis*.

Spotted Wry-mouth.

(PLATE VIII. FIG. 6.)

- Cryptacanthodes maculatus*, *Spotted Wry-mouth*, STORER, Report, p. 28.
 “ “ DEKAY, Report, p. 63, pl. 18, fig. 50.
 “ “ LINSLEY, Cat. of Fishes of Conn.
 “ “ STORER, Mem. Amer. Acad., New Series, II. p. 310.
 “ “ STORER, Synopsis, p. 58.
 “ “ H. R. STORER, Bost. Journ. Nat. Hist., VI. p. 254.

Color. Body a dark reddish-brown tinged with violet. Abdomen and throat a dirty grayish-white. A row or two of moderate-sized dark-brown blotches above the lateral line, and another row immediately beneath it, extend throughout the greater part of its length to the tail. Tip and sides of head, snout, and anterior portion of under side of lower jaw, marked with smaller spots of the same color as those on the sides. Pupils black; irides golden.

Description. Length of head about one sixth the entire length; greatest breadth about one half the length of the head. On each side of top of head, two prominent bony ridges run directly back from posterior angle of eye to occiput. The posterior angles of operculum and preoperculum; the lower edge of preopercle; the scapular bones, — all seem like sharp points and edges concealed by the skin. The operculum is large and triangular, covered by the skin, as is also the preoperculum, which presents to the touch two sensible carinæ. Eyes circular, deeply sunk in the projecting orbits; diameter of orbit about equal to distance between eyes. Nostrils tubular, situated on the side of the prominent snout, just at the edge of the intermaxillary bones. Lips fleshy; lower jaw projecting beyond the upper; mouth slanting obliquely downwards; numerous teeth in jaws and upon the vomer and palatine bones, — those on the back part of the jaws recurved, while those in front are smaller and nearly straight. Gape of mouth moderate. Branchiostegal membrane extended along and connected with the sides for a short distance. Lateral line straight and interrupted.

The dorsal fin arises above the posterior half of the pectorals, and is continued to and united with the caudal; all its rays are spinous and strong, concealed by a stout and fleshy membrane; the first few rays are shortest.

The pectorals arise beneath the membrane of the branchiæ; they are fleshy, small, and rounded.

The anal arises upon the anterior half of body ; it is similar in its form and the character of its rays and their enveloping membrane to the dorsal, and is also, like that fin, connected with the caudal.

The caudal is rounded, and appears like the prolongation of the dorsal and anal fins.

D. 78. P. 15. A. 50. C. 15. Length three feet.

Remarks. This is a very rare species. I have known of only seven individuals being taken. One of these Mr. Jonathan Johnson, Jr. sent me from Nahant; one was found by Dr. Henry Bryant of this city, at Commercial Point, Dorchester; one I received from Captain Atwood of Provincetown; three of the remainder were said to have been taken in Massachusetts Bay; and the last was found by Horatio R. Storer on a beach in Nova Scotia. The finest specimen, taken by Captain Atwood, has served for the above description.

GENUS VIII. HEMITRIPTERUS, CUV.

The head depressed; two dorsals, as in *Cottus*; no regular scales on the skin, but teeth in the palates. The head is bristly and spinous, and has several cutaneous appendages. The first dorsal is deeply emarginate, a circumstance which has led some authors to believe there were three dorsal fins.

HEMITRIPTERUS ACADIANUS, *Storer.*

The Deep-water Sculpin.

(PLATE VII. FIG. 4.)

- Cottus Acadianus*, *Acadian Bull-head*, PENN., Arc. Zoöl., II. p. 118.
Scorpena flava, *Yellow Scorpena*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 382, pl. 2, fig. 8.
Scorpena purpurea et *S. rufa*, MITCHILL, Amer. Month. Mag., II. p. 245.
L'Hemitriptère de l'Amérique, *Hemitripterus Americanus*, CUV. et VAL., IV. p. 268, pl. 84.
Hemitripterus Americanus, RICH., Fauna Boreal. Americ., III. p. 50.
 " " Règne Animal, ed. VAL., pl. 22, fig. 1.
 " " GRIFFITH'S CUV., X. p. 141, pl. 53, fig. 3.
 " " *Sea-Raven, Deep-water Sculpin*, STORER, Report, p. 23.
 " " *American Sea-Raven*, DEKAY, Report, p. 56, pl. 6, fig. 16.
 " " LINSLEY, Cat. of Fishes of Conn.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 310.
 " " STORER, Synopsis, p. 58.

Color. Varies exceedingly. Some specimens are of a deep blood-red; others of a pinkish-purple; while others still are of a yellowish-brown, darker on the back; each, however, variegated on the head, sides, and fins with irregularly defined markings. Abdomen yellow. A large female, weighing five pounds and measuring twenty-six

inches in length, had the whole upper part of the body of a dark brown, elegantly variegated with white and dark-brown markings; this appearance most striking upon the head, about the eyes, and along the upper jaw; it is also observable beneath the chin and lower jaw. The branchial rays, as also the rays of the dorsal, pectoral, and caudal fins, marked with transverse white lines, and the intervening membranes very minutely dotted with black. Abdomen white. In still another specimen of a reddish-brown color, transverse broad bands of sub-quadrangular form were noticeable upon the back; one of these occupied the space between the first and fifth dorsal rays; a second commenced at the seventh ray, and was continued to the fourteenth; a third, between the fifteenth and sixteenth rays; a fourth, between the eighteenth and twenty-second; and a fifth, from the twenty-sixth to the twenty-eighth; in the intervening spaces was a whitish marking beautifully edged with black. The orbits of the eyes were marked with white vertical lines. Pupils black; irides yellowish-brown.

Description. Body oblong, cylindrical. Surface granulated, and studded with innumerable tubercles, which are quite large upon the back, and very small or almost entirely disappearing beneath the lateral line. Head large, spinous, hideous in appearance. The length of the head, measuring to the posterior extremity of the operculum, is about one fourth the entire length; width of head across opercula equal to its length. Twelve more or less prominent, blunted, spinous tubercles on each side of the median line of the head; the sharpest-pointed, which in some instances is naked, is just back of the nostril; the largest are at the posterior angles of the eyes, and just in front of the dorsal fin. From several of these prominences, such as those at the anterior and posterior angles of the eyes and about the snout, are suspended fleshy digitated cirrhi; those hanging over the eyes appear like a broad fringe. Orbital cavity large. Eyes moderate in size; the distance between the posterior superior angles of the eyes rather less than one fourth the length of the head; space between them deeply depressed. The suborbital bone presents an irregularly elevated ridge. The preoperculum at its posterior angle is armed with two strong spines; the upper curves upwards and backwards; the inferior is directed backwards and downwards. The operculum is small, triangular, with an elevated longitudinal ridge at its superior part. The jaws are of equal length; from the edge of the lower jaw are suspended about a dozen fleshy prolongations, similar to those attached to the prominences upon the head, but considerably larger. Mouth very large. The teeth in the jaws, pharynx, upon the vomer and palatine bones, numerous, sharp, and recurved like those of a card. The lateral line, which is tubercular, commences just above the posterior angle of the operculum, and, curving with the body, terminates at the base of the caudal rays.

The first dorsal fin arises just back of the posterior spines of the head. The first three rays of this fin are longest; the seventh, eighth, ninth, and tenth rays are next in length; from the extremities of the rays are suspended delicate tentacula.

Just back of the first dorsal arises the second, appearing as if connected with it; and hence described by Mitchill as *one* fin. It is of a somewhat quadrangular form, rounded above when expanded, and having the extremities of the rays projecting beyond the connecting membrane. Height of the fin one third of its length.

The pectorals are very large; when expanded resembling a wing. The rays are uncommonly distinct; the eight anterior are stout and unequal in their length, the anterior one being much the shorter; the ten posterior are rounded posteriorly when expanded; the four anterior of these latter, the larger. These fins arise from the entire lower edge of the branchial aperture; their height to their length is as four to two and a half.

The ventrals arise just back of the first rays of the pectorals. They are composed of three rays, the first of which is shorter and much stouter than the second. In some specimens, however, the first ray is the longest of the three.

The anal commences and terminates on the same plane with the second dorsal. The first nine rays of this fin are deeply divided at their extremities. This is much more marked in some specimens than in others. The length is to the height as three and a half to one and a half.

The length of the caudal is two thirds of its height.

The fin rays are as follows:—D. 16–13. P. 18. V. 3. A. 15. C. $12\frac{3}{4}$. Length two feet.

Remarks. This species is frequently taken by the cod-fishermen in deep water in the neighborhood of ledges in Massachusetts Bay.

Nova Scotia and Gulf of St. Lawrence, CUVIER, RICHARDSON. Maine, Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

Inasmuch as authors generally suppose this to be the *Acadianus* of Pennant, I am compelled to assume his specific name. It is to be regretted, however, that his description should have been so meagre; and that, while he described well enough the dorsal fins, he should have utterly neglected mentioning the characteristic cirrhi of the head; this can only be accounted for upon the supposition that he never saw a recent specimen.

GENUS IX. SEBASTES, Cuv.

Body oblong, compressed, covered with scales; all the upper parts of the head also covered with scales. Eyes large; preoperculum and operculum ending in three or more spines; branchiostegous rays, seven; teeth small, numerous, equal in size, placed on both jaws, the vomer, and palatine bones; a single dorsal fin, partly spinous, partly flexible; inferior rays of the pectoral fin simple.

SEBASTES NORVEGICUS, Cuv.

The Norway Haddock.

(PLATE VII. FIG. 1.)

Perca Norvegica, FAB., Fauna Groenl., p. 167.*Perca marina*, Sea-Perch, PENN., Brit. Zool., p. 226.*Serranus Norvegicus*, FLEM., Brit. An., p. 212, sp. 140.*Scorpena Norvegica*, Northern Sebastes, JEN., Brit. Vert., p. 347.*Sebastes Norvegicus*, GRIFFITH'S CUV., x. p. 144.*La Sébaste septentrionale*, *Sebastes Norvegicus*, CUV. et VAL., IV. p. 327, pl. 87.*Scorpena (Sebastes) Norvegica*, Northern Sebastes, RICH., Fauna Boreal. Americ., III. p. 52.*Sebastes Norvegicus*, Bergylt, Norway Haddock, YARRELL, Brit. Fishes (2d edit.), I. p. 87.

" " Norway Haddock, Rose-fish, Hemdurgan Snapper, STORER, Report, p. 26.

" " Northern Sebastes, DEKAY, Report, p. 60, pl. 4, fig. 11.

" " STORER, Mem. Amer. Acad., New Series, II. p. 312.

" " STORER, Synopsis, p. 60.

Color. In the recent fish the entire body, together with the fins, is of a beautiful bright red, with the exception of a black blotch upon the posterior portion of the operculum. After death the color partially disappears upon the throat and abdomen, and the space beneath the ventrals becomes nearly white; and at the posterior base of the soft portion of the dorsal a dull blotch is observed. Pupils black; irides yellow.

Description. Body oblong, compressed, covered with small rough scales. Length of the head, from the tip of lower jaws when closed, to the posterior angle of the operculum, about one third the entire length; head flattened above, between the eyes and upon the occiput. The operculum is armed with three spines; one pointing upwards and backwards at its posterior superior angle; a second beneath this, directed obliquely backwards and downwards; and a third, much smaller, at its inferior angle. The preoperculum is rounded at its edge, and furnished with five spinous processes; the three posterior of which are the larger. Two spines upon the scapular bones, and two upon the suborbitals. Four spinous projections upon the supra-orbitals, all of which are pointed backwards; one at the upper anterior angle of the eye; a second with its base continued along the greater portion of the ridge; and two smaller ones behind.

Two elevated sharp ridges upon the occiput, which bifurcate posteriorly into spinous points. Eyes circular, very large; the diameter of the orbit nearly equal to one third the length of the head, when the jaws are closed; the distance between the eyes equal to five eighths the diameter of the eye. The nostrils are just in front of the eyes; the posterior is much the larger. The jaws, pharynx, vomer, and palatine bones are armed with numerous minute, sharp teeth; the upper jaw is very protractile, and has an emargination at its centre, into which the extremity of the lower jaw shuts, when the mouth is closed. The chin is prominent. The lateral line arises above the operculum, and, taking the curve of the body, terminates at the caudal rays; about thirty-six tubes are seen in the course of the line, which are more nearly approximated at the posterior portion of the body.

The dorsal fin commences on a line with the upper opercular spine. Its anterior half is composed of spinous rays; the length of its highest rays is equal to about one third the length of the fin; the connecting membrane does not extend to the summit of the rays, and they are thus left naked and projecting. The posterior half of this fin is composed of membranous rays which are higher than the spinous ones; the length of this portion, which is rounded above and posteriorly, is less than one half the length of the spinous portion.

The pectorals commence on a line with the third dorsal ray; they are rounded when expanded. The rays project beyond the connecting membrane; the length of these fins is equal to one third their height; the middle rays are the longest.

The ventrals are fan-shaped, and situated just back of the pectorals; their first ray is a strong spine; the second membranous ray is the longest.

The anal has three strong spines; the posterior the longest. The first membranous ray is equal to the length of the fin.

The caudal is slightly emarginated at its tip; its length less than one third its height.

The fin rays are as follows:—D. 15–15. P. 18. V. 1–5. A. 3–7. C. 19. Length one foot.

In the specimens I have seen, the preopercular and opercular spines are much more developed than they appear in Cuvier's figure of this species. Yarrell's and Dekay's figures are copies from that of Cuvier.

Remarks. This species is known to our fishermen by the names of "Rose-fish," "Hemdurgan," and "Snapper." It is not common in Massachusetts Bay; it is occasionally taken during the winter, and rarely in the summer, while fishing for cod, near shoal ledges contiguous to deep water. It is not a marketable fish with us, although

it is freely eaten by the Norwegians. Captain Atwood informs me that he never saw a specimen of this fish on the southern shore of Massachusetts Bay. The fishermen have an erroneous opinion that the spines of this species are very poisonous. weighs from one to five pounds.

Greenland, FABRICIUS. Gulf of St. Lawrence, RICHARDSON. Maine, WOOD. Massachusetts, STORER. New York, DEKAY.

GENUS X. GASTEROSTEUS, CUV.

Body without scales, more or less plated on the sides; one dorsal fin with free spines. Ventral fin with one strong spine, and no other rays; bones of the pelvis forming a shield, pointed behind; branchiostegous rays three.

GASTEROSTEUS BIACULEATUS, *Mitchill*.

The Two-spined Stickleback.

(PLATE VIII. FIG. 2, 3.)

<i>Gasterosteus biaculeatus</i> , <i>Two-spined Stickleback</i> ,	MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 430, pl. 1, fig. 10.
“ “ “ “	DEKAY, Report, p. 65, pl. 3, fig. 8.
“ “ “ “	STORER, Mem. of Amer. Acad., New Series, II. p. 314.
“ “ “ “	STORER, Synopsis, p. 62.
“ “ “ “	H. R. STORER, Bost. Journ. Nat. Hist., VI. p. 260.

Color. The living fish is of an olive-green color above, lighter upon the sides, silvery beneath. Gill-covers silvery, spotted with fuliginous. Pupils black; irides silvery. Fins colorless; in the dead specimens yellowish.

Description. Body oblong, compressed, becoming abruptly very slender at the base of the tail. On each side of the body are about thirty transverse horny plates, the posterior of which are the narrower; these plates are indistinctly striated. The lateral line is situated high up on the back; it takes the curve of the body, and is lost in the carina on the side of the tail. The head is less than one fourth the length of the body; above it is bony and granulated, as in the *Prionoti*, and flattened. The mouth is protractile. The jaws are equal, and furnished with numerous minute teeth. The eyes are large and circular. The nostrils are large, and situated about half way between the eye and the snout. The opercula are covered with radiating striæ, as in the *Syngnathi*. A broad silvery plate bounds the branchial orifice posteriorly. On each side of the base of the tail is a distinct membranous carina. There are two distinct spines of about equal size situated upon the dorsum anterior to the dorsal fin; these spines are broad at their base, strongly serrated on their sides, very acute at their extremity,

slightly recurved, and capable of being elevated or depressed at the will of the fish; the anterior of these is situated over the silvery plate back of the branchial orifice; the posterior is above the middle of the pectorals. Just anterior to the origin of the dorsal fin, and almost connected with it, is another very minute spine, which is naked throughout the greater portion of its extent.

The dorsal fin is longer than high; its posterior rays are very short.

The pectorals are elongated, broad, and fan-shaped when expanded. In front of the pectorals two prominent, acute, serrated spines, with a bony process at their external base, are observed in place of the ventrals. Between these spines is situated a bony plate formed like the head of a lance, granulated upon its surface, serrated at its edges, with a central carina. (Plate VIII. Fig. 3.)

The anal commences posterior to the dorsal, and terminates on a line with that fin. Like the dorsal, it is preceded by an exceedingly minute spine.

The caudal is scarcely emarginated.

The fin rays are as follows:—D. 2-1-11. P. 10. V. 1. A. 1-6. C. 12. Length two inches to two and a half.

Remarks. Specimens of this species were brought me by my son, Horatio R. Storer, from small pools of water left at low tide on the rocks at Nahant, and also from the marshes at Brookline. Captain Atwood has likewise sent me individuals from Provincetown.

Massachusetts, STORER. New York, MITCHILL, DEKAY. Nova Scotia, H. R. STORER. New Brunswick, PERLEY.

This species may perhaps have been the one referred to by Forster and Pennant; but it does not seem to be the Northern Two-spined Stickleback, which has been lately described by Girard from specimens brought from Labrador by my son, under the name of *G. Cuvieri*.

GASTEROSTEUS QUADRACUS, *Mitchill*.

The Four-spined Stickleback.

(PLATE VIII. FIG. 4.)

Gasterosteus quadracus, *Four-spined Stickleback*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., 1. p. 430, pl. 1, fig. 11.

L'Epinoche à quatre aiguilles (*Gasterosteus quadracus*, MITCH.), CUV. et VAL., IV. p. 504.

L'Epinoche à bassin fendu (*Gasterosteus apertes*, CUV.), CUV. et VAL., IV. p. 505.

Gasterosteus apertes, *Bloody Stickleback*, STORER, Report, p. 31.

Gasterosteus quadracus, *Four-spined Stickleback*, DEKAY, Report, p. 67, pl. 6, fig. 18.

“ “ “ “ STORER, Mem. Amer. Acad., New Series, II. p. 315.

“ “ “ “ STORER, Synopsis, p. 63.

Color. When alive, greenish-brown above the lateral line; beneath this line, which is very perceptible, the color is darker, and is broken irregularly by the extension of the whiteness of the abdomen. In young specimens the color is distributed in four or five transverse bands, which are indistinct in the mature fish. The membranous portion attached to the posterior inferior part of the ventral spine is of a bright scarlet color, which causes this part to appear as if covered with blood, when the fish is suddenly darting through the water, with the spine projecting.

Description. Body slightly convex in front of the first dorsal spine. Length of the head equal to nearly one fifth the length of the body. Three or four movable spines are situated in front of the dorsal fin, with a membrane at their base. Directly before the dorsal fin, and connected with it by a membrane at its base, is a fifth spine, which is equal to about two thirds the height of the rays of this fin. Commencing at the base of the first spine, and terminating at the spine of the dorsal fin, is situated a groove, into which the larger spines are received when recumbent. The first and second spines are each equal in length to one third of the head; when erect, one or more of these spines frequently project outward from the straight line; the others are shorter; the fourth, when there are five, is the shortest.

The rays of the pectorals are very delicate.

The ventral spine is serrated on its anterior edge.

The os innominatum extends, on each side, almost to the anus. At the origin of the anal fin is situated a recurved spine, rather larger than that at the origin of the dorsal fin.

The first rays of the anal fin are the highest. This fin terminates opposite the dorsal fin.

The caudal fin is slightly rounded, when expanded.

The fin rays are as follows:— D. 3 or 4, 1–12. P. 11. V. 1. A. 10. C. 13. Length one to two inches.

Remarks. This species, which Mitchill concisely described and badly figured in his paper on the Fishes of New York, is found in large numbers in creeks to which the sea has access, from Boston to Provincetown, and also in the mouths of rivers.

Massachusetts, STORER. New York, MITCHILL, CUVIER, DEKAY.

In this species, as in others of the genus, the number of dorsal spines varies. Cuvier's *Noveboracensis* is probably a variety with three spines, and my son has taken specimens with five spines in salt marshes at Cambridge.

GASTEROSTEUS DEKAYI, *Agassiz.**The Many-spined Stickleback.*

(PLATE VIII. FIG. 5.)

- Gasterosteus pungitius*, *Ten-spined Stickleback* STORER Report p. 32.
Gasterosteus occidentalis *Many-spined Stickleback* DEKAY, Report, p. 68, pl. 42, fig. 195.
 " " " " STORER, Mem. Amer. Acad., New Series, II. p. 315.
 " " " " STORER, Synopsis, p. 63.
Gasterosteus Dekayi, AGASSIZ. Lake Superior, p. 311.

Color. When alive, this fish is of a grayish-yellow color, with from six to ten transverse dark bands upon its sides, which are very distinct in some specimens, while in others they are scarcely visible. In the same individual, these bands are much more apparent at some moments than at others, as the fish is excited by fear or other causes. The opercula and abdomen are silvery. Pupils black; irides metallic. After death the color of the fish is much lighter, and the bands, in a great measure, disappear.

Description. Body much elongated. Greatest depth of the fish rather more than one eighth of its length. Length of the head one fifth the length of the entire fish. The mouth opens obliquely downwards; the jaws are armed with great numbers of minute teeth. The eyes are circular; the diameter of the eye is equal to about one quarter the length of the head. The lateral line commences at the posterior superior angle of the operculum, and pursues a slightly declining course to a line over the anus, from which it passes in a straight line to the tail. A strongly marked carina upon each side of the tail, which is crossed by twelve or more plates.

Upon the dorsum are situated from eight to ten incurved spines, inclining to the right and left. The first of these spines arises on a line midway between the opercula and pectoral fin.

The dorsal fin arises on a line directly above the anal spine, and gradually diminishes in height, until its rays are scarcely perceptible.

The ventral spines are stout, sharp, somewhat incurved, serrated upon their upper edge, with a membrane at their base. A bony plate is situated between the ventral spines, which terminates posteriorly in a point.

The anal fin is similar in its form to the dorsal; its spine is recurved.

The caudal fin is rounded.

The fin rays are as follows:—D. 8 or 9 or 10. 1–7. P. 11. V. 1. A. 1–9. C. 13. Length one to two inches.

Remarks. This pretty species, which is less common than the *quadracus*, is found in the salt marshes along the sea-coast, in company with that species and the different killifish.

Agassiz considers this species distinct from the *occidentalis* of Cuvier, and has accordingly named it for Dekay, who had previously expressed doubts of its identity.

Maine, H. R. STORER. Massachusetts, STORER. New York, DEKAY.

FAMILY III. SCLÆNIDÆ.

This family is very similar to that of the Percoids, and presents nearly all the same combinations of exterior characters, especially the denticulations of the preoperculum, and the spines of the operculum; but it has no teeth, either on the vomer or palatines; in general, the bones of the cranium and face are cavernous, and form a snout more or less rounded. It often occurs in this family that the vertical fins are rather scaly. Some of the genera have two dorsals, others but one.

GENUS I. OTOLITHUS, Cuv.

The bones of the anal fin are weak, and there are no barbels; some of the teeth terminate in elongated hooks, or are of the canine form. Their natatory bladder has a horn on each side, projecting forwards.

OTOLITHUS REGALIS, Cuv.

The Weak-fish.

(PLATE IX. FIG. 1.)

Johnius regalis, SCHN.

Labrus squeteague, *Weak-fish*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 396, pl. 2, fig. 6.

L'Otolith royal (Otolithus regalis, Cuv., Johnius regalis, Schn., Labrus squeteague, Mitch.), CUV. et VAL., V. p. 67.

Sciaena (Otolithus) regalis, Squeteague, RICH., Faun. Boreal. Americ., III. p. 68.

Otolithus regalis, Weak-fish, STORER, Report, p. 33.

“ “ “ AYRES, Bost. Journ. Nat. Hist., IV. p. 259.

“ “ “ DEKAY, Report, p. 71, pl. 8, fig. 24.

“ “ “ LINSLEY, Cat. of Fishes of Conn.

“ “ “ STORER, Mem. Amer. Acad., New Series, II. p. 318.

“ “ “ STORER, Synopsis, p. 66.

Color. The upper part of the body is of a bluish color, with irregularly distributed brownish spots. Sides silvery. Abdomen white. Pupils black; irides yellow. Dorsals, pectorals, and caudal fin brownish. Ventrals and anal orange.

Description. Body elongated, compressed. The length of the head is equal to one fourth the whole length of the fish; it is flattened between the eyes, and slightly convex back of them. The eyes are large and horizontally oblong, and about one seventh the length of the head. The nostrils are situated directly in front of the superior anterior angle of the eye; — the posterior the larger, a vertical slit; the anterior circular. Mouth

large. The lower jaw the longer, with a single row of separated, sharp teeth upon its sides, and several rows of smaller teeth at its centre. The sides of the upper jaw are armed with very minute teeth; somewhat larger teeth are observed at its centre, in the midst of which are situated two strong, incurved fangs. Minute teeth in the pharynx.

The lateral line arches backwards until opposite the posterior termination of the second dorsal fin, whence it pursues a straight course to the extremities of the caudal rays.

The triangular first dorsal fin commences just back of the origin of the pectorals; its third and fourth rays are longest.

The second dorsal is elongated, and diminishes in height posteriorly; it terminates on a line with the anal fin.

The pectoral fins arise just beneath the posterior angle of the operculum, and extend beyond the middle of the first dorsal.

The ventral fins commence posterior to the base of the pectorals, and terminate on a line with the tips of those fins.

The anal fin is short and quadrangular.

The caudal fin is somewhat emarginated.

The fin rays are as follows:—D. 8-1-28. P. 15. V. 6. A. 13. C. 17. Length one to two feet.

Remarks. Many years since, this species was found in abundance about Nantucket and Martha's Vineyard, but of late it has disappeared. Dr. Yale wrote me, in October, 1837, "The *squeteague* has deserted these waters; there has not been one taken for three or four years about here; they left about the time that the *blue-fish* came." Hon. Hezekiah Barnard, of Nantucket, in a letter to me, dated July, 1838, remarked, "The *squeteague* or *weak-fish* have disappeared since the return of the *blue-fish*, who are their avowed enemy. I have conversed with our fishermen; they say they have scarce seen one for six years."

On the 23d of June, 1847, a *squeteague* was taken at Provincetown, the first known to have been taken there for twenty years.

Bay of Chaleur, Lieut.-Col. HAMILTON SMITH. Massachusetts, STORER. New York, MITCHILL, DEKAY. Caribbean Sea, CUVIER.

GENUS II. UMBRINA, Cuv.

Distinguished from the *Scienoids* by a cirrus under the symphysis of the lower jaw.

UMBRINA NEBULOSA, *Storer.**The King-fish.*

(PLATE IX. FIG. 4.)

- Sciæna nebulosa*, *King-fish*, MITCHILL, Trans. Lit. and Phil. Soc. of N.Y., I. p. 408, pl. 3, fig. 5.
L'Ombrine des Etats Unis (*Umbrina alburnus*, CUV., *Sciæna nebulosa*, MITCH., *Perca alburnus*, LIN., *Centropomus alburnus*, LACEP.), CUV. et VAL, Hist. Nat. des Poiss., v. p. 180.
Umbrina nebulosa, *King-fish*, STORER, Report, p. 35.
 " " " AYRES, Bost. Journ. Nat. Hist., iv. p. 259.
 " " " LINSLEY, Cat. of Fishes of Conn.
Umbrina alburnus, *King-fish*, DEKAY, Report, p. 78, pl. 7, fig. 20.
 " " " STORER, Mem. Amer. Acad., New Series, II. p. 323.
 " " " STORER, Synopsis, p. 71.

Color. Of a dull gray color, with silvery reflections upon sides, ornamented with irregularly disposed dark bars; some passing obliquely forwards from the dorsal fin; others passing obliquely backwards from nape of neck; and one broader one pursues a straight course backwards through the middle of the body, from extremity of pectorals to the tail. Body beneath, yellowish. Extremities of first dorsal, pectorals, and tips of ventrals, white; rays black; second dorsal and base of pectorals and ventrals color of abdomen.

Description. Body elongated, slightly arched over pectorals, gradually tapering towards tail. Length of head, which is the same as the greatest depth of the body, equal to one fifth the entire length of the fish. Scales upon the head smaller than those upon the body; head slightly flattened between eyes; rounded upon occiput; somewhat depressed back of snout. Snout blunted, projecting slightly beyond upper jaw. Eyes of moderate size; the greatest diameter equal to half the distance between eyes. Nostrils directly in front of eyes; the posterior larger, situated obliquely beneath and in front of the anterior inferior angle of eye; at the anterior inferior angle of this orifice is situated the anterior nostril, which is very small and circular. Mouth of moderate size, projectile; lips fleshy; jaws filled with numerous very small card-like teeth, the front row in the upper jaw the longest; upper jaw the longer; a small fleshy cirrus is suspended from the chin. Preoperculum serrated at its posterior margin; more sparsely so beneath. A small, concealed, delicate spinous point is observed at posterior portion of operculum. Lateral line very distinct, curving with the body.

The triangular dorsal fin arises just back of the pectorals; its first ray is a minute spine; the third ray is much the longest of all; this ray is nearly twice as high as the length of the fin, and nearly three tenths the length of the fish. The extremities of the rays are free, like those of the other fins.

The height of the second dorsal, which is equal throughout, is one sixth of its length.

The length of the pectorals is less than one third their height.

The ventrals arise in front of the posterior half of the pectorals; extremities multifid; first ray stoutest.

The caudal is deeply emarginated; the upper lobe pointed, the lower broad and rounded at extremities; about as high as long.

The fin rays are D. 10 – 26. P. 21. V. 5. A. 10. C. 18.

or D. 9 – 26. P. 19. V. 5. A. 10. C. 17.

Length sixteen and a half inches.

Remarks. In my "Report on the Fishes of Massachusetts," published in 1839, I admitted this species under the name of *Umbrina nebulosa*. As Dekay, in his "Report on the Fishes of New York," published in 1842, accepted the opinion of Cuvier, that it was identical with the *Perca alburnus* of Linnæus, I felt in a measure compelled to coincide; and consequently in my "Synopsis of the Fishes of North America" I introduced it as the *Umbrina alburnus*. Convinced that our species is distinct from the Southern fish, I have resumed my former opinion.

This species must be very rare in our waters. The specimen belonging to the Natural History Society of this city was captured in a lobster-pot at the Boston light-house, previous to the year 1833. In 1840, a specimen was taken at Lynn, and was referred to by me in the Journal of the Natural History Society. In July, 1846, Captain Atwood caught one at Provincetown; and in November, 1847, a second specimen at the same place. Both of these latter specimens were taken in nets, while fishing for mackerel. These are all of which I have any knowledge.

Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHILL, DEKAY.

FAMILY IV. SPARIDÆ.

This family is characterized by the opercular pieces being unarmed; the palate toothless; the jaws not protractile; scales large. Branchial rays not exceeding six.

GENUS I. SARGUS, Cuv.

Trenchant incisors in front of the jaws, almost similar to those of man; molars rounded.

SARGUS OVIS, *Cuv.**The Sheep's-head.*

(PLATE X. FIG. 1.)

- Sparus ovis*, *Sheep's-head*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 392, pl. 2, fig. 5.
Le Sargue tête-de-mouton (*Sargus ovis*, *Cuv.*, *Sparus ovis*, *Mitch.*), *Cuv. et Val.*, Hist. Nat. des Poiss., VI. p. 53.
Sargus ovis, *Sheep's-head*, STORER, Report, p. 36.
 " " " DELKAY, Report, p. 89, pl. 8, fig. 23.
 " " " AYRES, Bost. Journ. Nat. Hist., IV. p. 260.
 " " " STORER, Mem. Amer. Acad., New Series, II. p. 332.
 " " " STORER, Synopsis, p. 80.

Color. Light gray, with six quite distinct, dark-brown, transverse bands, broad and nearly equidistant from each other; another band across neck, over shoulders. Head above darker; orbits greenish; gill-covers with silvery and golden reflections. Throat somewhat reddish. Pupils black, irides golden. Scales throughout body margined with darker than their centre. Fin membranes dark brown or black, save that of pectorals, which is nearly colorless.

Description. Body short, stout. Back rounded, slightly elliptical. Head hardly projecting, about one fourth the length of fish; its depth about five sevenths its greatest depth; its width between eyes about two fifths its length. Posterior and upper part of head scaled, the rest naked. Lips large and fleshy; jaws equal, armed in front with large, stout, quadrangular teeth, the outer of which are somewhat curved inward; these teeth in the upper jaw slightly overlap those of the lower; within and behind these are several rows of teeth, rounded or obtusely conical. Eyes large, their diameter nearly equal to half the distance between them; just above and in front of them the orbital ridge is quite prominent. Nostrils high up in head, anterior to eye, double, the posterior an elongated slit opening backwards. Head anteriorly abounding in mucous pores. Posterior opercular margin sinuous. Scales upon body generally very large, although in some places their size is greatly diminished, as upon top of head, the throat, and the bases of all the fins save the anterior three quarters of the dorsal. Lateral line commences high over pectorals, and, curving upwards at first rather more than the line of body, gradually becomes parallel to it until it reaches a line with termination of dorsal and anal, whence it runs straight to middle of caudal; its scales present dark ramifications, which appearance is also found upon the scales bordering a triangular space on top of head.

The first twelve rays of dorsal fin are strongly spinous; of these the alternate rays are much larger than their neighbors. The first five of these rays gradually increase in length; the remaining seven are about equal. The rest of the fin increases in height, giving its termination a peculiar truncated appearance. Behind and beneath the base of the fin, as well as at termination of anal, is a deep emargination.

Pectorals very much elongated; the rays of first half are simple, the others branched.

Ventrals stout, subtriangular; at their base a strong spinous process, covered with scales, connected along its edge by several membranous attachments. The first ray is spinous.

The anal shuts anteriorly into a deep groove, as does also the dorsal. Its first three rays are spinous; the second is much the largest.

Caudal slightly truncated; the interspaces between its rays are well scaled at first.

D. 12-12. P. 16. V. 1-6. A. 3-2. C. 22. Length twenty inches.

Remarks. This delicious fish, which has been so minutely described and so highly eulogized by Mitchill, in his "History of the Fishes of New York," is occasionally taken in the waters of Massachusetts south of Cape Cod. Thomas A. Greene, Esq. of New Bedford, informs me it is sometimes sold in that market from the above-noticed locality. Dr. Mitchill speaks of it "as the most esteemed of the New York fishes, and fetching a higher price than any, excepting, perhaps, fresh salmon and trout"; and Dekay remarks, "The sheep's-head holds the same rank with American gastronomes that the turbot holds in Europe. I have frequently eaten of both, under equally favorable conditions, that is to say, within an hour after having been taken from the water, and can assert that the sheep's-head is the more delicate and savory fish."

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUVIER, DEKAY. Lake Pontchartrain, Louisiana, LESUEUR.

GENUS II. PAGRUS, Cuv.

But two rows of small, rounded molar teeth in each jaw.

PAGRUS ARGYROPS, Cuv.

The Scapaug.

(PLATE X. FIG. 4.)

Sparus argyrops, LIN., Syst. Nat., GMEL., p. 1277.

" " *Silver-eyed Sparus*, SHAW, Gen. Zoöl., IV. p. 426.

Labrus versicolor, *Big Porgee of New York*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 404, pl. 3, fig. 7.

Le Pagre œil-d'argent, *Pagrus argyrops*, CUV. et VAL., VI. p. 164.

" " *Big Porgee, Scapaug, Scup*, STORER, Report, p. 38.

" " " DEKAY, Report, p. 95, pl. 9, fig. 25.

" " LINSLEY, Cat. of Fishes of Conn.

" " *Porgee*, AYRES, Bost. Journ. Nat. Hist., IV. p. 260.

" " STORER, Mem. Amer. Acad., New Series, II. p. 334.

" " STORER, Synopsis, p. 82.

Color. When just caught, this fish is of a beautiful pinkish tinge or flesh-color upon the upper portion of the sides; abdomen silvery. The naked portion of the head, be-

tween, anterior, and posterior to the eyes, reddish. At the base of the dorsal fin on each side is a narrow green ridge; also a similar ridge just back of the eyes. Pupils black; irides silvery, with the exception of the upper middle portion, which is brown or cupreous. The dorsal fin is reddish, with the bodies of the anterior rays silvery white. Pectorals with a slight tinge of red, greenish at their base beneath. Ventrals of a greenish tinge. Anal brownish, margined with blue. Caudal reddish.

Description. The length of this species is from eight to twelve inches; the length of the head is about one fourth the length of the entire fish; the depth of the body across from the base of the pectorals is equal to rather more than one third its length; the width of the body at the base of the tail is equal to one tenth its length. Body very much compressed towards the back; back gibbous, gradually curving towards the tail. The eyes are large and circular. The jaws when closed are equal. In the back of the jaws are two rows of blunt teeth; those in front of the jaws are sharp and prominent. The lips are large and loose. The nostrils are double; the anterior is smaller and circular, the posterior larger and vertical. The head is destitute of scales. The preoperculum and operculum are covered with scales. A large semicircular scale is observed at the commencement of the lateral line; between this scale and the outer angle of the naked space at the posterior angle of the eye, a band of smaller scales than those of the body passes obliquely upwards to the anterior portion of the dorsal ridge. The lateral line, commencing back of the upper angle of the operculum, and passing obliquely up to a point on a line with the fifth or sixth spine of the dorsal fin, curves with the body to the base of the tail.

The dorsal fin is received into a deep groove at its base; when this fin is not erect, the spines are scarcely visible, so completely do they shut into this groove. The third spine is the longest; from the extremities of the first three spines are suspended delicate filaments. Just anterior to the dorsal fin is situated a strong horizontal spine, almost entirely enveloped by the skin, which projects forwards.

The pectoral fins commence on a line beneath the origin of the dorsal fin; they are one fourth the length of the body.

The ventrals are just back of the pectorals; their second and third rays are the longest. A large subsidiary scale exists at the anterior edge.

The anal fin is shorter than the dorsal, and terminates on the same plane with that fin, and like the dorsal is received into a groove at its base.

The caudal fin is quite deeply forked.

The fin rays are as follows:—D. 12–12. P. 15. V. 6. A. 3–11. C. $16\frac{2}{3}$.

Length about a foot.

Remarks. This pretty species, which is known as the Scup, Porgee, and Scapaug, is taken in large quantities in Buzzard's Bay and the Vineyard Sound; and at New Bedford, Holmes's Hole, and Gay Head it is one of the most common fishes, and in a fresh state is used more than any other. At Holmes's Hole it is taken from the first of June until the middle of October with the hook; after that date, in the ponds, with spears and nets. Within a few years, small numbers have appeared north of Cape Cod, and are now yearly captured at Wellfleet and Sandwich.

In the year 1834 or 1835, Captain William C. Downes, of Holmes's Hole, carried a smack-load of this species from the Vineyard Sound, and threw them overboard in Plymouth Harbor.

Mr. James Newcomb, fishmonger in the Boston Market, informs me that in the year 1831 or 1832 a smack-load of scapaugs arrived in Boston Harbor. A portion of them were purchased by subscription among the fishermen in the market, and thrown into the harbor. The next season two specimens were caught from our wharves; in the summer of 1835, one individual was taken at Nahant, and was considered a very strange fish, no specimen having been known to have been seen there before; in 1836, still another was captured at Nahant. As no specimen had ever been taken so far north before, and as the few taken would lead to the inference that those which had been transplanted from Buzzard's Bay had not bred in the cold waters of this portion of Massachusetts Bay, we are led to believe the individuals taken immediately around Boston were of the number of those originally brought from the South.

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUVIER, DEKAY. South Carolina, LINNÆUS.

FAMILY V. SCOMBRIDÆ.

The fishes of this family have small scales, so that the greater part of the skin appears as if entirely smooth. The ventral fins are destitute of scales; the opercula are without spines or denticulations; in most of them the caudal fin is large and powerful, and generally they are furnished with numerous cœca.

GENUS I. SCOMBER, CUV.

Body fusiform, covered by scales which are uniformly small; sides of the tail not carinated, but merely raised into two small cutaneous crests; dorsal fins widely separated; some of the posterior rays of the second dorsal and anal free, forming finlets; one row of small conical teeth in each jaw.

SCOMBER DEKAYI, *Storer*.*The Spanish Mackerel.*

(PLATE XI. FIG. 1.)

<i>Scomber colias</i> , <i>The Spanish Mackerel</i> ,	STORER, Report, p. 45.
" " " "	DEKAY, Report, p. 104, pl. 11, fig. 23.
" " " "	STORER, Mem. Amer. Acad., New Series, II. p. 341.
" " " "	STORER, Synopsis, p. 89.

Color. The upper part of the body is of a light-green color, with numerous contiguous beautifully undulating lines of a darker green passing down the sides and just crossing the lateral line. Beneath the lateral line is an interrupted dull-brown band, arising beneath the pectorals and continued in a straight course to the tail; below this band the sides are silvery, with numerous irregularly marked blotches, circular, oval, and oblong. The abdominal ridge is immaculate; the entire sides exhibit cupreous reflections. The upper portion of the operculum is greenish, with cupreous reflections; the inferior portion, as well as the preoperculum and jaws, is silvery. The first dorsal fin is transparent, slightly dusky; the pectorals have a small black blotch at their base, within, which is scarcely perceptible unless the fins are raised; their outer base is silvery. The ventrals are of a reddish white. The caudal fin is of a yellowish green. The pupils are black; the irides silvery. The mouth is fuliginous; the tongue is greenish, with a metallic tint.

Description. The body is cylindrical, very plump, tapering towards the tail, at the origin of which it is very small. The greatest depth of the body is equal to rather more than one sixth its length. The length of the head is less than one fourth the length of the body; it is flattened upon its top, compressed upon its sides; the snout is rather pointed. The eyes are large and circular; the diameter of the eyes is less than the distance between them. The nostrils are double; the anterior is circular, in front of posterior a distance equal to that between the posterior and the eye; the posterior is vertical, just in front of the eyes. The jaws are equal, crowded by a single row of very minute teeth.

The first dorsal fin arises opposite the middle of the pectoral fins; its first ray upon its outer edge is margined, as well as the spaces between the tips of the rays, with black; the second ray is the longest; the most posterior ray is exceedingly minute. The tips of all the rays project slightly beyond the membrane.

The second dorsal fin commences back of the first, at a greater distance than the length of the first dorsal. This fin is shorter than the preceding; its rays are short, and enveloped in a thick membrane emarginated above; the extremities of the rays project

slightly beyond the membrane. There are five finlets back of the second dorsal fin; the fifth is deeply divided, making it appear like two finlets.

The pectorals are just beneath the origin of the lateral line; they are triangular, and their length is equal to the height of the first dorsal ray.

The ventrals are fan-shaped; they are situated just in front of the first dorsal fin: their rays are multifid.

The anal fin arises back of the second dorsal fin, and like it is emarginated above, and has five finlets posterior to it. A small spine, projecting backwards, is situated at the origin of the anal fin.

The caudal fin is deeply forked, and has at its base two lateral carinæ.

The fin rays are as follows:—D. 9–11 or 12. P. 19. V. 5. A. 12 or 13. C. 18½. Length, one to two feet.

Remarks. The many points of resemblance to the *Scomber colias*, Gmel. presented by this fish, caused me to consider it as identical with that species, and thus I described it in my "Report on the Fishes of Massachusetts." With this opinion Dekay coincided in his "Report on the Fishes of New York"; although we might infer that he was not perfectly convinced of our species being the foreign fish, from the following sentence at the conclusion of his description: "If this species is identical with the *S. colias* of Europe, it has a wide geographical range," &c. Subsequent investigation has convinced me that the species under consideration is indigenuous to the American coast. It differs from the *S. colias* in its more robust figure, its markings, and the number of rays in the first dorsal fin. I know of no other species for which it can be mistaken. With a melancholy pleasure I would dedicate it to the memory of the lamented naturalist who has accomplished so much for the science of our country.

This fish is of late years found more rarely along our coast than formerly. Captain Blanchard, of Lynn, informs me, that during some seasons but two or three individuals are taken by the fishermen. Captain Atwood has seen but a single specimen during the last four or five years; many years since, it was abundant at Provincetown, and would run up the small creeks, and be left by the tide. This fish usually weighs about three quarters of a pound; generally speaking, it is as fat as the *Scomber vernalis*, but it is not considered so good to eat; by epicures, however, it is thought to be excellent, even preferable to the common mackerel. Dekay states that he has seen specimens nearly two feet in length in the New York market.

Massachusetts, STORER. Connecticut, LINSLEY. New York to Carolina, DEKAY.

SCOMBER VERNALIS, *Mitchill*.

(PLATE XI. FIG. 2.)

- Scomber vernalis*, *Spring Mackerel*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 423.
Scomber grex, *Thimble-eyed, Bull-eyed, or Chub Mackerel*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 422.
Le Maquereau printanier (*Scomber vernalis*, MITCH.), CUV. et VAL., VIII. p. 48.
Le petit Maquereau de l'Atlantique (*Scomber grex*, MITCH.), CUV. et VAL., VIII. p. 45.
Scomber grex et vernalis, *Chub and Spring Mackerel*, RICH., Fauna Boreal. Americ., III. p. 81.
 " " " " " " STORER, Report, p. 41.
Scomber vernalis, *Spring Mackerel*, DEKAY, Report, p. 101.
Scomber grex, *Full Mackerel*, DEKAY, Report, p. 103, pl. 11, fig. 32.
Scomber vernalis et grex, STORER, Mem. Amer. Acad., New Series, II. p. 342.
 " " " STORER, Synopsis, p. 90.

Color. Upper part of the body of a dark-green color, marked throughout its whole extent from the occiput to the tail with beautiful transverse, more or less undulating, broken bands, of a deeper hue, commencing on the sides of the dorsal ridge, and extending downward below the lateral line. Top of head of a dark, almost black color, produced by longitudinal, broad, broken bands, passing backwards from the snout, and a large black blotch extending backwards from the occiput towards the gill-covers. The portion of the head directly back of the eyes cupreous. Gill-covers and maxillary bones silvery. Intermaxillary bones dark-fuliginous, as well as the tongue and inside of the jaws; angle of jaws dusky. Sides white, with cupreous reflections. Abdomen white. Beneath the lateral line, on each side, is a fuliginous, oftentimes interrupted line, much wider than the lateral line, arising beneath the pectoral fin, and traversing the length of the fish; the space between these two lines is of a duller color than the side beneath.

Description. Body elongated. Length of head almost equal to one sixth of the length of entire fish. Eyes large, circular, their diameter equal to one half the distance between them; pupils black; irides silvery. Eyes protected by a nictitating membrane. Nostrils circular. Inferior margin of preoperculum marked by a row of minute mucous pores, and a few are also seen on the posterior margin. Gape of mouth moderate. Jaws and palatine bones armed with a single row of very minute teeth.

The very narrow lateral line commences directly back of the humeral bone, on a line above the origin of the pectoral fin, and pursues a gently undulatory course to the base of the tail: this line, being slightly prominent, is very distinct.

The first dorsal fin, composed of strong rays, of which the second and third are the longest, arises on a line opposite the posterior half of the pectoral fins; in some specimens the membrane in this fin reaches to the top of the rays, in others the extremities project as in the figure; the length of this fin is hardly greater than its height. When unexpanded, it is entirely concealed in a groove at its base.

The second dorsal, situated upon the posterior half of the head, is of a fuliginous color, margined with white; it is nearly three times as long as high; back of this second dorsal, occupying the space between it and the tail, are five finlets, the fifth of which is usually the largest.

The pectoral fins, of a dark color, having at their base beneath, a black blotch, arise back of the upper third of the operculum. Their length is equal to about one third their height.

The ventrals arise back of the pectorals, and likewise have beneath them a black spot at their base; save the tinge given them by this spot, they are of a flesh color in the fresh fish, but soon become the color of the abdomen after death. The first ray is very strong. All the rays are subdivided at their middle, and again divided into smaller portions at their extremities.

The anal fin arises directly back of the anus, which is situated opposite the origin of the second dorsal. At the commencement of this fin is a short spine; this fin is slightly shorter than the second dorsal, and is of the same color as the abdomen. Back of this fin are six finlets; that next the anal fin appearing at first sight to be a portion of the fin.

At the base of the caudal fin are situated two longitudinal carinæ, extending the whole length of the fleshy portion of the tail; the outer rays of the caudal fin are much the larger; their articulations are very direct; the fin is deeply forked; its extremities are margined with white; the distance between the extremities of the caudal rays, when expanded, is equal to the length of the head.

The fin rays are as follows:—D. 10–12. P. 17. V. 5. A. 12. C. 20.

Remarks. Mitchill described the mackerel which visit our shores in the spring, and those which are taken in the autumn, as distinct species. Dekay coincides with him in his opinion. In my "Report" I considered them as one species, agreeing with Richardson, who observes: "The only differences between *S. grex* and *vernalis* seem to be in their size and color, and they are very probably different ages of the same species." In my "Synopsis" I reluctantly yielded my opinion to that of Dekay, and described the two species. Satisfied that my early impressions were correct, I again unite them, remarking, as in my "Report," that "I have examined with much care the mackerel which are brought to our market, and the differences are too slight between them to constitute distinct species."

This beautiful species is one of the most valuable fishes which frequents our waters. From the 10th of May to the 15th of June, they appear at the entrance of Massachusetts Bay, having been a few days previous at Nantucket and Vineyard Sound. Nine tenths of those which are first seen are *males*, and they are all large, but poor, weighing from

one pound to a pound and a half each. After they have been cured, and made ready for inspection, and are packed for the third quality, one hundred and fifty-four, fifty-five, or fifty-six constitute a barrel. At their first appearance they will not take the hook, and are therefore captured in nets. The fishermen of Provincetown are the only persons in the State who thus take them. Their nets are about eighty yards long and eighteen feet deep, with the meshes three and a quarter inches long, of a size intermediate between a herring net and a menhaden net, the one being too large and the other too small. These nets are suspended vertically in the water, so that when the mackerel, as they swim along, endeavor to pass through, they are caught by the gills; or should they be smaller than usual, they pass their heads through, and are caught by the body.

Most of the fishermen engaged in this method of catching mackerel reside at that portion of Provincetown called Long Point, north of the town; and it is exceedingly interesting to watch them in their laborious and successful avocation. The following notes I took upon the spot, June 26, 1847: — “Now all the male inhabitants of the Point are engaged in the mackerel fishery; from twenty to thirty boats, each of about three or four tons burden, sail at four or five o’clock in the afternoon, having all their nets, varying from ten to fifteen in number, carefully dried and rolled up for their night’s fishing. Each boat has two persons on board, one to manage the boat while the other takes charge of the nets. As the boats sail from the harbor, the scene is very exciting, all leaving at about the same time, and doubling the point upon which the light-house is situated nearly together. (Occasionally a boat arrives late in the morning from its night’s fishing, or is detained until an unusually late hour in the afternoon, by its nets being injured, or by the unusually large quantity of fish taken the previous night, and then it does not leave the harbor, but anchors within the Point; this, however, is seldom done, as but few mackerel, comparatively, are taken here, except when the fish first arrive upon the coast.) When the extremity of the Point is cleared, the boats separate from each other, and each skipper fixes upon his own locality. Some of the boats sail but a few miles, perhaps to the extremity of Race Point, which is distant four or five miles; while others go nearly to Plymouth, and others scatter all over the bay. The farther the boat sails, the later will the nets be thrown overboard; because, should the boats go, as they frequently do, nearly a fourth the distance to Boston, the crew will not be able to get them overboard until late in the evening, or even until midnight; and then, wishing to return as early in the morning as the other boats, they will necessarily keep them out but a few hours. Having thrown over their nets, the fishermen lie down in their little cabins, and get what sleep they can, having first fixed to one of the masts of their boat a light, to prevent their being run down by any vessel which may be passing; and some of the fishermen,

in stormy nights, hang up a bell in their rigging, which is kept ringing by the motion of the boat. About daylight in the morning the fishermen draw their nets, and one man continues to free them of the fishes they contain, during the whole time the boat is sailing homeward, while the other manages the boat. Frequently but small numbers of other species are taken besides the mackerel, while at other times the nets will contain three or four times as many whiting as mackerel, and, as the former are worthless, the duty of the fisherman is very laborious and irksome. The boats arrive early in the morning at the Point, and all is life and excitement. 'How many fish have you caught?' is the universal salutation; and, before they sail again in the afternoon, every boat's crew knows exactly how many have been taken by each boat during the previous night. As soon as the boats arrive, the fishermen at once draw their nets upon the shore, free them of the fish caught, unless it has already been done, and, spreading them upon the sand, or winding them upon a reel, leave them until the latter part of the afternoon to dry, when they again roll them up carefully and put them on board of their boats. Such quantities of whiting are sometimes contained in the nets that they cannot be freed for hours, not even until the middle of the day. Should only a few mackerel be taken during a night, they are sent at once to Boston in some one of the fishing-smacks which are in waiting to take them, and the carriers receive a part of the proceeds of the sale; or they are sold outright, for from three fourths of a cent to a cent and a half apiece, to the smacks. If many are caught, only a few are sent, and the rest are split and salted, and sold afterwards, to be sent in various directions. On the 26th, from twenty to twenty-three boats returned, while I was on the Point, from the previous night's fishing, and averaged about one thousand mackerel apiece; such a quantity could not be disposed of, fresh. Captain Atwood sold only one hundred of the largest, for two cents apiece, and was obliged to salt the remainder. It is very exciting to be on the shore and watch the fishermen as they empty their nets, — throwing out whiting, menhaden, sheep's-head, grunTERS, kiuks, blue-backs, goose-fish, and dog-fish."

To give an idea of this seining of mackerel, which continues only from a month to six weeks, I subjoin the following tables, furnished me by Captain Nathaniel E. Atwood, of his two years' fishing, including the seasons of 1846 and 1847, assisted by one person, in his beautiful little boat, the "*Scomber vernalis*."

Number of Mackerel caught in 1846.

Date.	Whole Number	Sold Large.	Sold Small.	Stock.	Number Salted.
May 20,	39	34	5	\$ 3.18	
" 21,					
" 22,	68	68		4.11	
" 23,	69	69		4.30	
Sunday.					
" 25,	85	63	22	2.27	
" 26,	355				355
" 27,	352				352
" 28,	315	260		14.30	55
" 29,	200	170	30	9.00	
" 30,					
Sunday.					
June 1,	179	113	66	6.57	
" 2,	453	275	178	15.47	
" 3,	352	291	61	11.78	
" 4,	1,117	100		3.12	1,017
" 5,					
" 6,	426				426
Sunday.					
" 8,	463	322	141	16.66	
" 9,	223	178		8.01	45
" 10,	282	208	74	11.02	
" 11,	206	156	50	7.25	
" 12,	296	188	108	9.85	
" 13,					
Sunday.					
" 15,	273	150	123	9.51	
" 16,	340	222	118	11.94	
" 17,					
" 18,	110	15	95	1.84	
" 19,					
" 20,					
Sunday.					
" 22,	70	18	52	2.02	
" 23,					
" 24,	242	172	70	10.39	
" 25,	142	87	55	4.16	
" 26,	123	87	36	4.72	
" 27,					
Sunday.					
" 29,	242	131	111	10.39	
" 30,	98	55	43	3.54	
July 1,	20	10	10	.76	
	7,140	3,442	1,448	\$ 187.16	2,250 = 13 bbls. packed.

Number of Mackerel caught in 1847.

Date.	Whole Number.	Sold Fresh		Stock.	Number Salted.
		Large	Small.		
June 1,	442	245	197	\$ 13.39	
" 2,	189	66	123	4.95	
" 3,	268	111	157	7.12	
" 4,	262	180	82	8.84	
" 5, Sunday.					
" 7,	368	176	192	10.55	
" 8,	326	163	163	8.80	
" 9,	261	90	171	7.09	
" 10,					
" 11,	18	9	9	.94	
" 12, Sunday.					
" 14,	654	263	391	20.17	
" 15,	410				410
" 16,	1,172	384	788	27.60	
" 17,	271	70	201	3.08	
" 18,	346	75	271	4.10	
" 19, Sunday.	460				460
" 21,	426	92	334	10.64	
" 22,					
" 23,	262	53	209	6.30	
" 24,					
" 25,	888	100		2.10	788
" 26, Sunday.	242				242
" 28,	14			Price not named.	
" 29,	102	18	84	"	

By small mackerel in the table is meant those about half the size of the largest; they are culled out by the fishermen, and sold for about half the price of the largest. The salted mackerel are generally contracted for by some purchaser for a certain price (in Captain Atwood's case, for \$5 per barrel), to be delivered at his wharf within a month or two from the time they are taken.

This species revisits our shores again in the autumn, but is not taken in such quantities as in the spring of the year. Thus in the months of October and November, 1847, there were taken, by thirty-five fishermen who followed this business, 1,076 barrels full, which were packed; and \$783.73 worth, which were sold fresh.

These mackerel are inspected at the wharf, before they are barrelled, and are of four distinct qualities.

The first must be 13 inches long, from the tip of the snout to the notch of the caudal fin. The second is under 13 inches in length, but fat. The third comprises those which

are 13 inches long, but are poor. And the fourth contains those which are under 13 inches and poor.

After the 1st of July, the fishermen at Provincetown cease to catch this species in nets; it now readily takes the hook, and is captured along our coast in immense quantities. Captain Atwood informs me, that in 1845 the mackerel-fishery yielded the fishermen at Long Point two thousand dollars.

It is calculated that from six to eight thousand barrels of mackerel are annually sold fresh in Boston market alone. But their great value arises from the employment afforded by them to such a number of persons, in the process of salting and packing, requiring mechanics of various descriptions, and seamen to manage the vessels which transport them from place to place.

The number of barrels of mackerel *inspected* in Massachusetts from the years 1831 to 1847 was as follows:—

1831,	383,559	1839,	73,018
1832,	224,000	1840,	50,992
1833,	225,000	1841,	55,537
1834,	253,000	1842,	75,543
1835,	197,000	1843,	64,451
1836,	180,616	1844,	86,181
1837,	138,157	1845,	202,303
1838,	108,358	1846,	174,064

Those packed in 1836 were furnished by the following towns:—

	Barrels.		Barrels.
Boston,	40,559	Scituate,	3,782
Gloucester and Manchester,	43,937	Yarmouth,	2,446
Newburyport and Newbury,	21,463	Salem and Beverly,	2,394
Wellfleet,	17,500	Plymouth,	1,477
Provincetown,	14,139	Lynn,	1,400
Hingham,	13,882	Duxbury,	1,000
Cohasset,	11,700	Charlestown,	822
Barnstable,	4,115		

At the prices these fish were worth in November, 1836, the value of the year's fishing amounted to \$ 1,264,012 dollars.

Mr. Solomon Lincoln, of Hingham, wrote me that the number of barrels of mackerel taken at that place in 1837 was 17,134½; and that he estimated the gross proceeds of the mackerel fishery of that place for that year at \$ 115,000.

By the "Statistical Tables" drawn up by the Secretary of State, from the reports upon the various branches of industry, by the assessors of the different towns, it appears that the number of barrels of mackerel taken in the year 1837, with their prices, were as follows:— Whole number of barrels, 234,059; value, \$ 1,639,042. Taken by the following counties: Barnstable Co., 76,036; valued at \$ 490,638. Essex Co., 69,599 = \$ 513,663. Suffolk Co., 43,266 = \$ 320,165. Plymouth Co., 25,258 = \$ 179,748. Norfolk Co., 18,450 = \$ 120,528. Middlesex Co., 1,000 = \$ 6,000. Bristol Co., 450 = \$ 3,300.

From the same source, for the year ending April 1st, 1845, we collect the following facts:— Whole number of barrels of mackerel taken, 86,628; value, \$ 637,052. Taken by the following counties: Essex Co., 30,247; valued at \$ 234,385. Barnstable Co., 29,407 = \$ 207,145. Plymouth Co., 10,388 = \$ 74,191. Norfolk Co., 8,859 = \$ 56,583. Suffolk Co., 7,455 = \$ 63,118. Dukes Co., 217 = \$ 1,300. Middlesex Co., 55 = \$ 330.

I have not been able to ascertain with accuracy the number of vessels engaged exclusively in this fishery. In many towns, the same vessels are used, at different seasons of the year, for the cod as well as the mackerel fishery. I have ascertained, however, that there were two hundred and two vessels employed in this fishery in 1836 in the county of Barnstable, and that of this number ninety-eight belonged to Provincetown, which were valued at \$ 147,000.

It might be inferred, from an examination of the above table of the numbers of mackerel inspected in different years, that in some seasons fewer vessels were engaged in the business, or that it was considered at such periods of less importance than at others; this, however, is not a correct conclusion. In some seasons immense shoals of these fish are readily met with, and the vessels return in a few weeks with full cargoes; while the same localities may be visited at other seasons and the efforts of the fisherman prove fruitless, and his fare meagre.

So peculiar are the habits of this species, that oftentimes weeks may pass, the fishing-smacks be surrounded by millions sporting upon the surface of the ocean, and scarce one allow itself to be taken; while, again, the success of a few days will nearly retrieve the disappointments of a season.

Thus a fisherman informed me that, in the year 1837, having been to the Bay of Chaleur, and taken but few fish, the vessel to which he belonged was returning home, when, off Cape Cod, the fish were so numerous and voracious, that the crew, consisting of ten men, captured in two hours nearly thirty barrels of them. At this time about two hundred smacks were together, and they were all equally successful, some of them taking even forty barrels of fish in the same period.

Occasionally this fish visits the very harbors along both shores of Massachusetts Bay, and is taken in great numbers. When they first enter the Bay, immense quantities are captured in the harbor of Provincetown. By the following extract from the Boston Atlas of July 12, 1845, copied from the Gloucester Telegraph, it appears that that place had received a visit from this species: — “For a few days past our harbor has been filled with mackerel; and on Monday about four hundred barrels, it is estimated, were taken in seines, vessels, boats, and from the wharves. Upwards of a hundred barrels were taken in a seine at one haul.” The following, which I extract from a “Statement presented to the Members of the House of Representatives, by Mr. Caleb Cushing,” in reference to a “Bill in Addition to an Act to authorize the Licensing of Vessels to be employed in the Mackerel Fishery,” exhibits the peculiarities of this fish in an interesting manner: — “Their movements and haunts are very precarious, and their habits are more versatile than those of almost any other fish of commercial importance. So true is this, that fishermen who have pursued the business for a long period have but little advantage over those recently engaged in it, in judging, with any degree of certainty, which may be the best spot of fishing-ground at any particular season of the year. It is oftentimes the case, that vessels in extreme parts of the Bay, and in nearly all intermediate stations, will have good fishing for a few days, and for many succeeding days no mackerel will be visible; after which they will appear to rise simultaneously in nearly all parts of the Bay; and in moderate weather large tracts of the surface of the sea will seem to be covered with shoals of the fish, swimming with one side of the gill out of water. At times, the fishermen can take only a few from a shoal, as it passes directly in contact with their vessel, without being induced to stop by bait, or altering its course in the least degree. It occasionally happens, that late in the year the fishermen will reap a rich harvest, when the whole previous season had been comparatively unproductive. Thus it was in the autumn of 1831. In October of that year the mackerel struck in very near to Cape Ann. Large fleets of vessels collected in such close order as to be continually coming in contact. The sea being smooth, and great quantities of bait thrown out, the fish collected in such quantities that some vessels took nearly one hundred barrels in a single day. At the same time they were very abundant off Cape Cod and on Jeffries’ Ledge; and it was computed that more than 70,000 barrels were taken in a single week.”

Several of our most intelligent fishermen inform me that the difficulty of taking mackerel is yearly increasing, from the barbarous custom prevailing of “gaffing” them; that is, of collecting them around vessels by throwing out bait, and then suddenly drawing up an instrument armed with numerous sharp iron points, by which many are captured, and greater numbers are cruelly maimed without being taken.

After being carefully inspected, a ready market is found for these fish, as is shown by the following notice, copied from Mr. Cushing's "Statement," above referred to:— "A small portion of the mackerel, consisting chiefly of the poorest quality, No. 3, is exported to foreign countries. It is not easy to ascertain the precise quantity exported, as the Annual Statement printed by order of Congress embraces all kinds of pickled fish under one head; probably the amount does not exceed 40,000 barrels. They are sent to the West Indies, to South America, to some ports of the Mediterranean, and to the East Indies. But the principal market for this fish is in the United States. Philadelphia, New York, Baltimore, and New Orleans have taken the largest quantities hitherto; but more or less is shipped to most of the chief ports along the seaboard from New York to New Orleans. Thus far Philadelphia, by its rapid and steady increase of demand, has held the lead of other ports. From 1820 to 1825 that city required from 30,000 to 40,000 barrels, as its yearly supply for its own consumption, its interior trade, and its foreign or domestic export. It now receives three times that quantity, and about one third part of the whole product of the fishery. In the Southern States, also, the demand increases with the increased facilities of interior transportation, and must continue to be enlarged, as the interior of the country goes on acquiring access to markets and added population and prosperity. It is understood, also, that this fish, owing to its good qualities as an article of food, and its convenient form for subdivision and distribution among the slaves, is gaining favor in the estimation of the planters of the South. As evidence of which fact, it may be stated, by way of example, that, with a colored population of 210,000 persons, the State of Georgia consumed, the last year (1835), 37,000 barrels, of all qualities, valued there at \$286,750. Doubtless the consumption is proportionably great in all the other planting States."

Labrador, H. R. STORER. The whole of the Atlantic Coast, RICHARDSON. Maine, Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY.

GENUS II. PELAMYS, Cuv.

The teeth strong, separate, and pointed.

PELAMYS SARDA, Cuvier.

The Striped Bonito.

(PLATE XI. FIG. 5.)

Scomber sarda, BLOCH, Systema, p. 22, pl. 334.

" " *Bonetta*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 428.

La Pélamide commune, ou Bonite à dos rayé (*Pelamys sarda*, CUV., *Scomber sarda*, BL.), CUV. et VAL, VIII. p. 149, pl. 217.

- Pelamys sarda*, Skip-Jack, STORER, Report, p. 49.
 " " *Striped Bonito*, DEKAY, Report, p. 106, pl. 9, fig. 27.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 343.
 " " STORER, Synopsis, p. 91.

Color. The head and the upper part of the body are of a greenish-brown color; the sides are lighter, the abdomen of a silvery white. From ten to twenty dark-bluish bands pass obliquely downwards and forwards from the dorsum towards the abdomen; the first of these bands commences at the posterior extremity of the first dorsal fin; the last arises at the commencement of the caudal fin; several of these bands pass very low down upon the sides, almost reaching the abdomen. Besides these, several indistinct lighter-colored bands cross the body transversely. The gill-covers are silvery, marked with fuliginous. The pupils are black; the irides silvery. The first dorsal fin is of a light color, with dull patches. The pectorals are of a dark color above, and lighter beneath. The anal fin is white, with fuliginous. The caudal fin is of a dirty bluish color.

Description. The body is oblong, compressed, perfectly smooth. The scales are exceedingly minute, with the exception of a large triangular patch of larger scales, situated back of the opercles, in the middle of which are the pectoral fins. Several series of longitudinally arranged scales are situated on each side of the dorsum, running the whole length of the first dorsal fin.

The lateral line arises high up on the back, and pursues an undulatory course till it reaches a line opposite the anterior third of the anal fin, whence it is continued in a straight line to the tail.

The length of the head, which is destitute of scales, is less than one fifth the whole length of the fish. The jaws are equal. The jaws and palatine bones have each a single row of sharp, recurved, prominent teeth; upon the middle of the lower jaw are four teeth, the anterior two quite small, the posterior two the largest in the jaws; the palatine bones are very small. The gape of the mouth is large. Eyes circular. Diameter of eye about a sixth the length of the head.

The first dorsal fin commences on a line over the origin of the pectorals; its second and third rays are longest; the posterior rays are very short; the whole fin, when unexpanded, is concealed in a groove at its base. It is continued almost to the origin of the second dorsal.

The second dorsal is nearly triangular, emarginated posteriorly; its posterior portion is slightly tufted like the commencement of finlets; back of this fin are eight finlets, the posterior of which are the smallest.

The pectoral fins arise just back of the operculum. The fan-shaped ventrals are just back of the origin of the pectorals; when unexpanded, these fins shut into a depression on the abdomen.

The anal fin arises on a line with the posterior extremity of the second dorsal, and is shaped like that fin. Seven finlets are situated back of the anal fin.

The anus is small, and situated directly in front of the anal fin. A stout fleshy carina is situated on each side of the fleshy portion of the tail; on each side of the posterior part of this carina two quite small obtuse carinæ run directly backward across the middle of the caudal fin, causing quite a depression between them.

The caudal fin is lunated. Length of the exterior rays, compared with distance between the extremities when expanded, as 3 to $5\frac{1}{2}$.

About twenty inches in length.

The fin rays are as follows: — D. 20-14 + VIII. P. 24 or 26. V. 6. A. 14 + VII. C. 24 or $26\frac{2}{9}$.

Remarks. This species, called by the fishermen in Boston Market the *Skip-Jack*, and by those at the extremity of Cape Cod the *Bonito*, is very rarely met with in Massachusetts Bay; it is occasionally taken at Provincetown, and even at Lynn. South of the Cape, at some seasons, it is frequently caught at Martha's Vineyard, with trailing bait. DeKay remarks that it is but an "occasional visitor" to the coast of New York.

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

GENUS III. THYNNUS, CUV.

Form of the body like that of Scomber, but less compressed. A kind of corselet round the thorax, formed by scales larger and coarser than those of the rest of the body; a long, elevated crest on each side of the tail. The anterior dorsal reaching almost to the posterior one. Numerous finlets behind the dorsal and anal fins. A single row of small, pointed, crowded teeth in each jaw.

THYNNUS SECUNDO-DORSALIS, Storer.

The American Tunny.

(PLATE XII. FIG. 4.)

- Thynnus vulgaris*, CUV., *Common Tunny*, STORER, Report, p. 47.
 " " DEKAY, Report, p. 105, pl. 110, fig. 28.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 343.
 " " STORER, Synopsis, p. 91.

Color. Nearly black above. Silvery upon sides; beneath white. Gill-covers a silvery gray. Pupils black; irides golden, with greenish reflections. Rays of first dorsal fuliginous; connecting membrane nearly black. Second dorsal of a reddish-brown color. Pectorals silvery gray. Ventrals black above; beneath white. Anal finlets, like those on the dorsum, of a bright yellow color; dark at base and upon anterior edge.

Description. Form elongated, gradually sloping from commencement of dorsal to extremity of snout, and tapering from dorsal to tail. Length of head about one fourth length of fish. Depth across base of pectorals, two ninths of entire length; across base of anal, about one seventh; at base of caudal, one twenty-eighth, and in another specimen, one thirty-fourth. Eyes circular; distance between them less than half the length of head. Opercula very large, perfectly smooth. Jaws equal when closed. Tongue large. Inside of mouth blackish. Gape of mouth very large. Entire body covered by large scales, which are almost hidden by superjacent smaller ones, and a thickened membrane. Patches of still larger scales, or bony plates, in front of first dorsal, around pectoral, between it and lateral line.

First dorsal commences just over pectorals. Its rays are very strong, gradually decreasing in length until hardly perceptible; the first the longer. The fin, when unexpanded, shuts out of sight into a deep groove, deepest of course at its origin.

The height of the second dorsal is much greater than that of the first, and more than twice its own length. Followed by ten finlets.

Pectorals falciform. About one seventh of length of fish.

Ventrals, just beneath pectorals; stout, and shutting, like dorsal, into a groove.

Anal commences some distance back of a line from termination of second dorsal. Behind it nine finlets, the middle ones the longer, as is also the case with those of the dorsal.

Caudal lunated. Measured across the extremities of its lobes, it is equal to one third the entire fish. At its base a stout lateral carina of considerable length. Above and below its posterior third are two smaller carinæ.

Owing to the denseness of the membrane which connects them, it is with great difficulty that the fin rays can be counted. As accurately as they could be ascertained, they are as follows:—D. 14-1-13 + X. P. 34. V. 1-5. A. 2-12 + IX. C. 19.

Length of two specimens which I have examined, 8 feet 6 inches and 9 feet 3 inches. Weight, over 1,000 lbs.

Remarks. In the year 1838 I had an opportunity to examine a specimen of this fish, which was taken near Cape Ann, and concluded that it must be the *vulgaris* of Cuvier. Dr. Dekay, in his Report, not having seen an entire specimen, adopted my description and conclusion. During the last spring, a second specimen was examined at Provincetown, and carefully figured by Mr. Sonrel; and I have satisfied myself that it differs from all the species of the genus contained in the *Histoire Naturelle des Poissons*. The following are the differential marks from the *vulgaris*, which it most nearly resembles:—

1st. In the *vulgaris* the height of the second dorsal is about that of the first. In our fish it is much greater, and also as compared with its own length.

2d. In the *vulgaris*, the anal arises on a line with the termination of the second dorsal. In ours, it is several inches behind it.

3d. In the *vulgaris*, the length of the tail, from the point of one lobe to that of the other, is shorter than the length of the head. In ours, it is much longer.

4th. In the *vulgaris*, the length of the pectorals is about one fifth the entire length. In both the specimens here examined, their length was one seventh the entire fish. It, however, differs in all other important respects from the *brachypterus* of the Mediterranean, which, indeed, seems identical with the *brevipinnis* of the same waters; and in this respect, as also in the greater height of its second dorsal, from the *Coretta* of the West Indies.

This species, which is known along our coast as the *Horse-Mackerel* and *Albicore*, comes into Massachusetts Bay about the middle of June, and remains until early in October. At the entrance of the Bay, they are met with in greater quantities than in any other part of it; thus, while a few stragglers are occasionally seen by the fishermen who supply the Boston market daily with cod and haddock, it is not an uncommon circumstance to observe fifty or more in a day at Provincetown. When this fish first appears, it is exceedingly poor, and is perfectly useless. By the first of September it becomes quite fat, and is frequently taken at Provincetown for its oil. This is not extracted from the liver, as in many other fishes, but is obtained from the head and belly by boiling. Sometimes twenty gallons of oil are procured from a single specimen. It is rarely caught with the hook, but is generally taken with the harpoon, in the same manner that whales are captured. Within a few years past, this species seems to have become more shy and distant. I learn from fishermen of veracity, that instances have occurred in which food has been taken by them from the hand when held to them from the boat. It feeds upon menhaden and other small species, which it drives near, and frequently upon, the shore. The fishermen are oftentimes much annoyed by having their nets injured by them. Its flesh is occasionally used for mackerel-bait, but not with us as an article of food, although Dekay states that it is met with in the New York market every season.

GENUS IV. CYBIUM, CUV.

An elongated body without a corselet; and large, compressed, sharp teeth. The palatines have only short and even teeth.

CYBIUM MACULATUM, *Cuv.**The Spotted Mackerel.*

(PLATE XIII. FIG. 1.)

Scomber maculatus, *Spanish mackerel*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 426, pl. 6, fig. 8.*Le Taassard tacheté* (*Cybiium maculatum*, CUV., *Scomber maculatus*, MITCH), CUV. et VAL., VIII. p. 181.*Cybiium maculatum*, *Spotted Mackerel*, STORER, Bost Journ. Nat. Hist., IV. p. 179.

" " AYRES, Bost. Journ. Nat. Hist., IV. p. 261.

" " *Spotted Cybium*, DEKAY, Report, p. 108, pl. 73, fig. 232.

" " STORER, Mem. Amer. Acad., New Series, II. 344.

" " STORER, Synopsis, p. 92.

Color. The top of the head and the upper part of the sides of the body are of a dark leaden color; the sides are lighter; the jaws, opercula, and abdomen are of a beautiful clear white, presenting a satin-like appearance; the dorsal ridge throughout its whole extent is of a beautiful dark-green color; twenty or more circular or oblong spots, situated above and beneath the lateral line, ornament its sides; the most anterior of these spots is beneath the pectoral fins; the largest number of the spots is anterior to the dorsal fin. The membrane connecting the first eight rays of the dorsal fin is black; the second dorsal fin is of a lead-color; the pectorals are black beneath, light above; the ventrals are white.

Description. In its figure it resembles the *S. colias*. Its greatest depth, measured from the origin of the first dorsal fin, is equal to nearly one fourth its entire length.

The length of the head is equal to about one seventh the entire fish, and terminates anteriorly in a sharp point. The eyes are circular. The anterior nostril is the smaller, and is semicircular; the posterior nostril, which is situated directly in front of the centre of the eye, is a transverse slit. The upper jaw terminates in a point; the prominent tip of the lower jaw projects slightly beyond the upper: both of the jaws are furnished with a single row of prominent, sharp, somewhat conical teeth; those situated towards the angle of the jaws are the largest.

The lateral line, which is raised above the general surface of the fish, arises half an inch above the origin of the pectoral fins, and, in the language of Mitchill, "does not travel straight, but crooks and meanders along prettily towards the tail."

The first dorsal fin, when unexpanded, shuts almost completely into a groove at its base; its anterior portion is much higher than the posterior; the second and third rays are the highest; all the rays project beyond their connecting membrane, and are furnished with delicate filaments.

The second dorsal fin is triangular, emarginated posteriorly; its first two rays are simple; posterior to this fin are eight or nine finlets, of the same color as the fin.

The pectoral fins are falciform, and arise directly back of the angle of the operculum.

The ventral fins are quite small.

The anal fin arises opposite the middle of the second dorsal, and is of the same length as that fin; eight or nine finlets are posterior to it, similar in their appearance to those back of the second dorsal fin.

The caudal fin is large and lunated. At its base is a lateral carina, upon which the lateral line terminates; and on each side of this are two smaller carinæ running the entire length of the fleshy portion of the tail.

Length, about twenty inches.

The fin rays are as follows:—D. 18–17 + VIII. P. 20. V. 4. A. 18 + VIII. C. 26.

Remarks. This species, which is found on the coast of South America, and which Dekay speaks of as occurring sparingly in the waters of New York, must be exceedingly rare on the shores of Massachusetts. I have known but five specimens to be taken here; one of these was captured at Lynn, July 24th, 1841, in a seine, in company with several *blue-fish*, and the others were taken at Provincetown, August, 1847. The former measured twenty-one inches in length, the latter but fifteen inches. It roams even farther north than Massachusetts, Captain Atwood having captured a specimen at Mohegan, on the coast of Maine.

Maine, Captain ATWOOD. Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY. South America, CUVIER.

GENUS V. TRICHIURUS, LIN.

Head pointed; body without scales, elongated, compressed, thin, ribbon-shaped. No ventral fins, nor scales instead; no anal fin; a single continuous dorsal fin; tail without rays, ending in a single elongated hair-like filament, from which the generic name is derived. A single row of compressed, cutting, and pointed teeth. Branchiostegous rays, seven.

TRICHIURUS LEPTURUS, *Lin.*

The Silvery Hair-tail.

(PLATE XII. FIG. 1.)

Trichiurus lepturus, LIN., Syst. Nat., p. 409.

Gymnogaster argenteus compressus, cauda attenuata impinna, BROWNE, Jamaica, p. 444, pl. 45, fig. 4.

Trichiurus lepturus, BLOCH, Ichth., v. p. 55, pl. 158.

Trichiurus argenteus, Silver Trichiure, SHAW, Gen. Zoöl., iv. p. 1, pt. 90, fig. 12.

Trichiurus lepturus, STRACK'S Plates, xx. fig. 1.

Trichiurus argenteus, Silvery Hair-tail, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., i. p. 364.

Le Trichiure de l'Atlantique (Trichiurus lepturus, LIN.), CUV. et VAL., VIII. p. 237.

- Trichiurus lepturus*, YARRELL, Brit Fishes (2d edit), i. p. 204.
 " " STORER, Bost. Journ. Nat Hist., iv. p. 181.
 " " DEKAY, Report, p. 109, pl. 12, fig. 35.
 " " STORER, Mem. Amer. Acad., New Series, p. 346.
 " " " Synopsis, p. 94.

Color. Of a uniform silver color throughout. Pupils black; irides golden. Lateral line of a greenish-yellow color. The dorsal fin is greenish-yellow at its base; fuliginous above. The pectorals are yellowish at their base, and more or less fuliginous above.

Description. Body without scales; long, very much compressed, tapering to a point. The abdomen is full, rounded, and smooth on its edge; the inferior portion of the body back of the anus forms an acute edge, which is marked throughout with sharp serrations. The length of my specimen is thirty-nine and a half inches; the length of the head is six inches, or nearly one seventh of its whole length. The head is compressed upon its sides, flattened between the eyes; a protuberance exists upon the top of the occiput, and two similar projections directly back of the eyes. The operculum is large, margined with a very delicate membrane, and presenting numerous very delicate striæ upon its surface; similar striæ are noticeable upon the posterior portion of the superior maxillary bone. The eyes are large and circular; their diameter nearly equal to an eighth the length of the head; the nostrils are large, vertically oval, situated in front of the anterior superior angle of the eye. The gape of the mouth is large. The lower jaw is the longer, with a prominent chin; both jaws have numerous acute, lancet-shaped teeth. At the extremity of the upper jaw are two large, much-incurved, barbed teeth; and back of these, two other similarly formed, rather larger teeth, separated from the former by one or two very minute ones; posterior to these are about a dozen acute unarmed teeth, the posterior ones the largest. At the tip of the lower jaw, on each side, is a large tooth similar to those above them in the upper jaw; when the jaws are closed, these project beyond the upper jaw; and the two anterior teeth of the upper jaw shut into a cavity of the lower, just back of the chin; back of these prominent teeth, in the lower jaw, are from fifteen to seventeen other smaller ones; of these, three, which are the larger, on each side, in about the middle of the jaw, are barbed. The palatine bones are armed with very minute teeth. The tongue is of moderate size, and smooth. A portion of the roof of the mouth is covered by a loose membrane.

The lateral line arises upon the shoulder, at the superior angle of the operculum, curves backwards and downwards to the inferior third of the body, until opposite the fourteenth or fifteenth dorsal ray, when it pursues a straight course to the tip of the tail.

The dorsal fin, which is composed of flexible rays, commences upon a ridge just back of the occipital protuberance, and gradually increases in height towards its middle, then diminishes, and is lost in the naked tail.

The fan-shaped pectoral fins arise from under the posterior inferior angle of the operculum, being partly crossed by that angle ; the first rays, which are highest, are nearly equal to one third the length of the head.

The fin rays are as follows : — D. 133 – 135. P. 12. Length, from two to three feet.

Remarks. This beautiful fish is a Southern species, and is very rarely found in our waters. During twenty years' attention to the fishes of Massachusetts, I have known but two individuals to be taken. One of these was cast ashore, during the summer of 1840, upon the beach at Buttermilk Bay, in the northern corner of Buzzard's Bay ; the other was captured at Wellfleet in the summer of 1845. From this latter specimen, received in a perfectly fresh condition, my figure and description have been prepared.

Dekay states that it is known by the fishermen of New York by the name of *Ribbon-fish*. According to Browne, it is called *Sword-fish* at Jamaica.

Massachusetts, STORER. New York, MITCHILL, DEKAY. Gulf of Mexico, Caribbean Sea, South America, CUVIER.

GENUS VI. XIPHIAS, LIN.

Body fusiform, covered with minute scales ; a single elongated dorsal fin ; ventral fins wanting ; tail strongly carinated ; upper jaw elongated, forming a sword. Mouth without teeth. Branchiostegous rays, seven.

XIPHIAS GLADIUS, *Lin.*

The Sword-fish.

(PLATE XIII. FIG. 2.)

- Xiphias gladius*, LIN., Syst. Nat., p. 432.
 " " *Common Sword-fish*, SHAW, Gen. Zoöl., IV. p. 99, fig. 14.
 " " " " STRACK'S Plates, XXI. fig. 1.
 " " " " PENNANT, Arc. Zoöl., II. p. 113.
 " " " " GRIFFITH'S Cuv., x. p. 187, pl. 27, fig. 1, and Supplement to the Acanthopterygii, p. 349.
L'Espadon épée (*Xiphias gladius*, LIN.), CUV. et VAL., VIII. p. 255, pl. 225 and 226.
Xiphias gladius, WILSON, Encyclopædia Brit., Art. Ichth., p. 184, pl. 202.
 " " JENYNS, Brit. Vert., p. 364.
 " " YARRELL, Brit. Fishes (2d edit.), I. p. 164, fig.
 " " STORER, Report, p. 51.
 " " DEKAY, Report, p. 111, pl. 26, fig. 79.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 347.
 " " " Synopsis, p. 95.

Color. In the fresh fish, the back and upper parts of the sides are almost black ; this color changes to a bluish after death. The abdomen is of a dirty-white color, which afterwards is changed into a silvery gray. The gill-covers are silvery brown, and present on their surface an arborescent appearance.

Description. The surface of the body is smooth. The length of the head from the posterior edge of the operculum to the angle of the jaws equal to one twelfth the entire length of the fish. The length of the lower jaw, from the angle to the chin, equal to one ninth the length of the fish. The length of the sword, from the anterior angle of the eye to its extremity, equal to one third the length of the fish. Upper part of the sword dark brown, almost black, with a groove extending throughout its whole extent. Under portion of the sword lighter colored, and having a velvety feel. The edges of the sword have a bony, shining, perfectly smooth edge. The widest portion of the upper jaw equal to about one twelfth the length of the sword. This upper jaw gradually terminates to a point. Jaws, without teeth; a velvety feel, to the finger, upon the lower jaw. Eyes large and very movable in their orbits; the orbit horizontally oval, the eye itself circular. Branchiæ composed of four pairs of large parallel laminæ, and one smaller one. Branchial membrane composed of eight rays.

The dorsal fin commences nearly on a line above the posterior edge of the operculum. It is strongly falciform, four times as high as the upper jaw is wide; its length is equal to three fourths its height. In the specimen described in my Report, eighteen rays were obvious in the anterior portion of the dorsal; in the specimen from which my present description is written, twenty-one rays may be counted, although the former specimen measured twelve feet five inches, while the present one measures only seven feet three inches. In this specimen, as well as that, the whole dorsal ridge between these rays, and within a few inches of the base of the tail, has no vestige of a ray above the surface, but in their place is a shallow groove throughout the whole extent, supporting a slight membrane; the bases of a few rays are seen, however, upon dissection, beneath the skin. A few inches in front of the base of the tail is situated the extremity of the dorsal fin, composed of three rays in both of the specimens I have seen, slightly emarginated above and terminating posteriorly in a point, and looking like the adipose fin of the *Salmonides*, or the finlets of many of the *Scomberoides*.

The pectoral fins are also falciform, less high than the dorsal; their length a little more than one fourth the height.

The anal fin is formed like the dorsal, and is three fifths its height. The extremity of this fin terminates on the same plane with the dorsal, and is formed much like that. This portion in the former specimen contained three rays, in the present two. This small posterior portion is one eighth the height of the longest rays. At the base of the tail is situated a transverse furrow. On each side of the base of the tail is situated a carina about the height of the posterior extremity of the dorsal fin, and about as long again as high, extending on to the caudal fin.

The caudal fin is very deeply forked.

The fin rays are as follows: — D. 18–3. P. 15. A. 11–2–3. C. 17.

Remarks. This species is seldom seen in Massachusetts Bay, but is a common fish at some seasons of the year from Nantucket to Block Island, and has become quite an article of commerce. It is generally discovered by the fishermen by the projection of its dorsal fin above the surface of the water, as it is pursuing shoals of mackerel and menhaden, upon which it feeds. It is occasionally taken with a hook baited with one of these fishes, but almost always it is captured with an instrument called a “lily-iron,” from the form of its shafts or wings, which resemble the leaves of a lily. This instrument is thrown, like a harpoon, with great force, into the fish, the attempt always being made to wound the animal in front of the origin of the dorsal fin. When wounded, it sometimes frees itself from the iron by its struggles; and has been known to dive with so much force towards the bottom of the sea, as to bury the sword its whole extent into the sand or mud, which was proved by its appearance when taken. When unmolested, it is observed, not unfrequently, to spring several times its length forwards, some feet above the surface of the water. It appears at Gay Head about the first of June, and remains there until into September. Fifteen to twenty boats are employed from Martha’s Vineyard and Noman’s Land in this fishery. At Noman’s Land, two men in a boat not unfrequently take eight in a day. When caught, their heads and fins are cut off, and they are carried fresh to New Bedford market, where they are sold like the halibut, cut into slices, or cut into slices and pickled or salted, and kept for sale in that state throughout the year. In the first part of the season they sell fresh for four cents per pound, but late in the season they do not bring more than two cents per pound. When salted, the flesh is worth \$6 per barrel. About one third of the quantity taken is sold fresh. About two hundred barrels of this species are yearly captured at Martha’s Vineyard. Very rarely is the flesh of this species offered for sale in Boston market, although when salted it is preferred by many to that of several other species.

The largest individuals weigh about three hundred and fifty pounds.

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

GENUS VII. PALINURUS, DEKAY.

Preopercle serrated, with spines on its margin. Opercle with one or more flat spines, more or less distinctly serrated beneath. Anal with one or more spines in front. Teeth small, pointed, subequal. Body compressed, oblong. The anterior portion of the single dorsal spinous.

PALINURUS PERCIFORMIS, *Dekay*.*The Black Pilot.*

(PLATE XIII. FIG. 3.)

- Rudder-fish, or Perch Coryphæna*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. pl. 6, fig. 7. No description.
 " " " *Coryphæna perciformis*, MITCHILL, Amer. Month. Mag., II. p. 244.
Trachinotus argenteus, STORER, Report, p. 53.
Palinurus perciformis, Black Pilot, DEKAY, Report, p. 118, pl. 24, fig. 25.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 351.
 " " " Synopsis, p. 99.

Color. Of a bluish-white color upon the sides, covered with minute black punctures, the lower portion of the sides and abdomen of a lighter color; the top of the head and back mottled with black blotches. In the immature fish the color is a dark brown, variegated with yellow patches.

Description. The body of this fish is oblong. The head in length is equal to one fourth that of the body; a bony ridge is observed over the eyes; the diameter of the eyes is rather more than one fourth the length of the head. The operculum is large, naked, of a horny texture, margined by a membrane. The preoperculum is strongly serrated throughout, more conspicuously posteriorly. A depression exists upon the top of the head between the eyes. The distance between the eyes is equal to twice the diameter of the eyes. The nostrils are situated directly in front of the anterior superior angle of the eyes; the posterior is much the larger. The jaws are of equal length, with small, sharp teeth; the upper jaw descends abruptly.

The lateral line commences high above the operculum, and, curving over the pectorals to their extremities, pursues a straight course to the tail.

The dorsal fin, whose fleshy portion is preceded by eight spinous rays, commences back of a line opposite the posterior angle of the operculum, and is continued to the fleshy portion of the tail.

The pectorals are just beneath the posterior angle of the operculum; they are as long again as high.

The ventrals are more than half the length of the pectorals; their outer ray is spinous.

The anal fin arises just in the middle of the body, and is as long again as high; this fin is preceded by three spinous rays.

The caudal fin is quite deeply lunated.

Length, about twelve inches.

The fin rays are as follows: — D. 8–22. P. 19 to 21. V. 1–5. A. 3–17. C. 16½.

Remarks. This species, which, while preparing my Report, I considered to be the *Trachinotus argenteus* of Cuvier, is occasionally found in New York, according to DeKay, and is not unfrequently met with at Holmes's Hole. Dr. Yale writes me, from the latter place: "It follows vessels, or keeps near old casks or planks that are floating, and sometimes is found about the wharf-logs in our harbor." The only specimen I have known to be captured north of Cape Cod was taken at one of the wharves in this city, September 12, 1846.

It is known by the fishermen at Martha's Vineyard as the *Rudder-fish*.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

GENUS VIII. CARANX, CUV.

Body covered with small scales, with the exception of the lateral line, which is armed with a series of broad scales, those on the posterior half of the body having an elevated horizontal keel in the centre, forming a continuous ridge, each scale ending in a point directed backwards. Two distinct dorsal fins; free spines before the anal fin; teeth exceedingly minute; branchiostegous rays, seven.

CARANX CHRYSOS, Cuv.

The Yellow Mackerel.

(PLATE XIV. FIG. 1.)

Scomber chrysos, *Yellow Mackerel*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 424.

Le Carangue jaune (*Scomber chrysos*, MITCH. ; *Scomber hippos*, LIN.), CUV. et VAL., IX. p. 93.

Caranx chrysos, *Yellow Caranx*, DEKAY, Report, p. 121, pl. 27, fig. 85.

" " " " STORER, Proceedings of Bost. Soc. Nat. Hist., I. p. 148.

" " " " " Mem. Amer. Acad., New Series, II. p. 353.

" " " " " Synopsis, p. 301.

Color. Of a greenish-blue color upon the back and upper portions of its sides; the greater portion of the sides of a bright yellow. An obscure dark-brown blotch is observed at the posterior superior angle of the operculum. The abdomen is yellowish-white. The pupils are black; the irides golden. The dorsal and pectoral fins are yellowish-brown. The caudal fin is yellowish throughout its greatest extent. The ventrals and the anal are of the color of the sides.

Description. The length of the head is less than one fourth the length of the entire fish. The top of the head and the gill-covers are smooth, and destitute of scales; the top of the head is arched; upon its top is a distinct ridge, which passes from above and

between the nostrils to the spine before the first dorsal fin. The eyes are large and circular; the portion at the superior anterior angle of the eyes is translucent; at the anterior extremity of this space the nostrils are situated, and are obliquely oval, the posterior being the larger. The jaws are about equal in length, armed with numerous very minute teeth, which are also observed on the vomer and palatine bones. The tongue is rounded and single.

The lateral line commences just back of the blotch upon the opercula, and passes (slightly obliquely) upwards opposite the posterior half of the pectorals, then courses downwards to near the extremities of the pectorals, whence it proceeds in a straight line to the extremity of the fleshy portion of the tail. The lateral line is smooth until it assumes a straight course; thence it is armed with horny plates, about forty-eight in number; these plates at first are scarcely observable; they become gradually larger, and are most prominent upon the fleshy portion of the tail; they are most crowded at its termination. These plates terminate posteriorly in an acute angle, rendering the line a sharp ridge.

Just in front of the first dorsal fin is a naked recumbent spine, which projects forwards.

The rays of the first dorsal fin are so broken in my specimen that I am obliged to use the words of Dekay respecting it, and also to copy this portion of his figure: — “The first dorsal fin is triangular. This fin is composed of eight spinous rays; the first short, slender, and closely attached to the second, which is shorter than the third; the fourth longest, and all received into a deep groove.”

The second dorsal arises on a line just before the termination of the pectoral fins; its rays are connected by a dense membrane; the first ray is shorter than the second; the first half-dozen rays much the highest; the posterior rays are very short. This fin shuts into a fleshy groove when unexpanded; the fin is continued to the fleshy portion of the tail.

The pectoral fins commence just beneath the posterior angle of the operculum; they are long, falciform, articulated.

The ventral fins are situated just back of the pectorals; when closed, they are received into a concavity of the abdomen, to which they are attached by a membrane connected to their inferior rays.

The anal fin is of a similar form with the second dorsal, and, like that fin, shuts into a groove at its base. Two strong spines are situated before this fin.

The caudal fin is deeply forked; two carinæ are seen on each side of its base.

Length, seven and a half inches.

The fin rays are as follows : — D. 8-24. P. 21. V. 1-4. A. 2-1-20. C. 19 $\frac{1}{4}$.

Remarks. I have seen a single specimen only of this species, which was taken from one of the bridges connecting Charlestown with this city. According to Dekay, it is found in great abundance at New York in the autumn.

Massachusetts, STORER. New York, MITCHILL, CUVIER, DEKAY.

GENUS IX. ARGYREIOSUS, LACEP.

Body much compressed. Spines between the dorsal fins. Dorsal, ventral, and anal rays filamentous.

ARGYREIOSUS CAPILLARIS, *Dekay.*

The Hair-finned Dory.

(PLATE XIV. FIG. 3.)

Zeus capillaris, Hair-finned Dory, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 383, pl. 2, fig. 2.

Argyreiosus capillaris, Hair-finned Argyreiose, DEKAY, Report, p. 125, pl. 27, fig. 82.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 356.

“ “ “ Synopsis, p. 104.

Color. Of a beautiful silvery color, with several dark, almost black, transverse bands crossing the upper part of the sides ; these bands disappear in the dead fish. The dorsal and ventral filaments are black.

Description. The body, which is perfectly smooth, is of an irregular rhomboidal form, exceedingly compressed laterally. The forehead is high, and gradually slopes to the snout, which is very prominent.

The length of my specimen is two inches and five eighths ; its depth from the base of the first dorsal across to the pectorals is about two inches ; its greatest thickness is less than one quarter of an inch. The length of the head is seven eighths of an inch. The jaws are equal when closed. The eyes are circular, and are a little more than an eighth of an inch in diameter. The nasal orifices are directly in front of the eyes. The branchial rays are exposed. A slightly raised line passes upward from the upper portion of the operculum, curving backward before reaching the base of the first dorsal. Just back of this commences the lateral line, which at its origin rises immediately, makes a semicircle of an inch in height, and is then continued in a straight line to the tail. Three slight protuberances are situated anterior to the first dorsal fin.

The first dorsal fin is composed of eight rays, the first of which is a minute spine ; the second is a membranous ray prolonged into a filament, measuring in its whole extent

four and a half inches; the third ray is about half an inch long; the remaining five rays are small, naked spines.

The second dorsal fin, which appears to be almost a continuation of the first dorsal fin, is continued nearly to the tail. The first ray is spinous; the second ray is nearly an inch long; the fifteen posterior rays are of equal height.

The pectoral fins are situated directly on a line with the base of the first dorsal.

The ventral fins are an inch and five eighths in length. Anterior to the anal fin are two small spines. The first ray of the anal fin is spinous; the first four membranous rays are longer than the remainder; the first membranous ray is half an inch long; the posterior rays are as high as the corresponding ones of the second dorsal fin. This fin terminates opposite the termination of the second dorsal.

The caudal fin is deeply forked; the depth of its fleshy portion is less than the eighth of an inch; the length of its rays is half an inch.

The fin rays are as follows: — D. 8 - 1 - 22. P. 17. V. 1 - 5. A. 2 - 1 - 18. C. 17. Length, five and a half inches.

Remarks. The only individual of this species I have known to be taken on our coast, was captured in a seine at New Bedford, in August, 1842, and sent to me by Mr. William H. Taylor of that place. I received it in fine condition, and from it the accompanying figure was made. DeKay observes that this fish is taken in the month of August "in very inconsiderable numbers" in gill-nets.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

ARGYREIOSUS UNIMACULATUS, *Batchelder.*

The One-spotted Dory.

(PLATE XIV. FIG. 2.)

Argyreiosus unimaculatus, BATCHELDER, Proceed. Bost. Soc. Nat. Hist., II. p. 78.

" " STORER, Mem. Amer. Acad., New Series, II. p. 523.

" " " Synopsis, p. 271.

Color. Above, light bluish-slate; on sides and belly, silvery; an ill-defined fuliginous band passing upwards, slightly backward, from superior angle of eye. On sides, over vertebral column, but not reached by pectorals, a single darkish oblong spot, of moderate size.

Description. Outline of body semicircular beneath, semioval above; truncated and inclined in front; its depth five eighths its length, of which its greatest thickness is about one eleventh, it being very much compressed. Head large, gibbous above, thence

inclined forwards. Mouth and throat greatly projecting. Length of head about one third the length of body; its depth through eyes about three fifths the greatest depth. Eyes rather large, situated about midway between top of head and throat; their diameter about three fifths of the distance above them. Nostrils double, in front of eye; the anterior nearly beneath the posterior. Jaws about equal. Scales wanting. Lateral line with an abrupt curve over pectorals to lateral spot; thence straight to tail.

First dorsal commences slightly in front of pectorals. Second ray strongly filamentous; others somewhat so. Between this and the second dorsal four short but well-defined spines.

The first ray of the second dorsal is short and spinous; the next four much longer than the rest, which are of nearly equal length.

Pectorals quite large, of an elongated oval shape.

Ventrals somewhat filamentous, with an almost concealed spine at base.

Anal preceded at some distance by two spines, of which the anterior is the smaller; another spine at origin of the fin. Along its base, as at that of the dorsal, are spines corresponding in number to the rays, their points directed backward.

Caudal fan-shaped and deeply emarginate.

Length, two inches.

The fin rays are as follows:—D. 8-1-22. P. 9. V. 4. A. 2-1-17. C. 20.

Remarks. Although in many respects this fish resembles the *A. capillaris*, I think it must be distinct, and if so, the *unimaculatus* of Batchelder. His specimen was taken at Saco, Maine. The only specimen I have seen was caught in a scoop-net at one of the bridges leading to South Boston, in October, 1847, and sent to Dr. Gould, who kindly transmitted it to me.

Maine, BATCHELDER. Massachusetts, STORER.

GENUS X. SERIOLA, Cuv.

Lateral line with scales not larger than those on the rest of the body. First dorsal fin with a continuous membrane. No finlets.

SERIOLA ZONATA, Cuvier.

The Banded Mackerel.

(PLATE XV. FIG. 5.)

Scomber zonatus, Banded Mackerel, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 427, pl. 4, fig. 3.
La Seriole à ceintures, Seriola zonata, CUV. et VAL., IX. p. 213.

Seriola zonata, DEKAY, Report, p. 128, pl. 9, fig. 26.

" " STORER, Mem. Amer. Acad., New Series, II. p. 357.

" " " Synopsis, p. 105.

Color. Of a silvery-brown color; lighter upon the sides, with a yellowish tint, which is also observable upon the opercula and along the lower jaw. Five well-marked dark-brown transverse bands, upon the sides, passing from the dorsum to the abdomen, are continued upon the dorsal fin.

The first dorsal fin is black. The second dorsal fin has a yellowish tinge; its first rays are tipped with white. The ventrals are fuliginous beneath, with their extremities yellowish-white. The centre of the anal fin is of a greenish brown; its base and tips are white. The caudal fin is yellowish-green, with a dusky tinge at its base and posterior portion; its extremity is white.

Description. Body elongated, compressed, with very minute scales. Its greatest depth is more than the length of its head. The length of the head is less than one third the length of the body; the top of the head and the opercula are destitute of scales. The eyes are circular, and of moderate size. The nostrils are double, oval, just anterior to the edge of the superior orbital bone. The gape of the mouth is large; the jaws are armed with several rows of minute card-like teeth. The tongue, pharynx, palatine, and vomer roughened by slight asperities.

The lateral line, which is a mere thread, commences at the superior angle of the operculum, and slants downwards in an undulatory manner to about opposite the middle of the second dorsal fin, whence it pursues a straight course to the tail, being elevated into a ridge upon its fleshy portion, forming a well-marked carina.

Just in front of the dorsal fin is a small distinct truncated spine, pointing forwards.

The first dorsal fin, which is composed of seven spinous rays, is quite small and triangular; it arises just back of the pectorals, and is united by a prolongation of its connecting membrane to the base of the first ray of the second dorsal fin; its third and fourth rays are highest; the first ray and last two rays are very short.

The second dorsal fin arises opposite the extremity of the ventrals, and is continued until within a short distance of the tail; it is high at its origin, diminishes in height until about the fourteenth or fifteenth ray, and the remainder of the rays are about the same height; the rays are bifid at their extremities, all of which slightly project above the connecting membrane.

The pectoral fins are subtriangular, and are situated directly beneath the posterior angle of the operculum.

The ventral fins are just beneath the origin of the pectorals, and are composed of five strong multifid rays.

Just anterior to the origin of the anal fin are two very minute naked spines, the anterior of which is the smaller.

The anal fin is similar in form to the second dorsal, and terminates on a plane with it.

The caudal fin is very deeply forked; its rays are articulated, and its two extremities terminate in sharp points.

Length, about ten inches.

The fin rays are as follows: — D. 1-7-38. P. 20. V. 6. A. 2-20. C. 15 $\frac{1}{2}$.

Remarks. I have seen but two specimens of this fish. Both of these were caught in the harbor of Wellfleet, one in August, 1844, and the other in November, 1849. DeKay speaks of it as not being uncommon in Long Island Sound.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

GENUS XI. TEMNODON, Cuv.

The tail unarmed; the little fins or the detached spines before the anal, as in *Seriola*. The first dorsal fragile and low, the second and the anal covered with small scales; but the principal character consists in a row of separated, pointed, and cutting teeth in each jaw; behind the upper ones is a row of smaller teeth, and there are some fine as velvet on the vomer, palate, and tongue. The operculum terminates in two points, and there are seven branchiostegous rays.

TEMNODON SALTATOR, Cuv.

The Blue-fish.

(PLATE XV. FIG. 1.)

Saltatrix, *Skipjack*, *Green-fish*, LIN., CATESBY'S *Carolina*, II. pl. 14.

Gasterosteus saltatrix, LIN., 12 edit., p. 491.

“ “ *Skipping Stickleback*, SHAW, *Gen. Zoöl.*, IV. p. 609.

Pomatome Skip, LACEPEDE, IV. p. 436.

Scomber plumbeus, *Horse-Mackerel*, MITCHILL, *Trans. Lit. and Phil. Soc. of N. Y.*, I. p. 424, pl. 4, fig. 1.

Le Temnodon sauteur (*Temnodon saltator*, CUV.; *Perca saltatrix*, LIN.; *Cheilodiptere poptucanthe*, LACEP.), CUV. et VAL., IX. p. 225, pl. 260.

Temnodon saltator, *Blue-fish*, STORER, *Report*, p. 57.

“ “ “ AYRES, *Bost. Journ. Nat. Hist.*, IV. p. 261.

“ “ “ DEKAY, *Report*, p. 130, pl. 26, fig. 81.

“ “ “ STORER, *Mem. Amer. Acad.*, *New Series*, II. p. 360.

“ “ “ “ *Synopsis*, p. 108.

Color. The upper part of the body is bluish; a greenish tinge upon the sides and abdomen. The irides are yellow. The pectorals are of a greenish-brown color, with a deep black blotch at their base beneath. The second dorsal and caudal fin are likewise of a greenish-brown color. The ventral and anal fins are of a bluish-white color.

Description. Body oblong, compressed, becoming suddenly narrower at the base of the tail. Length of the head not quite equal to one fourth the length of the fish; head above naked. Preoperculum naked beneath, finely denticulated upon its inferior edge, and terminated inferiorly and posteriorly in an obtuse angle. Eyes circular, and moderate in their size. Operculum terminating in two membranous points superiorly and posteriorly, which do not amount to spines. Nostrils double, terminating in the same cavity; the anterior orifice is perpendicularly ovate, and situated directly in front of the posterior, which is larger and crescent-shaped. Gape of the mouth large. Jaws armed with prominent, sharp, lancinated teeth; the lower jaw has but one row of these, ten or twelve in number; the upper, besides a similar row to that in the under, has a row of very small teeth back of these. A row of very minute teeth at the base of the tongue; also small teeth upon the vomer. The lateral line commences just above the posterior angle of the operculum, and, curving slightly at its commencement, pursues nearly a straight course to the caudal rays.

The first dorsal fin, commencing on a line with the anterior half of the pectorals, is composed of seven spinous rays, the second, third, and fourth of which are longest; the rays of this fin are connected by a membrane, which proceeds obliquely backwards from the posterior tip of one to the anterior centre of the succeeding ray. This fin, when not expanded, is received into a groove at its base.

Just back of the first dorsal commences the second, which is nearly as long as the head; it is composed of a very dense membrane, which envelops all the rays, the second, third, fourth, fifth, and sixth of which are longest; this fin is slightly emarginated above, and its posterior termination resembles a finlet.

The pectorals are triangular.

The ventrals are beneath the pectorals, and are fan-shaped.

The anal fin, similar in its structure and form to the second dorsal, arises just back of the origin of that fin, and terminates nearly on a line with the termination of it.

The caudal fin is large, and deeply forked.

Length, about eighteen inches.

The fin rays are as follows: — D. 7–26. P. 17. V. 6. A. 28. C. 20.

Remarks. On some parts of our coast this is a common species. Many years since, it was held in high estimation by the aborigines of our country. For a long series of years it disappeared from our waters, as may be learned from a journal of the first settlement of the island of Nantucket, written by Zaccheus Macey, in 1792, and contained in the third volume of the *Massachusetts Historical Collections*. In this account, notice is taken of a great pestilence which attacked the

Indians of that island in 1763 and 1764, with such mortality that, of 353, the whole number, 222 died. He adds: "Before this period, and from the first coming of the English to Nantucket, a large fat fish, called a *blue-fish*, twenty of which would fill a barrel, was caught in great plenty all round the island, from the 1st of the 6th till the middle of the 9th month. But it is remarkable that in the year 1764, the very year in which the sickness ended, they all disappeared, and that none have been taken since." Occasionally, for the last thirty years, a few straggling specimens, very small, have been taken, but they were rarely seen until within the last fifteen years. During this latter period, they have gradually increased in numbers, and, generally speaking, have been of much larger size than when they were first observed. Now they visit the coast south of the Cape, at Buzzard's Bay, the Vineyard Sound, and Nantucket, in large numbers; and also Massachusetts Bay as far as Boston, from the wharves of which city I have observed specimens to be taken yearly since September, 1844. This species occasionally weighs fourteen pounds. In its flavor it resembles the mackerel, and is highly esteemed by many as an article of food; but it is excessively fat, and cannot always be borne by the stomach. In the early part of summer it is very lean; towards the latter part of summer and the commencement of autumn, it is in a state of perfection for the epicure. Its food is herring and mackerel, and when it appears these fisheries are destroyed. Thus, in March, 1846, the *herring fishery* on the south side of Falmouth was spoiled by the ravages of this species. On the night of the 27th of June, 1847, Captain Atwood caught in his mackerel-nets two large blue-fish. He fished but two nights more that season;—the blue-fish had driven the mackerel entirely from the coast. From that time until now, 1853, the mackerel fishery at Provincetown has been ruined. It is usually caught from the shore at Nantucket by throwing a drail,—a hook fixed into a piece of bone or ivory, and sometimes pewter, somewhat in the form of a fish, with brass wire around the line near it, to prevent its being bitten off by the strong jaws of the fish. It is also caught from a boat under sail with a good breeze, the line dragging behind; and they have been taken with a seine. In a number of the *Nantucket Enquirer*, July 8th, 1837, I find the following: "A few days since, there were caught at one haul, 241 blue-fish, 108 scuppaugs or poggies, 28 bass, and 19 shad, in all 396 fish, weighing about half a ton."

Maine, H. R. STORER. Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHILL, DEKAY. South Carolina, LIN., CUV.

GENUS XII. RHOMBUS, LACEP.

Head and body compressed. Body covered with minute scales. Extremity of the

pelvis forming, anterior to the anus, a small, pointed, and cutting blade, which resembles a vestige of the ventral fins. A horizontal, partially concealed spine before the dorsal and anal fins.

RHOMBUS TRIACANTHUS, *Dekay*.

The Skipjack.

(PLATE XV. FIG. 4.)

Stromateus triacanthus, PECK, Mem. Amer. Acad., II. p. 48, pl. 2, fig. 2.

Stromateus cryptosus, *Cryptous Broad-Shiner*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 365, pl. 1, fig. 3.

Peprilus cryptosus, CUV., Griffith's Transl., X. p. 203.

Le Rhombe à fossettes (*Rhombus cryptosus*, NOB., *Stromateus cryptosus*, MITCH.), CUV. et VAL., IX. p. 408.

Peprilus triacanthus, *Three-spined Peprilus*, STORER, Report, p. 60.

Rhombus triacanthus, *Short-finned Harvest-fish*, DEKAY, Report, p. 137, pl. 75, fig. 80.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 362.

“ “ “ Synopsis, p. 110.

Color. Of a leaden color upon the back; lighter upon the sides; silvery beneath. The cheeks, intermaxillaries, chin, base of pectorals, and base of caudal fin, together with more or less of the abdomen, sprinkled with very minute black dots. The opercles are cupreous.

Description. The body is ovate, very much compressed laterally, particularly at the abdomen. The arch of the back is continued to the spine at the origin of the dorsal fin. The length of the head is rather more than one fifth the length of the body, and is gradually arched from the snout. The eyes are circular; their diameter is equal to one fourth the length of the head. The nostrils are small; the anterior is circular, the posterior a vertical fissure. The mouth is of moderate size. The jaws are of equal length, and present at their edges a large number of very minute, equal, compact teeth.

The lateral line, which is very well marked, commences just back of the posterior angle of the operculum, and, arching backwards, curves with the back to the base of the caudal fin. A slightly depressed straight line, destitute of scales, is seen passing from beneath the origin of the lateral line to the middle of the fleshy portion of the tail; and another line, similar in appearance to the last, though not so obvious, passes from the inferior base of the pectorals, curving with the abdomen, to the lower part of the fleshy portion of the tail, corresponding in its course to that of the lateral line. These lines gradually disappear after death. On each side of the dorsal fin, commencing at its origin and terminating towards its posterior half, are situated between twenty and thirty small circular black punctures, the orifices of mucous ducts.

At the origin of the dorsal fin is a small, naked, horizontal spine, pointing forwards. The dorsal fin commences opposite the anterior half of the pectorals, and is continued to the fleshy portion of the tail. The fifth, sixth, and seventh rays are the highest. The

most posterior rays are not quite equal to one fourth the height of the highest rays. The height of the pectorals is one fifth greater than the height of the head.

Just back of the anus is a minute naked spine, pointing forwards like that before the dorsal fin.

The anal fin terminates opposite the extremity of the dorsal fin. The membrane uniting the rays of this fin, as well as that of the dorsal fin, is very fine, appearing to be a continuation of the cuticle of the fish; it is not continued to the extremities of the rays, which are naked and bifid. Some distance anterior to the anus is a very minute spine, which is naked and directed backwards.

The caudal fin is deeply forked; its longest rays are higher than the length of the head. Length about ten inches.

The fin rays are as follows:—D. 45. P. 21. A. 43. C. 20.

Remarks.— This species was first described by Professor Peck in 1794, and his communication was published in the Memoirs of the American Academy for 1804. His description, which was a very accurate one, was accompanied by a respectable figure. His specimens were taken on the coast of New Hampshire. This fish, which is known upon some portions of Cape Cod as the *Sheep's-head*, and at Provincetown by the name of *Skipjack*, is not uncommon in the waters of our State. It is taken along the Cape, in considerable quantities, in nets with bass and mackerel. I have known a single specimen to be taken from one of the wharves in this city. A peculiarly unpleasant odor is emitted by this fish when caught, resembling somewhat that of sulphuretted hydrogen, which sometimes produces a faintness accompanied with headache in the captor. It is used as bait for the *Striped Bass* by our fishermen. By some it is considered an excellent pan-fish. Being very oily, it is principally used for manure upon several portions of Cape Cod.

New Hampshire, PECK. Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHILL, DEKAY.

GENUS XIII. SPHYRÆNA, Cuv.

Body elongated, with two distinct dorsals. Lower jaw longest; both with long teeth. Ventrals back of the pectorals.

SPHYRÆNA BOREALIS, *Dekay*.

The Northern Barracuda.

(PLATE XII. FIG. 3.)

- Sphyræna borealis*, *Northern Barracuda*, DEKAY, Report, p. 39, pl. 60, fig. 196.
 “ “ “ “ STORER, Proc. of Bost. Nat. Hist. Soc., I. p. 148.
 “ “ STORER, Mem. Amer. Acad., New Series, II. p. 300.
 “ “ “ Synopsis, p. 48.

Color. Of a greenish brown above, silvery beneath; this silvery appearance is more striking upon the inferior portions of the head and throat. The lateral line and caudal fin are yellow.

Description. Body very much elongated and slightly compressed. Length of head equal to about one fourth the length of the body; it is flattened above and ridged; this upper portion of the head, as well as its sides in front of the eyes, and the intermaxillaries, is destitute of scales; gill-covers with minute scales. The operculum terminates posteriorly in an acute angle; preoperculum rounded posteriorly. Eyes large, circular; distance between eyes equal to diameter of eye. Nostrils situated directly in front of eye; the anterior circular and the smaller. Snout obtuse; lower jaw projecting beyond the upper. Gape of mouth large. Fleshy protuberance at chin. Posterior teeth in lower jaw largest of all, with the exception of the two anterior. Two prominent sharp teeth on each side of tip of upper jaw. A large number of very minute teeth are seen upon the intermaxillaries; numerous teeth also upon the palatines on each side, the three anterior of which are much the largest. Tongue rough. The lateral line commences at the posterior superior angle of the operculum, and, curving slightly downwards to a line above the posterior half of the pectoral fin, pursues a straight course thence to the tail. The scales along the lateral line slightly resemble those in the same situation of the genus *Caranx*.

The first dorsal fin commences nearly opposite the origin of the ventral fin. It is of a triangular form; its membrane is exceedingly delicate; the second ray is the highest; the first and third are equal; the length and greatest height of the fin are equal. The tips of all the rays project considerably beyond the connecting membrane.

The second dorsal fin commences anterior to the anal, and is subquadrangular. The membrane connecting the rays is much firmer than that of the first dorsal. The first ray is simple, the others bifurcated.

The pectorals commence just beneath the posterior angle of the operculum. The first ray is simple; its height is about equal to that of the first dorsal.

The ventrals are situated beneath the first dorsal; they are a little shorter than the pectorals.

The anal is situated beneath the second dorsal, and its height is about equal to the height of that fin.

The caudal is deeply forked.

Length about nine inches.

The fin rays are as follows:—D. 5–10. P. 14. V. 6. A. 10. C. 20.

Remarks. Several specimens of this fish were sent me in September, 1843, by Dr. Yale, from Holmes's Hole.

Massachusetts, STORER. New York, DEKAY.

FAMILY VI. ATHERINIDÆ.

Mouth protractile; no notch on the upper jaw, nor tubercle on the lower. Suborbital not dentated. A broad silvery band on the side. Very small crowded teeth on the pharyngeals. The first branchial arch with long pectinations. Two dorsal fins, most commonly distant. Ventrals behind the pectorals.

GENUS I. ATHERINA, LIN.

Body elongated. Two dorsals widely separated; ventrals further back than the pectorals; mouth highly protractile, and furnished with very minute teeth. A broad silvery band along each flank on all the known species.

ATHERINA NOTATA, *Mitch.**The Dotted Silver-side.*

(PLATE XVI. FIG. 1.)

- Atherina notata*, *Small Silver-side*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 446, pl. 4, fig. 6.
L'Athérine de Bosc (*Atherina Boscii*, CUV., *Atherina notata*, MITCH.), CUV. et VAL, X. p. 465.
Atherina Boscii, *Small Silver-side*, STORER, Report, p. 62.
 " " " " AYRES, Bost. Journ. Nat. Hist., IV. p. 262.
Atherina notata, *Dotted Silver-side*, DEKAY, Report, p. 141, pl. 28, fig. 88.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 366.
 " " " Synopsis, p. 114.

Color. Alive, the entire fish is translucent, with the exception of the abdomen, which is rendered opaque by the contained viscera. The body is greenish above, with minute black dots distributed along the edges of the scales upon the upper portion of the sides, and over the entire scales upon the dorsum, making it to appear quite dark-colored. Upon the sides a beautiful broad silvery band runs from the upper base of the pectorals to the tail; along its upper edge runs the black lateral line; the portion of the body beneath this band is of a lighter color than that above it, and of a silvery appearance. Minute black dots exist between the rays of the anal fin at its base. The fins are all translucent, colorless, and articulated. The top of the head is covered with minute black dots, similar to those on the scales. The space between the eyes is nearly black, owing to the black pupils beneath. The pupils are deep black, the irides a beautiful silvery color. A golden reflection is seen upon the operculum, which in some specimens is continued along the abdomen to the vent.

Description. The body is elongated, somewhat compressed, flattened upon the top of

the head. The scales are rounded, smooth at their edge with concentric striæ. Its greatest depth is equal to about one seventh its whole length. The length of the head is rather more than one fifth the whole length of the body. The eyes are horizontally oval; their greatest diameter is equal to one fourth the length of the head; the distance between the eyes is equal to their greatest diameter. The upper jaw is slightly the longer when the mouth is closed; the lower jaw, when closed, is situated obliquely with regard to the upper; both jaws are armed with minute teeth. The mouth is very protractile.

The first dorsal fin arises at a distance back of the posterior extremity of the pectorals about equal to half the length of the head. It is subtriangular when expanded, with a very delicate connecting membrane. Its first ray is shorter than the three next posterior; the last ray is connected to the dorsum by a prolongation of the connecting membrane.

The second dorsal fin is situated back of the first, at a distance equal to that at which the first dorsal is back of the extremities of the pectorals. This fin is quadrate, slightly emarginated above; its posterior ray projects slightly beyond the preceding rays.

The pectoral fins commence directly back of the upper part of the operculum; their highest rays are equal to three quarters the length of the head; the length of the fin is equal to one third of its height. The upper rays are as high again as the lower rays, when unexpanded. These fins cover a portion of the silvery lateral band.

The ventral fins are fan-shaped, and arise on a line opposite the posterior rays of the pectorals; their rays are multifid; they are connected at the inner edge of their base by a delicate membrane.

The anal fin is situated just back of the commencement of the first dorsal fin; it is much elongated, and terminates just posterior to the second dorsal. Its first eight or ten rays are much the highest.

The caudal fin is deeply emarginated. The height of its outer rays is equal to the height of the pectorals.

The fin rays are as follows: — D. 5–9. P. 12. V. 5. A. 25. C. 18.

Remarks. This species, specimens of which I have received from Holmes's Hole and Provincetown, in the spring and autumn accompanies the smelt in large numbers into the mouth of Charles River at Boston, and is taken by the boys, by whom it is invariably called the *Capelin*; which is the common name of the *Mallotus villosus*. In the third volume of the *Massachusetts Historical Collections*, for 1794, this fish is called the *Atherina (menidia)*, Lin., and is spoken of as being "found in great abundance in the River Piscataqua, in the months of August and September." The author's name is not mentioned, but we suppose it to be Professor Peck, who then resided at Kittery, N. H.

New Hampshire, PECK. Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, CUVIER, DEKAY. South Carolina, CUVIER.

FAMILY VII. MUGILIDÆ.

Body almost cylindrical, covered with large scales, and furnished with two distinct dorsal fins, the first of which has only four spinous rays. Head rather depressed, also covered with large scales or polygonal plates. Muzzle very short. Teeth very fine, sometimes scarcely perceptible. The ventrals are attached somewhat behind the pectorals. Branchiostegous rays, six.

GENUS I. MUGIL, LIN.

Ventrals placed a short distance behind the pectorals. The first dorsal with four spinous rays. The middle of the under jaw tuberculated within, and a corresponding cavity in the upper jaw. Teeth very small.

MUGIL LINEATUS, *Mitch.**The Striped Mullet.*

(PLATE XVI. FIG. 4.)

Mugil lineatus, MITCH., MS. communicated to Cuvier.*Le Muge rayé* (*Mugil lineatus*, MITCH.), CUV. et VAL., Hist. Nat. des Poiss., II. p. 96.*Mugil lineatus*, DEKAY, Report, p. 144, pl. 15, fig. 42.

" " AYRES, Bost. Journ. Nat. Hist., V. p. 265, pl. 12.

" " STOREY, Mem. Amer. Acad., New Series, II. 367.

" " " Synopsis, p. 115.

Color. Dusky grayish-blue above, thence to steel and to dirty silvery, with metallic reflections upon lower sides and abdomen. Sides throughout their whole depth from back to centre of belly marked with continuous longitudinal and parallel lines, equidistant, of little over a hair's breadth, and passing through the centre of each scale; the two upper reach over the top of the head to the snout; their number is from ten to fourteen. Snout and upper operculum clouded with greenish fuliginous; lower operculum a clear silver. Pupils black, irides yellowish. All the fins save the ventrals clouded with dusky, even the membrane of first dorsal. Second dorsal and caudal the darkest, the terminal margin of the latter edged with very dark brown. A deep purplish spot at upper base of pectorals.

Description. Body nearly cylindrical; dorsal outline somewhat convex, especially gibbous in region of second dorsal. Depth of body equal to length of head; depth near tail about one half of greatest depth.

Head moderate; its length about one fifth that of the entire fish; somewhat flattened

above, cheeks slightly protuberant. Opercles entire, though their suture is plainly visible. Space between edges of interopercula of moderate size. Jaws nearly equal, the lip of the upper, which is protractile, a little projecting; the tip of lower jaw with a pointed knob, which fits into a corresponding cavity above. Gape of mouth moderate and triangular; outer edge of upper jaw with a single row of very minute teeth, those on lower jaw scarcely perceptible, even if present. Nostrils double; the posterior near upper anterior angle of eye; the anterior smallest and rounded. Eyes large, their diameter equal to about two thirds the distance between them; with a thick gelatinous membrane, which more than covers them, and extends to some distance around.

Scales throughout body, large, rounded, engraved; present also upon throat and top of head; in which latter locality some of them are strangely channelled and grooved, as if by worms.

First dorsal commences just behind a line midway between pectorals and second dorsal. Moderate, rounded triangular; its rays spinous, the second the longest, the last the smallest and least stout. When shut, concealed nearly from view. Rays so arranged as to fall alternately upon opposite sides of the median line when fin is closed.

Second dorsal quadrangular, emarginated posteriorly, or rather superiorly; fleshy.

Pectorals subtriangular, slightly falciform; with a large, delicate, and movable axillary scale.

Ventrals with a movable pelvic plate, their first ray spinous and welded to the next, the rest branched; in advance of the pectorals.

Anal commences slightly in front of second dorsal, and terminates about on a line with it; the first three rays progressively increase in length, the first of them being very short, and are spinous.

Caudal deeply emarginated.

The fin rays are as follows: — D. 4–9. P. 16. V. 1–5. A. 3–10. C. 14.

Length ten inches.

Remarks. Dekay says this species “was first detected on our coast by Dr. Mitchill, who sent a specimen, with the name and a description, many years ago.” Cuvier, in his *Histoire Naturelle des Poissons*, accepts the specific name of Mitchill.

The only individual of this species I have known to be taken in our waters was found by Captain Atwood on the northern side of Long Point, Provincetown, November 7th, 1851, where it had run ashore.

Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHILL, CUVIER, DEKAY.

XII.

A History of the Fishes of Massachusetts.

BY DAVID HUMPHREYS STORER, M. D., A. A. S.

(Continued from page 168.)

FAMILY VIII. GOBIDÆ.

Body more or less elongated. Scales small or entirely wanting. The spines of the dorsal fin slender and flexible. Branchial aperture small. Ventrals, when present, placed in advance of the pectorals. Many viviparous.

GENUS I. BLENNIUS, CUV.

Head rounded and blunt; body smooth, unctuous, compressed; a single elongated dorsal fin; ventral fins placed before the pectorals, and containing generally but two rays, united at their base; teeth slender, in a single row.

BLENNIUS SERPENTINUS, *Storer.*

The Snake-shaped Blenny.

(PLATE XVII. FIG. 1.)

Blennius serpentinus, STORER, Proceedings of Bost. Soc. Nat. Hist., III. p. 30, April, 1848.

Color. Upper part and sides, of a yellowish-brown, with intervening colorless spaces. Abdomen white. The dorsal fins are brownish, with broad, oblique, white bands. Pectorals white, the outer ray brownish. Anal and caudal white with a tinge of yellow. Ventrals white.

Description. Body very much elongated and compressed. Length of head about one tenth the length of the body; convex upon its posterior portion; blunted anteriorly; compressed upon sides. Gape of mouth moderate; upper jaw the longer; a single row of minute teeth in each jaw. Lips fleshy. Nostrils tubular, directly in front of eye. Greatest depth of body about one twentieth its length. Eyes obliquely oblong; their longest diameter equal to one sixth the length of the head.

The first dorsal fin commences on a line above the pectorals, and is continued to the second dorsal, to which it is connected by a membrane, and terminates anterior to the middle of the fish. Its anterior three spines are the shortest. Posterior to the fifth ray, the fin is of a uniform height throughout, with the exception of the two last rays, which are shorter.

The second dorsal, which is of nearly a uniform height throughout, terminates at the fleshy portion of the tail.

The pectorals, when closed, are lanceolate; rounded when expanded. The rays are branched and free at their tips.

The ventrals are situated beneath and in front of the pectorals. The inner ray the longer.

The anal commences on the anterior third of the body, and terminates on a line with the second dorsal.

The caudal is rounded.

The fin rays are as follows:— D. 37—50. P. 13. V. 2. A. 66. C. 22.

Length of specimen, sixteen inches.

Remarks. The preceding description is drawn up from the only specimen of this fish that I have ever seen. It was brought me by Captain Nathaniel E. Atwood, who took it from the stomach of a cod-fish in Massachusetts Bay, early in April, 1848.

GENUS II. PHOLIS, FLEMING.

Neither cirrhi nor fleshy crests upon the orbits.

PHOLIS SUBBIFURCATUS, *Storer.*

The Radiated Shanny.

Pholis subbifurcatus, *Subbifurcated Pholis*, STORER, Report, p. 63.

“ “ *Radiated Shanny*, DEKAY, Report, p. 150.

“ “ STORER, Mem. Amer. Acad., New Series, II, p. 370.

“ “ “ Synopsis, p. 118.

Color. General color of the body, reddish-brown; several lighter-colored circular

patches along its upper part, at the base of the dorsal fin; the spaces between the rings darker than the rest of the body, presenting the appearance of bars. From beneath the eye a broad black band, wider at its base, crosses the operculum obliquely; two other bands of the same color extend from behind the eye backwards, in nearly a straight line, the distance of from one to two lines. Body beneath the lateral line lighter colored; abdomen yellowish-white. Head above, brownish; opercula and preopercula yellow. Numerous black spots upon dorsal fin. Those upon the five first rays larger. Pectorals light, with some darker shades. Edge of anal dark-colored. Small dark-colored spots upon caudal.

Description. Length, including tail, five inches five lines; depth across on a line with the anus, one inch; body much compressed. Body smooth, scales very minute. Length of head, from tip of snout to posterior angle of the operculum, is to the entire length of body, as one to three; entire surface destitute of scales; jaws somewhat protractile, armed with prominent sharp teeth; lips large and fleshy; over nostrils a minute filament one third of a line in length; circumference of eye two lines.

The lateral line commences just above the angle of the operculum, and having extended two lines, subbifurcates; passing down in a gradual curve a little more than a line, it is continued in a straight course to the base of the caudal fin; while the upper portion abruptly terminates opposite the fourteenth ray of the dorsal fin.

The dorsal fin, commencing on a line with the posterior angle of the operculum, is continued to the caudal fin; the first five rays of this fin are shorter than the sixth; the rays become again shorter as they approach the tail.

The pectorals are rounded; they arise on a line with the posterior angle of the operculum.

The ventrals are situated two lines in front of the pectorals; the rays are united throughout the greater portion of their extent; extremities free. The anus is situated two and a half inches from the extremity of the jaws.

The anal fin commences just half-way between the tip of the snout and the extremity of the tail.

The caudal fin is rounded.

The number of fin rays are as follows:— D. 43. P. 13. V. 3. A. 30. C. 14.

Remarks. I have seen but a single specimen of this fish; it was found at an unusually low tide among the sea-weed at Nahant, in 1838, and brought to me by my brother-in-law, Thomas M. Brewer, M. D. It was placed in the collection of the Boston Society of Natural History, and has been destroyed, compelling me to introduce here my former description, and preventing me from giving a figure.

GENUS III. GUNNELLUS, FLEMING.

Body elongated, much compressed. Head oblong. Mouth small. Teeth velvet-like, or in cards. Dorsal rays spinous throughout. Ventrals excessively small, and reduced often to a single spine.

GUNNELLUS MUCRONATUS, Cuv.

The Butter-fish.

(PLATE XVII. FIG. 2.)

Ophidium mucronatum, *Spinous Ophidium*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 361, pl. 1, fig. 1.

Le Gonnelle épineux, *Gunnellus mucronatus*, CUV., CUV. et VAL., XI. p. 427.

Blennius (Centronotus) gunnellus, LIN., *Spotted Gunnelle*, RICH., Fauna Boreal. Americ., III. p. 91.

Murcenoides guttata, *Spotted Gunnel*, LACEP., STORER, Report, p. 65.

Gunnellus mucronatus, *American Butter-fish*, DEKAY, Report, p. 153, pl. 12, fig. 36.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 374.

“ “ “ Synopsis, p. 122.

“ “ H. R. STORER, Bost. Journ. Nat. Hist., VI. p. 261.

Color. The living fish is of an olive-brown color, with numerous transverse, indistinct, darker bands upon the sides; about twelve black ocelli along the base of the dorsal fin, each surrounded by a yellow ring. Fins yellow; the anal barred with white. Pupils black; irides golden. Abdomen yellowish. An oblique black band passes from beneath the eye to the throat.

Description. Body elongated, compressed, scaleless; and so translucent, that when the fish is held to the light, the vertebral column is distinctly seen. Head about one tenth the length of the body, convex above, blunted anteriorly. Gape of mouth nearly vertical. Jaws equal. Minute sharp teeth upon each jaw, and upon vomer.

The dorsal fin, which is composed of spinous rays entirely concealed, save their points, by the membrane, is but slightly raised above the back, and commences on a line above the posterior angle of the operculum, and is continued nearly to the tail, to which it is attached by a membrane.

The pectorals, which are situated just beneath the posterior angle of the operculum, are small and delicate.

Two small spines, attended each by a delicate filamentous ray, directly in front of the pectorals, take the place of the ventrals.

The anal fin, which is rather higher than the dorsal, commences on the posterior half of the body, and is continued nearly to the tail, to which it is attached by a membrane, as the dorsal. The first two rays are spinous, the remainder flexible.

The caudal is rounded when expanded.

The fin rays are as follows:—D. 75 – 78. P. 11 or 12. V. 1. A. 2, 36 – 40. C. 16 – 18.

Length four to twelve inches.

Remarks. This pretty species is common at Nahant, Provincetown, and Holmes's Hole, and probably along our entire sea-coast. At low tide it is found upon the beaches beneath stones and sand. On account of the mucus with which it is covered it is known as the Butter-fish. From being enveloped in this secretion, it is with difficulty retained in the hand after it is captured. It is frequently found in the stomachs of other fishes. My son has detected it on the shores of Nova Scotia, and thence southward as far as our own waters.

Bay of Fundy (Island of Grand Menan), Nova Scotia, Maine, New Hampshire,
H. R. STORER. Massachusetts, STORER. New York, MITCHILL, DEKAY.

GUNNELLUS MACROCEPHALUS, *Girard.*

The Big-headed Gunnel.

(PLATE XVII. FIG 3.)

Gunnellus macrocephalus, GIRARD, H. R. STORER, Fishes of Labrador, Bost. Journ. Nat. Hist., VI. p. 263.

Color. Marbled, and banded transversely. Base of dorsal with the generic dark spots, in number twelve or more.

Description. Body elongated, compressed, attaining its greatest depth just posterior to opercular angle. Head quite large, abrupt, triangularly prismatic, the base downward, flattened, however, on occiput; its length one eighth that of body, and just equal to greatest depth of body. Cheeks protuberant. Gape of mouth large, obliquely upward, so that lower jaw, projecting when open, does not equal the upper when mouth is closed. Teeth in two rows in front of jaws; the principal row being the inside one on lower jaw, and the outside one on upper jaw. Eyes moderate, their horizontal diameter double the distance between them. Scales moderate, of nearly equal size throughout body; when covered with mucus, giving the appearance of granulation. Lateral line straight, running along middle of body.

The dorsal fin commences above posterior angle of operculum, and is connected to the caudal by a membrane of less height than its own. Its first rays nearly straight, its posterior ones strongly curved. Its height greatest on a line above tips of pectorals. Membrane stoutest posteriorly.

The pectorals are of moderate size, somewhat fan-shaped.

The ventrals are strongly marked, both the spine and filamentary ray, situated anteriorly to pectorals.

The anal commences about on median line, connected with caudal by a low membrane, and is of nearly equal height throughout. First two rays spinous, the anterior the stouter. Its posterior rays longer than corresponding ones of dorsal.

The caudal is quite large, circular when expanded.

Length, eight inches.

The fin rays are as follows: — D. 76. P. 12. V. I. 1. A. II. 41. C. 20.

Remarks. The specimen from which I have drawn the above description was taken alive, in 1848, by Mr. Girard, from a sand-pool on Chelsea Beach at low tide. It is the only specimen of which I have knowledge, and has since been in the possession of Professor Agassiz, from whom I have it. Its specific value was detected by Mr. Girard while comparing the Labrador species of my son, *Gunnellus ingens*, with the *mucronatus* of our own shores. It most nearly resembles the former, of which there is an accurate and beautiful plate in Vol. VI. of the Boston Journal of Natural History, but is clearly distinct from both.

“Its size is nearly that of *G. ingens*, and is consequently much greater than that of the average *G. mucronatus*. It differs from *G. ingens* in having a proportionally larger head, whence a larger mouth and larger teeth. These last are longer than those of *G. ingens*; their tip is club-shaped in both. Profile of head very convex above eyes, whereas in *G. ingens* the convexity of the head is in advance of the eyes, thus giving to it a more rounded appearance. Body more compressed than that of *G. ingens*; height also greater. Lateral line straighter than in that species. The vent, placed under the thirty-fifth dorsal ray, is at an equal distance from the snout and the tip of the caudal, whilst it is a little farther back in *G. ingens*, and rather nearer the head in *G. mucronatus*.

“The dorsal and anal are much higher than in either *G. ingens* or *mucronatus*. The dorsal begins a little farther back than in *G. ingens*. The pectorals are larger; their tip reaching beyond a line with the seventh dorsal spine.

“The rays of the anal show the remarkable peculiarity of having at their anterior and convex margin several small rays converging in an acute angle from the tip to the third or half of the length of the principal ray itself, in imitation on a small scale of the finlets of Scomber and Polypterus, with this difference, however, that in these last the additional small rays are on the posterior margin. In *G. ingens* these rays are dichotomized; in *G. mucronatus* they are simple.”

The ventrals also are larger and placed more anteriorly than in the *G. ingens*.

Massachusetts, GIRARD.

GENUS IV. ZOARCES, Cuv.

Body elongated, and covered with a mucous secretion, in which are imbedded very small scales. Dorsal, anal, and caudal united; no spinous rays in the dorsal, except on its posterior part. Ventrals jugular, small. Vent with a tubercle. Teeth conical, in two or three rows in front, in a single row on the sides; none on the palate or tongue. Branchial rays, six.

*ZOARCES ANGUILLARIS, Storer.**The Eel-shaped Blenny.*

(PLATE XVII. FIG. 4.)

Blennius anguillaris, PECK, Mem. Amer. Acad., II. pt. 2, p. 46, fig.*Blennius labrosus*, *Large-lipped Blenny*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 375, pl. 1, fig. 7.*Le Zoarces à grosses lèvres*, *Zoarces labrosus*, CUV. et VAL., XI. p. 466, pl. 342.*Zoarces anguillaris*, *Eel-shaped Blenny*, STORER, Report, p. 66." " *Thick-lipped Eel-pout*, DEKAY, Report, p. 155, pl. 16, fig. 45." " *Eel-shaped Blenny*, STORER, Mem. Amer. Acad., New Series, II. p. 375.

" " " " " Synopsis, p. 123.

" " H. R. STORER, Bost. Journ. Nat. Hist., VI. p. 263.

Color. The living fish is of a light salmon-color, mottled with irregular olive blotches, darker towards the head. The front and top of the head are of a light brown; two indistinct oblique bands upon the operculum, one back, the other in front, of the eye, on each side of the head. Body beneath white; neck flesh-colored. The dorsal fin is almost white, salmon-colored at its edge. The pectorals are of a true salmon-color, lighter at their origin. The ventrals are salmon-colored. The anal fin is flesh-colored at its base, salmon-colored at its edge, with seven distinct white blotches in its length. The dorsal, pectoral, and anal fins are perfectly transparent.

In the dead specimen the colors are deeper; the general tint is a yellowish-brown or fawn color, sprinkled with darker patches. The front and top of the head are livid; the gill-covers are lighter, but rather dull. The dorsal and anal fins are greenish tinged with yellow.

Description. Body very much elongated, tapering to a point, compressed posteriorly. Its entire surface, with the exception of the head, exhibits innumerable minute cup-like depressions. Head large, compressed at its sides, broad and flat above as far as the angle of the eyes, convex at forehead. Cheeks protuberant. Lips exceedingly fleshy; the upper lip is very large, projecting beyond the lower, and in some individuals even an inch beyond it; the under lip is less fleshy than the upper, and is suspended at its angles like those of a mastiff. The upper jaw slightly projects beyond the lower.

The teeth are large and conical; those in the back of the jaw the sharper; a single row from the entire angle of the upper jaw the extent of four teeth; then a double row of three teeth; then to the middle of the jaw a row of three teeth deep; the front teeth of this triple row are the largest in the jaw. From the outer angle of the lower jaw towards the middle, a single row of eight teeth exists; then a double row of five to six teeth to the middle of the jaw; three rows of sharp teeth in the upper pharyngeals; two rows in the lower pharyngeals. Tongue large, fleshy, smooth. Nostrils tubular, situated about half-way between the eyes and the snout; the distance between the eyes is equal to about one sixth the length of the head. The lateral line, which is most perceptible in immature specimens, commences above the operculum, at a distance in front of its posterior angle equal to the distance between the eyes, and, passing just beyond the posterior angle of the operculum, makes a slight curve downwards, and then passes on towards the posterior extremity of the body in a straight course. The fins are all enveloped in a fleshy membrane.

The dorsal fin commences some distance anterior to the posterior angle of the operculum, and is continued to the tail; previous to reaching which, however, about seventeen of its rays lose their fleshy portion, and exhibit only their spinous bases. The first ray of the dorsal is quite low; the succeeding three or four gradually become higher, making the commencement of the fin to appear rounded when expanded; it gradually diminishes in its height, so that the posterior rays are about two thirds the height of the anterior portion.

The pectorals are broad, rounded at their extremities; the extremities of the inferior rays are slightly scalloped.

The ventrals, appearing like little warts, are situated in front of the pectorals; they are composed of two rays, but, being enveloped in a tough membrane, appear as one.

The anal fin is about half the height of the dorsal; terminating in the caudal, it runs off to an acute point; the rays of these two fins cannot be distinguished from each other.

The fin rays, as far as practicable to be counted, are as follows:— D. 118 or 120. P. 19 or 20. V. 2. A. 100.

Length, three feet.

Remarks. As early as the year 1804, Professor Peck wrote a very good description of this species, and accompanied it with a figure, in the *Memoirs of the American Academy*.

It is occasionally taken at all seasons of the year, but more frequently in the spring and summer. It sometimes attains the size of three and a half feet, and weighs from one to twelve pounds.

It feeds upon the Mollusca and Testacea, and the flesh of the young fish is sweet and very palatable. The following shells I have found in its stomach: *Buccinum undatum*, *Fusus corneus* and *pleurotomarius* and *turricula*, *Turbo inflatus* and *obscurus*, *Natica triseriata* and *consolidata*, *Bulla tritacea*, *Tellina sordida*, *Nucula minuta*, *Trichotropis borealis*, *Turritella erosa*, *Venus gemma*, *Pecten Islandicus*; and a species of *Pectinaria*.

It is seldom met with in Boston market; occasionally, however, it is brought in by the cod-fishers of Massachusetts Bay, by whom it is known as the *Ling* and *Conger-Eel*.

Captain Atwood informs me that it is not taken so often at Provincetown of late years as formerly.

My son observed it on the coast of Labrador in 1849.

Labrador, H. R. STORER. New Hampshire, PECK. Maine, Massachusetts, STORER. New York, MITCHILL, CUVIER, DEKAY.

GENUS V. ANARRHICAS, LIN.

Head smooth, rounded, muzzle obtuse; body elongated, covered with minute scales; dorsal and anal fins long, distinct from the caudal; no ventral fins. Teeth of two kinds; those in front elongated, curved, pointed; the others on the vomer, as also on the jaws, truncated or slightly rounded; branchiostegous rays, six.

ANARRHICAS VOMERINUS, Agassiz, MS.

The American Wolf-fish.

(PLATE XVIII. FIG. 1. { 1. a. head in front.
1. b. teeth as seen in front.)

- Anarrhicas lupus*, *Sea-Wolf*, MITCHILL, Amer. Month. Mag., v. p. 242.
 " " " STORER, Report, p. 69.
 " " " DEKAY, Report, p. 158, pl. 16, fig. 43.
 " " " STORER, Mem. Amer. Acad., New Series, II. p. 376.
 " " " " Synopsis, p. 124.
Anarrhicas vomerinus, AGASSIZ, MS.

Color. Of a purplish brown, with ten or twelve transverse nearly black bars passing from the abdomen high upon the dorsal fin. Beneath lighter. One large specimen was of a light flesh-color, thickly spotted with moderately sized black ocelli. Rays of dorsal black, intervening membrane dark gray or slate; pectorals and anal leaden-gray; caudal slate-color, reddish at extremity.

Description. Body elongated, subcylindrical, compressed posteriorly, covered with an extremely viscid secretion. Head large, compressed at sides, rounded, slightly flattened above. Length of head more than one fourth the entire length of the body. Rows

of circular mucous pores are seen passing from the snout backwards beneath the eye to the occiput; also irregularly distributed upon the cheeks and along the upper portion of the operculum; a few are observed upon the lower jaw. Eyes moderate in size, the distance between the eyes equal to one fifth the length of the head. Nostrils tubular, situated about half-way between the tip of the snout and the eyes. Jaws equal, armed with long, strong, pointed teeth. The six in the intermaxillary above are much the largest, and diverge outwards; back of these on each side are six smaller, conical, sharp-pointed teeth. Four large recurved teeth in the lower jaw; back of these are about half a dozen sharp-pointed teeth of various sizes, irregularly disposed; a double row of rounded molars, some of them having a pointed summit. Vomerine teeth perfectly united together, forming a solid mass. Two rows of palatine teeth, the outer much the larger. Two rows of sharp teeth in the pharynx. Tongue large, fleshy, fuliginous. Lips loose, fleshy.

The dorsal fin arises in front of the base of the pectorals; it is slightly higher at its anterior portion, and is continued nearly to the tail, appearing as if almost united to it by the prolongation of the membrane of the fin.

The pectoral rays are very large; these fins are rounded when expanded, and slightly scalloped at their margin.

The anal fin arises immediately back of the anus, which is very large, and terminates on the same plane with the dorsal; it is about half the height of the dorsal.

The depth of the caudal at its base is less than one third the height of its rays.

The fin rays are as follows:— D. 74. P. 20. A. 46. C. 16.

Length, three to five feet.

Remarks. Mr. Agassiz considers this a distinct species from the European, basing his opinion upon a difference in the number and disposition of the vomerine tubercles.

This ferocious fish, weighing from five to thirty pounds, is captured about rocky ledges at all seasons of the year, although greater numbers are taken in winter than at any other time.

The Cusk rocks between Boston and Cape Ann are one of its favorite resorts. It feeds upon crustaceous animals and shell-fish. Its hideous appearance renders it an object of such disgust, that it is not unfrequently thrown away as soon as caught. By many of our fishermen, however, it is considered very delicate, the smaller specimens weighing from five to ten pounds are quite palatable when fried, boiled, or broiled, the skin having been previously removed. It is also occasionally split and salted, or dried, or smoked, and is said to be, when thus prepared, very good.

Greenland, FABRICIUS. Maine and Massachusetts, STORER. New York, MITCHILL, DEKAY.

FAMILY IX. LOPHIDÆ.

Scales usually absent, or replaced by bony plates, or by small grains armed with spines. The two carpal bones elongated, and forming a kind of arm to support the pectoral fin. Branchial aperture round, or a vertical slit behind the pectorals. Sub-orbital bone wanting, except in the genus *Malthea*.

GENUS I. LOPHIUS, ARTEDI.

Head enormously large, broad, and depressed. Mouth large, armed with slender conical teeth on the jaws, palatines, vomer, and pharyngeals. Tongue smooth. Branchial rays, six; branchial arches, three. Dorsal fins, two; the anterior rays distant, detached, forming long filaments supporting fleshy slips.

LOPHIUS AMERICANUS, *Cuv.**The American Angler.*

(PLATE XVIII. FIG. 2.)

Lophius piscator, *Bellows-fish* or *Common Angler*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 465.*Lophius piscatorius*, *Angler*, *Frog-fish*, *Sea-Devil*, *Goose-fish*, *Wide Gab*, STORER, Report, pp. 71, 404.*La Baudoire d'Amérique*, *Lophius Americanus*, CUV. et VAL., XII. p. 380.*Lophius Americanus*, *American Angler*, DEKAY, Report, p. 162, pl. 28, fig. 87.

" " " " STORER, Mem. Amer. Acad., New Series, II. p. 381.

" " " " " Synopsis, p. 129.

Color. All the upper part of the body, in the living fish, is of a dark-brown color, caused by minute irregular markings somewhat resembling reticulations, which occasionally appear like blotches; breast of a dirty white color. Cirrhi of a light brown. Pupils black, irides yellowish-brown.

Description. Body compressed, orbicular anteriorly, elongated and attenuated posteriorly. Its width in front of the pectoral fins is rather less than one half of its length. The length of the head from the tip of the snout to the occiput is equal to about one fourth the length of the entire fish. Numerous fleshy cirrhi are arranged along the lower jaw, edging it to its angles; beyond these, they are continued to, and upon, and back of, the pectoral fins, to the base of the tail: beneath the jaw these cirrhi are much larger than they are upon the sides of the body; on the posterior portion of the body they are smallest. The branchial apertures are large, and situated under and back of the pectorals. The vertical gape of the mouth, when expanded, is very large; the distance across the head, from the outer angles of the jaws, is less than

one third the length of the fish ; the tip of the lower jaw projects beyond the upper. The intermaxillary bones are capable of being protruded considerably beyond the maxillaries, and are armed with a single row of small, pointed teeth upon each side, and two rows of much larger teeth in their centre, the innermost row being the larger ; one of these is upon the edge, the other within and beneath, very incurved. Upon the upper jaw at its tip is a space of one and a half inches destitute of teeth ; on each side of this space is one quite large tooth, and a second much smaller ; about half an inch outside of these is a single row of eight or ten teeth, the first three or four of which are much the largest. On each side of the pharynx are three rows of sharp incurved teeth resembling spines ; these rows are arranged directly above each other, and are double. The lower jaw has a single row of numerous, very sharp teeth : the tongue has a broad, bony, triangular plate upon each side, armed with two rows of teeth which are recurved. The distance from the margin of the upper jaw to the eye is about equal to the distance between the eyes. Several spines are situated upon the head : two just back of the snout on each side ; a bifurcated one over the middle of the eye, and another similar one at its posterior angle ; and a small one on a line back of these, at the posterior portion of the head. A spine pointing forwards is situated just back of the angle of the jaws, and three straight spines are seen back of this. The eyes are oval. Just back of the snout are two elongated, naked tentaculæ, of the fineness of bristles, with the extremities free. As the tentaculæ are depressed, directly at their posterior extremities is situated a third, with about half of its extent only naked ; all the tentaculæ are capable of being elevated at the pleasure of the animal.

The first dorsal fin is situated a short distance back of the third tentaculum ; it is composed of three small rays, the posterior of which is the shortest, connected at their bases by a dark-colored membrane.

The second dorsal fin is composed of stout, fleshy rays ; it is rounded posteriorly, and is as long again as high.

The pectorals are rather higher than long, slightly digitated at their extremities, and ciliated.

The ventrals are stout and fleshy ; their anterior ray is bifurcated at its base.

The anal fin arises back of the commencement of the second dorsal ; its posterior portion is the higher.

The caudal fin is stout, fleshy, and digitated at its extremity.

The fin rays are as follows : — D. 3 - 11. P. 24 or 25. V. 5. A. 9. C. 8.

Length, four feet.

Remarks. This fish, which weighs from fifteen to seventy pounds, is not a common species in Massachusetts Bay, although it is taken throughout its whole extent from Lynn to Provincetown during the months of September, October, and November, and is met with in great numbers at its mouth. It is captured with the hook, while fishing for other species, and also in nets. Among the fishermen in some parts of the Bay, there is a common saying, "When you take a goose-fish, look out for an easterly storm." It is exceedingly voracious, feeding upon all kinds of fish, and the capacity of its mouth enables it to swallow species as large as itself. Captain Atwood, of Provincetown, tells me he has repeatedly seen one swimming towards the shore with another of the same species as large as itself in its mouth. And both he and Captain Nathaniel Blanchard, of Lynn, assure me, that, when opened, entire sea-fowl, such as large gulls, are frequently found in their stomachs, which they supposed them to catch in the night, while they are floating upon the surface of the water. I was informed by Captain Leonard West, of Chilmark, that he had known a goose-fish to be taken having in its stomach six coots in a fresh condition. These he considered to have been swallowed when they had been diving to the bottom in search of food. No use is made of this fish, as its liver contains but little if any oil; and its flesh has no fat. This is a singular fact, as most, if not all, other fish have either fat in their livers or in their flesh. It is seldom that fat is found both in the liver and in other parts of the body of a species. The dog-fish, however, supplies the fishermen with oil from its liver, and its body when dried will burn, to use a fisherman's words, "like fat pine." This is considered a very stupid fish; thousands run ashore at Provincetown every season, and are thus destroyed. They frequently swim towards the shore in the day-time, and if pushed into the water by a passer-by are as likely to turn again to the shore as from it.

Maine, Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUVIER, DEKAY. Delaware, DEKAY.

GENUS II. CHIRONECTES, CUV.

Head vertically compressed. Three free rays on the summit of the head. Mouth cleft more or less vertically, opening to the gills by a round aperture behind the pectorals. Tongue edentate. Intermaxillaries, lower jaw, vomer, palatines, and pharyngeals with minute, card-like teeth. Dorsal long.

CHIRONECTES LÆVIGATUS, *Cuv.**The Smooth Mouse-fish.*

(PLATE XVIII. FIG. 3.)

Chironectes lævigatus, CUV., Mém. du Muséum, III. p. 423, pl. 16, fig. 1.*Le Chironectes uni*, *Chironectes lævigatus*, CUV. et VAL., XII. p. 399.*Chironectes lævigatus*, *Smooth Chironectes*, STORER, Report, p. 73." " *Smooth Mouse-fish*, DEKAY, Report, p. 165, pl. 27, fig. 83.

" " STORER, Mem. Amer. Acad., New Series, II. p. 382.

" " " Synopsis, p. 130.

Color. Brownish, with irregularly distributed lighter-colored blotches margined with white. Besides these blotches, numerous yellowish spots are scattered over the entire surface. The markings upon the dorsal, anal, and caudal fins form irregular transverse bands. Pectorals and ventrals marked with white dots.

Description. Body smooth, much compressed laterally, tapering to the tail; thickest at pectorals. Greatest depth less than half its length. Between and above the eyes is situated a dark-colored flexible ray, terminated by a slight filament. Behind this are ten rays connected by a strong membrane, which is continued posteriorly; one of these rays is quite large and stout; a filament is suspended from its extremity. Minute cuticular processes are observed beneath, and along the edge of, the lower jaw; one exists at the base of the ray, between the eyes. Eyes small, circular. Jaws armed with numerous minute teeth. Branchial orifice, a small aperture beneath the pectorals.

The dorsal fin, which is longer than high, commences on a line above the origin of the pectorals, and is continued to the fleshy portion of the tail.

The pectorals are stout, expanded, and digitated at their extremity.

The ventrals are situated in front of the pectorals, and are digitated like those fins.

The anal fin commences opposite the posterior portion of the dorsal; it is higher than long, and is rounded.

The caudal fin is rounded.

The fin rays are as follows: — D. 12. P. 10. V. 5. A. 6. C. 9.

Length, from two to four inches.

Remarks. The only specimens of this species I have known to be taken in this State were sent me several years since from Holmes's Hole, by the late Dr. Yale of that place.

Massachusetts, STORER. New York, DEKAY. South Carolina, CUVIER.

GENUS III. BATRACHUS, SCHNEIDER.

Head depressed, broader than body. Ventrals jugular, with three rays; the first elongated. First dorsal small; second low and long. Base of the pectorals elongated. Branchial aperture small, with six rays. Subopercle as large as the opercle, and both spinous. No suborbital. Teeth on the jaws, front of the vomer and palatines.

BATRACHUS TAU, *Lin.**The Common Toad-fish.*

(PLATE XIX. FIG. 1, 2, young and adult fish.)

Gadus tau, LIN., Syst. Nat. (twelfth edition), p. 440.

" " BLOCH, II. p. 150, pl. 67, fig. 2 and 3.

" " *Toad Gadus*, SHAW, Gen. Zoöl., IV. p. 159.*Lophius bufo*, *Toad-fish*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 463.*Batrachoides variegatus*, var. a. b., LESUEUR, Journ. Acad. Nat. Sc., III. pp. 399, 401.*Batrachus variegatus*, *Toad-fish*, STORER, Report, p. 74.*Le Batrachorde tau*, *Batrachus tau*, CUV. et VAL., XII. p. 478.*Batrachus tau*, *Common Toad-fish*, DEKAY, Report, p. 168, pl. 28, fig. 86.

" " STORER, Mem. Amer. Acad., New Series, II. p. 384.

" " " Synopsis, p. 132.

Color. Yellowish, the entire surface of the head, sides, and abdomen marbled with black spots, which are confluent upon the sides, presenting the appearance of irregular bands. All the fins also barred with black. The dorsal bands oblique, those of pectorals and caudal concentric, five or six in number.

Description. Shape of fish broad anteriorly, laterally compressed posteriorly; its width gradually diminishing to extremity of caudal fin. Length of head one third that of entire fish; its breadth equal to its length. Greatest depth equal to one fourth its length. Body entirely covered by a copious viscid secretion, which flows from numerous mucous pores distributed over its surface, those on the head being much the largest. Head large, compressed above, rounded anteriorly. Mouth very large. Lower jaw the longer. Jaws covered with strong, conical, and distinct teeth, disposed in several rows in front and in a single row behind in each jaw. Teeth also, but smaller and crowded, on intermaxillaries and vomer; none on palatine bones. Tongue scarcely perceptible. Lips large and fleshy. Nostrils double. Four small and blunted cirrhi on chin; on each side of these, along the margin of the lower jaw, a series of five or more larger ones sometimes palmated at tips. Also a very large cirrhus over each eye, preceded by a much smaller one. Eyes moderate, slightly oblique, guarded by a thick, gelatinous membrane. Preoperculum armed with three distinct concealed spines, the middle the smallest. Branchial aperture of same width

as base of pectoral fin. The lateral line, marked throughout its whole extent by very distinct mucous pores, arises just back of upper spine of operculum, and runs nearly a straight course high up on the back to the tail.

The dorsal fin arises just back of the head, and is continued to the tail. Its first three rays are spinous, the central one being much the longest; these are united to the fleshy rays by a deeply emarginated membrane. Fleshy portion of nearly uniform height. Rays multifold. Terminates abruptly at base of tail, to which it is connected by a membrane.

The pectorals, stout and fleshy, arise at the lower edge of the branchial opening; rounded and fan-shaped when expanded.

The ventrals, of very irregular shape, originate some distance in front of pectorals; the first ray, which is stout and falciform, is enveloped in a thick, fleshy membrane. Fin tied down to abdomen posteriorly.

The anal fin commences beneath the anterior third of the dorsal, and terminates on a line with the posterior extremity of that fin; the fleshy margin is strongly digitated.

The caudal fin is broad and rounded posteriorly.

The fin rays are as follows:— D. 3—27. P. 16. V. 3. A. 24. C. 14.

Remarks. The Toad-fish is an inhabitant of our entire Atlantic coast, extending its residence also even as far as into the Gulf of Mexico, and to some of the West India Islands. It lives generally in shoal water, being seldom taken at any great distance from the shore. The particular situations which it chooses vary with the nature of the coast. Thus along our Southern shores it is found in the shallow bays. The sandy or muddy bottom of these is overgrown with Eel-grass (*Zostera marina*), under cover of which it lives in security, and finds abundant sources of food. Where the coast, on the contrary, is more or less rocky, we meet with it chiefly under stones. Examining the places where the water is but a few inches in depth at low tide, we see that, under many of the stones and smaller rocks, the sand on one side has been removed, leaving a shallow cavity, perhaps a foot in width, and extending back beneath the stone. If we approach this cautiously, we shall probably distinguish the head of a Toad-fish, very much in the position of that of a dog as he lies looking out of his kennel. The fish is at rest, and might be overlooked by a careless observer. A closer attention, however, readily distinguishes the curve of its broad mouth, the delicate lacinated processes with which its jaws and other parts of its head are ornamented, its truly beautiful eyes, and sometimes the anterior portion of its body. At the slightest alarm, it retreats beneath the stone, but presently reappears. It is lying here, perhaps merely as in a safe resting-place, perhaps on the watch for its prey.

But during the months of June, July, and August, we shall in many instances be able to discover another purpose, — it is apparently guarding its eggs or young. We shall then find, on the inferior surface of the stone, the young Toad-fish adhering, to the number of several hundreds. They will be in different stages of development, according to the season of our examination. We may see the eggs, not larger than very small shot; a little later they are increased in size, and the young fish plainly visible through their walls; a little later still, the young have made their escape, but are still attached to the stone. The attachment now, however, is accomplished in a different manner. The yolk, not being yet absorbed, occupies a rounded sac protruding by a narrow orifice from the abdomen, and the part of this sac near its outer border, being constricted, leaves external to it a disc, by means of which, acting as a sucker, the young fish adheres so firmly as to occasion difficulty in detaching it. They remain thus until they have attained the length of half or three quarters of an inch, or until the yolk-sac is entirely absorbed. During this period an adult fish occupies the cavity beneath the stone, and if driven from it speedily returns. That this is, in all cases, the mother of the young ones, and that she is there for the purpose of guarding them, we have no means of determining: we can only infer it. Although the assertion, that fish have no affection for their young, has long been considered universally true, yet exceptions to it are now well known to exist. Our common Cat-fish, or Horned Pout, furnishes an example, and the habit of the *Batrachus* here described appears to give another illustration bearing on the same point.

During the winter months, in our colder latitudes, the Toad-fish in some instances, perhaps, retire into deep water; it is true, however, that many of them become nearly torpid. They are found buried beneath the mud, in the same manner as the Eels, and are sometimes taken with the spear thrust down in search of their more valued neighbors. One which was caught in this way was nearly as vigorous and capable of motion after twenty-four hours of removal from the water, as when first taken.

The Toad-fish is not commonly employed as an article of food. Its slippery, slimy surface, and its generally repulsive aspect, cause it to be looked on rather with disgust. That its flesh, however, is delicate and good, can scarcely be questioned, though the small size which it attains, — eight inches to a foot in length, — and the fact that it is never taken in any large quantities, prevent it from being of much economical value.

The specific name *tau*, given to this species by Linnæus, is derived from a character not discernible until the fish is dead and his integuments have become dry. The bones on the upper surface of the skull are then seen to present a transverse ridge met by another in a longitudinal direction, thus resembling the Greek letter T (tau).

For the beautiful living specimen, from which my description and drawing have been made, I am indebted to John Manchester Smith, M. D., of Tisbury; and the notes upon the habits of this species were furnished me by my excellent friend, William O. Ayres, M. D., a very accurate observer, of East Hartford, Connecticut, now established in San Francisco, California.

Maine, Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUVIER, DEKAY. Gulf of Mexico, CUVIER.

FAMILY X. LABRIDÆ.

Body oblong and scaly; a single dorsal is supported in front by spines, each of which is generally furnished with a membranous appendage; the jaws are covered with fleshy lips; there are three pharyngeals, two upper ones attached to the cranium, and a large lower one, all three armed with teeth, sometimes *en pavé*, sometimes in points or laminae, but generally stronger than usual; an intestinal canal without cœca, or with two very small ones, and a strong natatory bladder.

GENUS I. CTENOLABRUS, VAL.

Body elongated. Preopercle denticulated. A band of velvet-like teeth in front; behind, the conical teeth, in the jaws. Three spinous rays to the anal fin.

CTENOLABRUS CERULEUS, *Dekay*.

The Common Conner.

(PLATE XX. FIG. 1.)

- Tautoga cerulea*, *Blue-fish or Bergall*, MITCHILL, Report in part, p. 24.
Labrus chogset, *Bergall of New York*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 402, pl. 3, fig.
Crenilabrus burgall, SCHOEFFE, Griffith's Cuv., x. p. 258.
 " " *Conner, Blue Perch, Chogset*, STORER, Report, p. 78.
 " " " " " AYRES, Bost. Journ. Nat. Hist., IV. p. 263.
Le Ctenolabre chogset, *Ctenolabrus chogset*, CUV. et VAL., XIII. p. 237.
Ctenolabrus ceruleus, *The Common Burgall*, DEKAY, Report, p. 172, pl. 29, fig. 93.
Ctenolabre mouché, *Ctenolabrus uninotatus*, CUV. et VAL., XIII. p. 239.
 " " " " " DEKAY, Report, p. 174, pl. 29, fig. 90.
Ctenolabrus ceruleus, STORER, Mem. Amer. Acad., New Series, II. p. 386.
 " " " " " Synopsis, p. 134.

Color. This species varies exceedingly in its coloring: some specimens being of a deep-blue color; others, of a uniform brown or rust color; while the ground of others is greenish, with copperish spots; or red, with black points or dots sprinkled over

their entire surface, including oftentimes the fins. Irregular bluish lines, appearing like hieroglyphics, are distributed over the head; these are more strongly marked between and in front of the eyes than on the neck. The pupils are black, the irides a beautiful silver.

Description. Form elongated. Its height measured across to the anus, including the dorsal fin, is not quite equal to one third of its length; its thickness is about equal to half of its height, not measuring the dorsal fin. The length of the head to the length of the entire fish is as one to four: it is slightly flattened upon its top, and on the back of the neck, in front of the dorsal fin, is a perceptible convexity. The portion of the head between the eyes, and in front of them to the angle of the jaws, is destitute of scales, as well as the lower portion of the opercula. The scales upon the operculum are larger than those upon the preoperculum. The preoperculum is finely denticulated upon its posterior edge, throughout its whole length: the posterior edge of the operculum is bordered by a fleshy membrane.

The jaws are equal, and are armed with numerous teeth; the six front teeth in either jaw larger than the others; the front teeth in the upper jaw larger than the corresponding ones in the lower. The upper jaw is very projectile. The lips are large and fleshy. The eyes are circular; the diameter of the eye is equal to one fifth the length of the head.

The lateral line arises just back of the superior angle of the operculum, and curves with the body until about opposite the termination of the dorsal fin, whence it pursues a straight course to the tail. -

The dorsal fin arises on a line with the posterior angle of the operculum, and terminates within about an inch of the tail. It has eighteen strong spinous rays, the extremities of which are naked; the upper portion of their connecting membrane is free, presenting the appearances of small filaments or tentacles; the eleven posterior rays are membranous. The spinous rays gradually increase in height from the first to the membranous rays, which are still more elevated. The first spinous ray is very short, being only one seventh the height of the last spinous ray. The membranous portion of this fin is rounded when expanded.

The pectorals arise on a line with the dorsal; their height is to their length as three to one.

The ventrals are just back of the pectorals; the first ray is a strong spine. The length of these fins is to their height as one to three.

The anal fin has three spinous rays; from the extremities of these spines, as well as from that of the ventral fins, filaments are suspended as in the dorsal fin.

The caudal fin is nearly even at its posterior extremity; its rays are longer than high.

The fin rays are as follows:—D. 18—11. P. 15. V. 6. A. 12. C. 16.

Length, from six to fourteen inches.

Remarks. This very common species is taken from the middle of June until late in October, and is brought to market in immense quantities. Being considered an excellent fish for the table when fried, it meets with a ready sale. It is caught with the hook along our entire coast, from the rocks and bridges and boats; and is taken along the shores of the islands in great numbers in nets. It is kept alive for the market in large cars, which are located in the neighborhood; these cars, which are about three feet deep and twelve or fifteen feet in length, are closed beneath, and latticed at their sides; being anchored in deep water, the tide is constantly flowing through them and changing the water. Sometimes as many as five thousand fish will be contained in a single car; this car will be daily called upon for the supply needed in the market, and is replenished each week or fortnight, as may be required.

Newfoundland, CUVIER. Maine, Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUVIER, DEKAY.

GENUS II. TAUTOGA, MITCH.

Jaws with a double row of teeth. Opercle and preopercle without spines or denticulations, and with few or no scales.

TAUTOGA AMERICANA, *Dekay.*

The Tautog.

(PLATE XX. FIG. 2.)

Labrus Americanus, BLOCH, SCHN., p. 261.

Tautoga niger, MITCHILL, Report in part, p. 23.

Labrus tautoga, *Black-fish or Tautog*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 399.

Labrus Americanus, *Black-fish or Tautog*, STORER, Report, p. 76.

“ “ “ “ AYRES, Bost. Journ. Nat. Hist., IV. p. 263.

Le Tautogue noir (*Tautoga nigra*, MITCH.), CUV. et VAL., XIII. p. 293.

Tautoga Americana, *New York Tautog*, DEKAY, Report, p. 175, pl. 14, fig. 39.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 389.

“ “ “ Synopsis, p. 137.

Color. This species varies considerably in its markings. Generally, however, it is of a bluish-black above, diversified with bands and blotches, mottled with darker spots towards the abdomen, which is whitish. Pupils black, irides silvery.

Description. The body is regularly arched from the tip of the snout to the

extremity of the dorsal fin; its height across the base of the ventrals, not including the dorsal fin, is about equal to the length of the head. The length of the head, to the posterior angle of the operculum, is equal to about one fourth the length of the body, including the tail. The head is naked, with the exception of a patch of small scales upon the upper part of the operculum, and a vertical band of similar scales upon the preoperculum, just back of the eyes. The lips are large and fleshy; the jaws have two rows of conical teeth: those of the first row are strong, the front teeth being the largest; those of the second row scarcely project above the flesh of the jaws. Teeth in the pharynx. The eyes are circular, the diameter equal to half the distance between them. The nostrils, which are small and double, are situated in front of and above the anterior angle of the eyes. The lateral line arises just above the operculum, and curves with the body.

The dorsal fin rises just back of the pectorals; the first seventeen rays terminate in naked spines, at the base of which are small floating tentaculæ; the posterior, fleshy rays of this fin are nearly as high again as the spinous rays, and this portion of the fin is of a rounded form. This fin extends to within a short distance of the tail. The base of the rays is scaled.

The pectorals commence just in front of the posterior angle of the operculum; they are rounded at their extremities. Their length to their height is as one to three.

The ventrals are situated a short distance back of the pectorals; their length is equal to about one fourth of their height. The outer ray is spinous, and is about half as high as the middle ray.

The anal fin arises opposite the last spinous ray of the dorsal fin, and terminates on the same plane with that fin; the first three rays are spinous; the fleshy portion is of the same form as the corresponding portion of the dorsal fin; this fin is longer than high.

The caudal fin is even at its extremity; its rays are covered with scales for about one half of their height.

The fin rays are as follows:—D. 28. P. 15. V. 6. A. 11. C. 15.

Length, six to eighteen inches.

Remarks. Although a few years only have passed since this species was brought into Massachusetts Bay, it is now taken along a large portion of the coast. At Plymouth, Nahant, and Lynn, at some seasons, it is found in considerable numbers, and is frequently caught from the bridges leading from Boston. A specimen was taken from one of these bridges a year or two since which weighed eleven pounds and three

quarters. The Boston market is for the most part supplied by Plymouth and Wellfleet. At the former place they are taken at Monument Point. I am told that two or three families reside at Billingsgate Point, Wellfleet, who pursue no other avocation than that of taking Tautog, and are thus enabled to support themselves. Many of the fish are carried to New York from Wellfleet.

The Tautog fishery continues from April to November, and the fish is taken by the hook alone. Besides the large number of Tautog sold in the recent state, they are also pickled, and may be kept in a weak brine for a long time. In this state they are considered by epicures a great delicacy. When fresh, this species sells in the market for from eight to twelve cents per pound. Its ordinary size is from one to two pounds, although they often exceed that weight. Mr. Henry Blood, of New Bedford, informed me that a specimen of this fish was taken in Rochester harbor which weighed fourteen pounds and three ounces. The largest individual of which I have any accurate knowledge weighed sixteen pounds. DeKay states that he had "heard of one which weighed twenty pounds, but the largest he had seen did not exceed twelve pounds."

Maine, Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUVIER, DEKAY. South Carolina, DEKAY.

ORDER II. MALACOPTERYGII. SOFT-RAYED.

All the fin rays soft and cartilaginous, with the exception sometimes of the first in the dorsal and the first in the pectoral fins. These rays are of an articulated structure, and generally more or less branched at their extremities.

ABDOMINALES.

The ventrals behind the pectorals, and not attached to the humeral bone.

FAMILY XI. SILURIDÆ.

Skin naked, and covered with a mucous secretion. In some genera the body is nearly covered by osseous plates. Head depressed, and generally enlarged, with several fleshy filaments. A second adipose dorsal often present. The intermaxillaries,

suspended under the ethmoid bone, form the edge of the upper jaw. First ray of the dorsal and pectoral fins usually a strong, articulated spine, with a complicated movement.

GENUS I. PIMELODUS, Cuv.

Palate smooth and without teeth. Barbels varying from six to eight. Casque occasionally present.

PIMELODUS ATRARIUS, *Dekay*.

The Horned Pout.

(PLATE XX. FIG. 3.)

Pimelodus nebulosus, STORER, Report, p. 102.

Pimelodus catus, STORER, Mem. Amer. Acad., New Series, II. p. 402.

“ “ “ Synopsis, p. 150.

Pimelodus atrarius, DEKAY, Report, p. 185, pl 36, fig. 116.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 404.

“ “ “ Synopsis, p. 152.

Color. The living fish is of a fuliginous color, darker upon the head and back, approaching to black; lighter upon the sides, which are tinged with a cupreous shade; white beneath in front of the ventrals; yellowish beneath the lower jaw and the under portion of the branchiæ. Irides silvery. Pupils blue. All the fins are dark-colored, In the dead specimen the coloring matter readily rubs off; and the individual, even if untouched, rapidly becomes of a lighter color.

Description. Body elongated, compressed posteriorly; head flattened above; a convexity anterior to the dorsal fin. Length of the head to the posterior angle of the opercular spine, to the entire length of the fish, about as one to four. Greatest width of head equal to about one sixth the length of the fish; greatest depth of the fish greater than the width of the head. Upper jaw the longer, both jaws furnished with numerous small teeth; eight cirrhi about the head; that at the angle of the upper jaw, on each side, much the longest. Two others are situated back of, and above these, on each side; beneath the lower jaw are also four cirrhi, two on each side of its middle, the outer the longer; all the cirrhi of the same color. The eyes are circular and very small; distance between the eyes equal to about one half the length of the head. Two blunted spines or processes on the humeral bones, the upper much the smaller. The lateral line arises above the posterior angle of the operculum, and runs a very slightly curved course to the tail.

The dorsal fin is situated on the anterior third of the fish; its length is equal to half its height. Its first ray is spinous, and shorter than the central rays. A small adipose fin is situated within a short distance of the tail.

The pectorals arise on a line a short distance in front of the posterior angle of the operculum; their length is equal to about one third their height; their outer ray is spinous and serrated upon its outer edge; it is naked at its point, and shorter than the first fleshy rays. When taken, great caution is necessary in removing this species from the hook, it having the power to erect this spine to defend itself.

The ventrals arise on a line just back of the dorsal fin; the length of these fins is equal to about one third their height. Anus large, oblong, beneath the posterior half of the ventrals.

The height of the anal fin is equal to about half its length.

The caudal fin is concave; the upper lobe slightly the longer.

The fin rays are as follows: — D. 1 – 6. P. 1 – 8. V. 8. A. 20. C. 19.

Length, seven to nine inches.

Remarks. This is quite a common species in the ponds throughout the State, and is familiarly known as the *Horned Pout* and *Minister*. Specimens are occasionally taken weighing three quarters of a pound. By many, it is highly esteemed as an article of food, and preferred to any other fresh-water fish save the Pickerel. It is generally fried, the skin having been previously removed.

Maine, New Hampshire, Massachusetts, STORER. Connecticut, AYRES. New York MITCHILL, CUVIER, DEKAY.

FAMILY XII. CYPRINIDÆ.

Mouth moderately or but slightly cleft, terminal, subterminal, or inferior; upper margin formed by the intermaxillaries. Jaws rather weak and without any teeth. A pharyngeal arch of curved and sometimes hooked teeth, disposed upon one or a double row. Branchial rays not very numerous. Top and sides of head generally smooth, and always without any scales. Body scaly. No great disparity in the fins between the sexes. Stomach without cul-de-sac; no cœcal appendages to the pylorus. Least carnivorous of all fishes.

GENUS I. CYPRINUS, LIN.

Body covered with large scales; a single elongated dorsal fin; lips fleshy; mouth small; teeth in the pharynx, but none on the jaws; branchial rays, three.

CYPRINUS AURATUS, LIN.

The Golden Carp.

(PLATE XXI. FIG. 1.)

- Cyprinus auratus*, LIN., *Syst. Nat.*
 " " BLOCH, III. pl. 93, 94.
 " " *Gold Carp*, PENNANT, *Brit. Zoöl.*, III. p. 490.
 " " *Golden Carp*, JENYNS, *Brit. Vert.*, p. 403.
 " " *Gold Carp*, YARRELL, *Brit. Fishes* (2d edit.), I. p. 361.
 " " *Golden Carp, Gold-fish*, GRIFFITH'S *CUV.*, X. p. 377.
 " " " " STORER, *Report*, p. 82.
 " " " " DEKAY, *Report*, p. 190.
Le Carpe dorée, Cyprinus auratus, CUV. et VAL., XVI. p. 101.
 " " STORER, *Mem. Amer. Acad.*, New Series, II. p. 407.
 " " " *Synopsis*, p. 155.
Carrassius auratus, HECK., in *Russ. Reise*, II. p. 1014.

Color. All the upper part of the body a bright orange; sides lighter; beneath, silvery. Fins color of the back. Occasionally the larger species are dark-colored above, and the fins are margined with black.

Description. Body convex in front of dorsal fin. Its greatest depth is equal to rather less than one fourth its length. Scales large, striated. The lateral line pursues nearly a straight course to the tail. The head is flattened between the eyes; its length is equal to the greatest depth of the fish. Eyes prominent; their diameter is equal to one half the distance between them. Mouth small, very projectile. Nostrils large.

The dorsal fin commences on the anterior half of the body, and is as long again as high. The first two rays are spinous; the first is very short and slightly roughened behind; the second is much longer, and is strongly serrated posteriorly. The first two membranous rays are higher than the others, which gradually diminish in height to its posterior extremity.

The pectorals arise just back of the opercula, and extend beyond the origin of the ventrals.

The ventrals commence on a line beneath the origin of the dorsal fin, and are of the same length as the pectorals.

The anal fin is higher than long; its first two rays are spinous, serrated behind like those of the dorsal.

The caudal fin is deeply lunated.

The fin rays are as follows: — D. 15. P. 15. V. 9. A. 7. C. 18.

Length, six to ten inches.

Remarks. This beautiful species, which is a native of China, was introduced many

years since into this country, and is now extensively known among us. It thrives in quite a number of ponds in the neighborhood of Boston, connected with country-seats, bearing well the rigors of our winters, and breeding freely. This species varies exceedingly in its appearance in different individuals. Yarrell, in his "History of British Fishes," observes: "M. de Sauvigny, in his *Histoire Naturelle des Dorades de la Chine*, published at Paris in 1780, has given colored representations of eighty-nine varieties of the Carp, exhibiting almost every possible shade or combination of silver, brilliant orange, and purple." It is a very common circumstance to observe an abnormal condition of one or more of the fins in this fish. Yarrell says: "These fishes are sometimes seen with double anal fins, and others with triple tails; when this occurs, it is generally at the expense of the whole or part of some other fin: thus the specimens with triple tails are frequently without any portion of the dorsal fin, and such specimens have been figured by Bloch and others. Among two dozen Gold-fish for sale in London, were some with dorsal fins extending more than half the length of the back; some, on the contrary, had dorsal fins of five or six rays only, and one specimen without any dorsal fin whatever."

Massachusetts, STORER. New York, DEKAY.

GENUS II. LEUCOSOMUS, HECK.

Body very much compressed, flattened laterally, and deepest at the middle of its length. Head proportionally small, and compressed like the body. Mouth small, terminal, unprovided with cirrhi or barbels of any kind. Eyes very large. Caudal fin forked. Body covered with large scales appearing higher than long when observed imbricated, but which are in fact as long as high and even longer than high when examined in an isolated state. Lateral line forming a very open curve upon the abdomen, convex downwards. Dorsal and anal fins without strong and spiny rays at their anterior margins. Insertion of ventrals in advance of the anterior margin of the dorsal. Pharyngeal teeth conical, pointed, and slightly curved at tip, and disposed upon a double row.

This genus is allied to *Hypsolepis*, from which it differs by its flattened body, small head and mouth, the shape of its scales, and the insertion of the ventral fins.

LEUCOSOMUS AMERICANUS, *Girard*.*The Shiner.*

(PLATE XXI. FIG. 2.)

- Cyprinus Americanus*, LACEP, v. pl. 15, fig. 3.
 " " *American Carp*, SHAW, Gen. Zool., v. p. 204.
Cyprinus chrysoleucas, *New York Shiner*, MITCH., Trans. Lit. and Phil. Soc. N. Y., I. p. 459
Leuciscus chrysoleucas, STORER, Report, p. 88.
Stilbe chrysoleucas, *New York Shiner*, DEKAY, Report, p. 204, pl. 29, fig. 91.
Leuciscus Boscii, *L'Alle de Bosc*, CUV. et VAL., Hist. Nat. Poiss., xvii. p. 313.
Leuciscus Americanus, STORER, Mem. Amer. Acad., New Series, II. p. 408.
 " " " Synopsis, p. 156.
Leucosomus chrysoleucas, ПЕЕК., in Russegger's Reise, II. p. 1042.
Leucosomus Americanus, GIRARD, in Lit.

Color. General color of the back and upper part of sides greenish. Scales with golden reflections; lower portion of sides golden. Abdomen, yellowish-white; opercles golden. Pectorals reddish-yellow. Ventrals and anal red, tinged with black. Dorsal and caudal yellowish-brown. Pupils black, irides golden.

Description. Body very much compressed; its greatest depth rather less than one fourth its entire length; the length of the head equal to about one sixth the length of the body. Head naked, above somewhat depressed. Eyes circular, their diameter equal to one fourth the length of the head.

The lateral line, consisting of about fifty-six scales, commences just back of the superior angle of the operculum, and, passing obliquely down over about eighteen scales. opposite the posterior extremity of the pectoral fins very gradually passes up again towards the posterior extremity of the body, assuming nearly a straight course, which is pursued to the middle of the caudal rays.

The dorsal fin, which is situated upon the middle of the dorsum, is triangular and partly shuts into a groove at its base when not expanded. The first two rays are simple, the remainder multifid. The first ray is very short; the second is as long as the head.

The pectorals commence at the posterior inferior angle of the operculum; they are less high than the dorsal.

The ventrals are fan-shaped, and their rays are multifid.

The anal is quadrangular, and commences on a line opposite the termination of the base of the dorsal; it is emarginated above. Its first three rays are simple.

The fin rays are as follows: — D. 9. P. 17. V. 9. A. 13 - 16. C. 19 - 22.

Length, seven inches.

Remarks. This species is very common in the ponds throughout the State. It is seldom found in Boston market, although it is said to be a delicate fish for the table. It is generally used as bait for Pickerel, and is considered the best bait for that fish.

Massachusetts, STORER. New York, MITCHILL, DEKAY. Ohio River, KIRTLAND. Pennsylvania, South Carolina, CUVIER.

GENUS III. HYPSOLEPIS, BAIRD, MS.

Body rather short, compressed, much the deepest upon the middle of its length. Head very large, sub-conical. Mouth of medium size and terminal; no cirrhi nor barbels of any kind. Jaws equal. Eyes large. Tail tapering. Caudal fin forked. Body covered with very large scales, much higher than long. Lateral line running beneath the middle of the flanks, very conspicuous from the head to the base of caudal fin, and slightly bent downwards upon the abdomen. Dorsal and anal fins without strong and spiny rays at their anterior margins. Insertion of ventrals beneath the anterior margin of dorsal. Pharyngeal teeth disposed upon a double row; external row composed of a few teeth only. Skull twice as broad upon the occiput as between the eyes.

HYPSOLEPIS CORNUTUS, *Girard.*

The Red-fin.

(PLATE XXI. FIG. 3.)

- Cyprinus cornutus, Red-fin, or Rough-head,* MITCH., Amer. Month. Mag., II. p. 324.
Leuciscus cornutus, Red-fin, STORER, Bost. Journ. Nat. Hist., IV. p. 182.
 " " " " Mem. Amer. Acad., New Series, II. p. 409.
 " " " " Synopsis, p. 157.
 " " " DEKAY, Report, p. 207, pl. 29, fig. 92.
Hypsolepis cornutus, GIRARD, in Lit.

Color. Above, blackish-brown with metallic reflections. Sides brilliant, cupreous. After death, the appearance of a broad longitudinal band upon sides. Dorsal and caudal fins dark brown, sometimes mottled with darker color; ventrals and pectorals light-colored; all the fins and the opercles margined with crimson.

Description. Body cylindrical, quite deep anterior to dorsal fin. Greatest depth of fish more than one fifth its entire length. Lateral line commences at the posterior superior angle of operculum, and, curving downwards to posterior extremity of

pectorals, pursues thence a straight course to tail, including in its course fifty scales. Length of head equal to one fifth the length of the fish. Head naked upon its sides, covered upon its top, the sides of the snout, and along the edge of the lower jaw, with numerous pointed horny tubercles, broad at their bases, and acute at their tips, which are larger along the edge of the jaw and quite small upon the top of the head. Very small asperities are felt back of the occiput, upon the dorsum, which to the eye appear like minute white dots.

Eyes moderate, circular; beneath them a series of mucous pores. Nostrils large, tubular; the posterior much the larger. Gape of mouth moderate; the lips slightly project when the mouth is closed. Scales upon sides of body large, very small beneath pectorals. Eight scales in an oblique line above lateral line, and seven below it.

The dorsal fin is situated upon the anterior half of the body; it is quadrate, rather higher than long; the first rays the highest.

The pectorals are broad, rounded when expanded.

The ventrals are fin-shaped; they commence on a line just back of the dorsal fin.

The anal fin is slightly emarginated.

The caudal fin is forked.

The fin rays are as follows: — D. 8. P. 15. V. 8. A. 9. C. 19.

Length, five inches.

Remarks. This beautiful little species is found in many of the streams throughout the State.

GENUS IV. CHEILONEMUS, BAIRD, MS.

Body elongated, subfusiform, compressed. Head stout; its shape being that of a truncated cone, owing to the bluntness of the snout. Mouth very large, sub-terminal, the snout slightly protruding beyond the tip of the lower jaw. A minute barbel at the angle of the mouth. Eyes of medium size. Tail tapering; caudal forked. Body covered with very large scales, which are a little longer than high, subrounded or irregular in their outline. Lateral line conspicuous for the whole length of the body, and slightly inflexed downwards upon the abdomen, and nearer to the insertion of the ventrals than to the base of the dorsal. Dorsal and anal without stout and spiny rays at their anterior margins. Insertion of ventrals situated a little in advance of the anterior margin of the dorsal. Pharyngeal teeth as in the *Hypsolepis*. Skull proportionally broader between the eyes than in the latter.

CHEILONEMUS PULCHELLUS, *Girard.**The Beautiful Leuciscus.*

(PLATE XXII. FIG. 2.)

- Leuciscus pulchellus*, *Beautiful Leuciscus*, STORER, Report, p. 91.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 412.
 " " " Synopsis, p. 160.
 " " *Roach Dace*, DEKAY, Report, p. 208.
 " " *L'Able gentil*, CUV. et VAL., Hist. Nat. Poiss., XVII. p. 320.
 " " AYRES, Proc. Amer. Assoc. Adv. Sc., II. p. 402.
 " " HECK., in Russ. Reise, II. p. 1039.
Leuciscus Argenteus, *Silvery Leuciscus*, STORER, Report, p. 90.
 " " *Silvery Dace*, DEKAY, Report, p. 208.
Leuciscus Storeri, *L'Able de Storer*, CUV. et VAL., Hist. Nat. Poiss., XVII. p. 319, pl. 505.
Leucosomus argenteus, HECK., in Russ. Reise, II. p. 1043.
Cheilonemus pulchellus, GIRARD, in Lit.

Color. Above, of a dark brown; upper portion of sides brassy green; lower portion of sides and abdomen of a beautiful flesh-color, tinged with golden reflections. Head black above; gill-covers cupreous, with flesh-colored tints, and edged posteriorly with a brown, membranous prolongation. Color of dorsal fin similar to that of the back, the firmest portion of the rays reddish. The pectorals are of a reddish-brown above, lighter beneath. The ventrals above are the color of the abdomen.

Description. Body elongated, dorsum slightly arched in front of dorsal fin. Scales upon the body large, transparent, rounded at their summit, truncated at their base, exhibiting numerous striæ; at the base of each scale is seen a dark-colored membrane, which, projecting as far as the apex of the preceding scale, gives the appearance of indistinct oblique bands across the fish; scales smaller upon the back, and smallest upon the throat. The lateral line commences at the superior angle of the operculum, and, curving downwards nine scales, pursues nearly a straight course to the tail. The lateral line is composed of fifty-one scales; nine are situated above the lateral line in an oblique line from the origin of the dorsal fin, and six below the lateral line.

The head is naked; its length is less than one fourth the length of the fish. Diameter of eye about one sixth the length of the head; distance between the eyes equal to one third the length of the head. Nostrils situated in front of the eyes; the posterior orifice the larger, the anterior tubular. Jaws without teeth; the upper jaw projects slightly over the inferior.

The dorsal fin, which is subquadrangular, arises on the anterior half of the body. The first two rays are simple, the others multifid. The first ray is one fourth the height of the second.

The pectorals arise beneath and just anterior to the posterior angle of the operculum.

The ventrals, which are fin-shaped, arise opposite the origin of the dorsal fin. They are not as high as the pectorals.

The anal fin arises opposite the posterior extremity of the dorsal fin when it is closed; it is similar in form to the dorsal. Its first two rays are simple, the remainder multifid. The first ray bears the same proportion to the length of the second, as the first ray of the dorsal to its second ray.

The caudal fin is large, deeply forked. The height of its middle rays is equal to half the height of the outer rays. Width of the tail at extremities when expanded, to height of middle rays, is as three to one.

The fin rays are as follows:—D. 9–10. P. 16–17. V. 8. A. 9–10. C. 20–22.

Length, fourteen inches.

Remarks. This beautiful species is found in many of our rivers, and is known under the names of Roach, Dace, Chivin, and Cousin Trout. It attains the length of about fourteen inches, although the specimens usually met with are much smaller.

GENUS V. ARGYREUS, HECK.

General physiognomy resembling that of *Catostomus*. Snout more or less protruding beyond the upper jaw, thus giving the mouth an inferior position. The mouth itself is rather small, bordered with quite narrow and smooth lips, and provided at its angles with a small barbel, not always easily recognizable, especially in immature specimens preserved in alcohol. The pharyngeal teeth are disposed upon a double row.

This character of a barbel at the angle of the mouth, as well as the structure of the lips and the disposition of the ventral fins, which are inserted in advance of the anterior margin of the dorsal, indicates in these fishes a much greater affinity with *Cheilonemus* than with *Catostomus*. Indeed, the only conspicuous generical differences which can be traced between *Argyreus* and *Cheilonemus* consist in a more cylindrical body and very small mouth in *Argyreus*, and the tendency of the snout to elongate and project in some instances considerably beyond the jaws.

ARGYREUS ATRONASUS, *Heck.**The Black-nosed Dace.*

(PLATE XXI. FIG. 4.)

- Cyprinus atronasmus*, *Brook Minnow*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 460.
 " " *Black-nosed Dace*, DEKAY, Report, p. 205, pl. 33, fig. 69.
Leuciscus atronasmus, *L'Able à Nez noir*, CUV. et VAL., Hist. Nat. des Poiss., XVII. p. 376, pl.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 408.
 " " " Synopsis, p. 156.
Rhinichthys atronasmus, AGASSIZ, Lake Sup., p. 354.
Argyreus atronasmus, HECK., in Russ. Reise, II. p. 1040.
 " " GIRARD, in Lit.
Argyreus rubripinnis, Mus. Par. fide Heck. in Russ. Reise, II. p. 1040.

Color. Above, of a reddish brown; abdomen of a silvery white with minute brown blotches. A broad black band, commencing at the snout, passes through the eyes along the whole length of the fish and is lost upon the caudal fin. A narrow lighter line arises at the operculum and runs along the upper edge of the former. Pupils black. Irides golden. The dorsal and caudal fins are of a dark-brown color. The anal is nearly colorless. The pectorals are orange.

Description. Body oblong, tapering to the tail. The greatest depth of this species is equal to the length of the head. Head flattened above; the length of the head is equal to about one sixth the entire length of the fish. The eyes are moderate. The nostrils are large. The upper jaw projecting.

The dorsal fin, which is situated upon the middle of the dorsum, is subquadrangular and emarginated above.

The fan-shaped pectorals are situated just beneath the posterior angle of the operculum.

The ventrals are very delicate.

The caudal fin is deeply forked.

The fin rays are as follows: —D. 8. P. 14. V. 8. C. 19.

Length of fish three inches.

Remarks. This pretty little species, which seldom if ever exceeds three inches, is found in many of our rivers.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

ARGYREUS NASUTUS, *Girard.**The Long-nosed Dace.*

(PLATE XXII. FIG. 1.)

Leuciscus nasutus, AYRES, Bost. Journ. Nat. Hist., IV. p. 299, pl. 13, fig. 3.

" " STORER, Mem. Amer. Acad., New Series, II. p. 415.

" " " Synopsis, p. 163.

Rhinichthys nasutus, AGASSIZ, Lake Sup., p. 354.*Argyreus nasutus*, GIRARD, in Lit.

Color. Dorsum and upper part of sides dark brown. Beneath, white. Dorsal and caudal fins brownish. Pectorals lighter than dorsal. Ventrals and anal colorless.

Description. Body elongated; cylindrical in front of the dorsal fin, compressed posteriorly; its greatest depth equal to about one eighth of its entire length. Head equal in length to one fifth of the fish; flattened above and destitute of scales, terminating in an obtuse snout, having the mouth beneath. Eyes circular, equal in diameter to one sixth the length of the head. The nostrils are directly in front of the eyes, the posterior the larger. The lateral line pursues nearly a straight course to the caudal fin.

The dorsal fin is situated on the anterior half of the dorsum, and is subquadrangular.

The pectorals are just beneath the posterior angle of the operculum; they are large and rounded.

The ventrals arise opposite a line just in front of the dorsal fin.

The anal fin is of a similar form with the dorsal, and arises opposite the termination of that fin.

The caudal fin is lunated.

The fin rays are as follows:—D. 8. P. 16. V. 9. A. 8. C. 19.

Length, four inches.

Remarks. This species was first described by William O. Ayres, M. D., in the Boston Journal of Natural History. He had received specimens from West Hartford, Connecticut, from Mr. Charles P. Turner of Hartford, and others from Blanford in this State, from Mr. C. H. Olmstead. From this latter gentleman, we learn that "they inhabit rapid streams, hiding most commonly under stones, from which they often dart out with great speed." When taken, "they struck at the bait with all the quickness and vigor of Trout, and might be taken in almost any numbers." It has also been found by Mr. S. F. Baird in Nichols Brook, a tributary of the Connecticut River.

Massachusetts, OLMSTEAD, BAIRD. Connecticut, AYRES.

GENUS VI. CATOSTOMUS, LESUEUR.

Back with a single dorsal fin. Gill-membrane three-rayed. Head and opercula smooth. Jaws toothless and retractile. Mouth beneath the snout, lips plaited, lobed, or carunculated, suitable for sucking. Throat with pectinated teeth.

CATOSTOMUS BOSTONIENSIS, *Lesueur*.*The Sucker.*

(PLATE XXII. FIG. 3.)

Cyprinus catostomus, FOSTER, Mem. Amer. Acad., II. pt. 2, p. 55, pl. 2, fig. 4.*Catostomus Bostoniensis*, LESUEUR, Journ. Acad. Nat. Sc., I. p. 106.

" " STORER, Report, p. 84.

Le Catostome Bostonien (*Catostomus Bostoniensis*, LES.), CUV. et VAL., XVII. p. 432.

" " STORER, Mem. Amer. Acad., New Series, II. p. 423.

" " " Synopsis, p. 191.

Color. Above of a light-brown; the sides of a reddish-brown, presenting beautiful metallic reflections; opercula golden. Head, dark-olive above; beneath, white. Pupils black, irides golden. The pectorals, ventrals, and anal fin are reddish-yellow; the dorsal and caudal fins are brown; the latter fin is the darker.

Description. Body subcylindrical, elongated; rounded in front of the dorsal fin, compressed posteriorly; the dorsum is broad in front of the dorsal fin. The scales on the anterior portion of the body are quite small; they increase in size towards the posterior portion, and back of the dorsal fin are much larger; they exhibit at their exposed extremity a few very distinct longitudinal striæ, which are crossed by minute concentric lines; more numerous longitudinal striæ are seen at the concealed extremity, which is rounded at its centre.

Head naked; its length is rather less than one fifth the length of the body. A series of mucous pores extends across the occiput to the gill-covers on each side, and from the termination of this series a second passes forward to the posterior superior angle of the eye, downward back of the eyes, then curves forward and is lost about the snout. Another series passes forward, from the occipital series between the eyes, which extends to the snout. Eyes moderate in size, oblong; distance between the eyes equal to less than one third the length of the head. Mouth small, very protractile, lips carunculated. Lower lip bilobate. Nostrils double, the anterior quite small, the posterior much the larger and partially covered by a fleshy valve. The lateral line, which seems to be a continuation of the series of mucous ducts upon the head,

commences at the posterior superior angle of the operculum, and, curving downwards and backwards a few scales, pursues a straight course to the tail.

The dorsal fin is subquadrangular; it arises at the middle of the body, not including the caudal fin. The first rays are simple.

The pectorals are just back of the inferior posterior angle of the operculum; their height is less than the length of the head.

The ventrals are situated beneath the middle of the dorsal fin; they are as high as the pectorals.

The anal fin is equal in height to the pectorals; it is rounded when expanded. The first two rays are simple; the others are branched; the posterior rays are the shortest.

The caudal fin is deeply lunated; the rays are articulated.

The fin rays are as follows: — D. 14–16. P. 18. V. 10. A. 9. C. 18.

Length, fifteen inches.

Remarks. During the spring and autumn this species is frequently met with in Boston market, and in a mild winter they may be found there at almost any time. They are most commonly brought here from Charles River, Watertown; and sometimes attain the weight of five pounds. They are of but little value. Occasionally they are brought into the city by the cart-load, and sold as the Mullet.

New Hampshire, PECK. Massachusetts, LESUEUR, STORER. New York, Pennsylvania, CUVIER.

CATOSTOMUS GIBBOSUS, *Lesueur.*

The Chub Sucker.

(PLATE XXII. FIG. 4.)

- Catostomus gibbosus*, *Chub Sucker*, LESUEUR, Journ. Acad. Nat. Sc., I. p. 92, fig.
 “ “ *Gibbous Sucker*, STORER, Report, p. 88.
 “ “ CUV. et VAL., Hist. Nat. Poiss., xvii. p. 443.
 “ “ STORER, Mem. Amer. Acad., New Series, II. p. 420.
 “ “ “ Synopsis, p. 168.
Labeo gibbosus, *Gibbous Chub Sucker*, DEKAY, Report, p. 194, pl. 32, fig. 101.
Catostomus tuberculatus, LESUEUR, Journ. Acad. Nat. Sc., I. p. 92, fig.
 “ “ STORER, Report, p. 85.
 “ “ *Horned Sucker*, DEKAY, Report, p. 199, pl. 31, fig. 97.
 “ “ CUV. et VAL., Hist. Nat. Poiss., xvii. p. 444.

Color. The back and upper portion of the sides of this species, when first caught,

are of a dark-brown, which, after death, changes to a greenish hue. Head of a dark slate-color above; opercula, a pale dull yellow. Sides of a greenish-yellow, with golden reflections. Abdomen in front of ventrals nearly white, towards anal fin slightly pinkish. Body marked with four or five faint transverse bands. Dorsal and caudal fins color of the back. Pectorals and ventrals reddish, edged with dark-brown. Anal fin in some individuals color of pectorals and ventrals, in other specimens of a bluish or purplish brown.

Description. Body compressed laterally, convex in front of dorsal fin; this convexity commences suddenly at the occiput, and is greatest at the origin of the dorsal. Greatest depth of fish equal to about one fourth its length. Scales with very distinct striæ; when plucked from the fish, they are quadrangular and exhibit concentric lines passing across the striæ; exceedingly delicate concentric lines are seen over the entire scale. The head, which is smooth, is less than one fifth the length of the fish. Snout short, rounded. Eyes moderate. Nostrils double, separated by a loose membrane, the posterior the larger. Mouth small, lunated. At some seasons of the year, between the eyes and snout on each side of the head are four prominent spines having broad fleshy bases; the upper anterior prominences the largest, and the upper posterior the smallest. Beneath the first spine a smaller one is seen; and directly back of it a third nearly as large as the first. These first three form a triangle. Just above the third prominence and in front of the upper anterior angle of the eye, and between the nostrils and the eye, is a fourth prominence smaller than the others. In some individuals, the spinous parts are removed and the bases remain as hard tubercles; sometimes the bases themselves are removed, and while the points from which they were thrown off in some specimens are scarcely perceptible, in others a distinct excavation is seen. Sometimes one or more tubercles are missing in the same individual. Dekay remarks that this species has "three to five tubercles on each side." I have never met with more than four.

The quadrangular dorsal fin commences upon the anterior half of the body.

The pectorals arise just back of the posterior inferior angle of the operculum; they are rounded when expanded.

The ventrals, which are very nearly as high as the pectorals, are situated opposite the anterior half of the dorsal fin.

The anal fin is deeply emarginate; its third and fourth rays are the longest.

The lower lobe of the caudal fin is slightly longer than the upper.

The fin rays are as follows:— D. 16. P. 16. V. 9. A. 10. C. 18.

Length, seven to twelve inches.

Remarks. This species, which is known under the name of "Barbel" and "Chub Sucker," is found in many of the ponds throughout the State.

Massachusetts, LESUEUR, STORER. New Hampshire, Connecticut, New Jersey, DEKAY. Pennsylvania, LESUEUR.

FAMILY XIII. CYPRINODONTIDÆ.

The mouth is constructed upon the same plan as in the Cyprinidæ; but there are teeth upon the jaws. Instead of a pharyngeal arch, bearing recurved and hooked teeth, the Cyprinodonts have the surface of the posterior portion of the hyoid apparatus paved with short teeth; and opposite to the latter, in the back part of the roof of the mouth, there are patches of velvet-like teeth. There are neither vomerine nor palatine teeth. The upper surface of the head is generally covered with scales to the tip of the snout. The dorsal fin, in most instances, is situated upon the posterior half of the body, and opposite the anal fin.

GENUS I. FUNDULUS, LACÉP.

Upper surface of head, structure of mouth, and maxillary teeth similar to the same parts in *Hydrargyra*. Lower pharyngeal teeth sub-conical, more slender than in the latter. Branchial rays five on either side. Dorsal similarly opposed to the anal. Caudal posteriorly rounded. Upper surface and sides of head covered with scales as in *Hydrargyra*.

The genera *Fundulus* and *Hydrargyra* are closely allied. The chief differences are, a more flattened head in *Hydrargyra*, giving it some resemblance to *Pæcilia* or *Molinesia*; six branchial rays instead of five; the pharyngeal teeth shorter and stouter, with a more conspicuous crown. Finally, the caudal is sub-truncated posteriorly, instead of being rounded as in *Fundulus*, — a character, however, of minor importance, since we find in the same family genera including species with a rounded, and others with a truncated, caudal fin.

FUNDULUS PISCULENTUS, *Cuv. et Val.**The Ornamented Minnow.*

(PLATE XXIII. FIG. 3. Male. 4. Female.)

- Esox pisculentus*, *White-bellied Killifish*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., 1. p. 441.
Esox pisciculus, *Yellow-bellied Killifish*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., 1. p. 441.
Esox zonatus, *Banded Killifish*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., 1. p. 443.
Fundulus fasciatus, VAL., in Humboldt and Bonpland, II. p. 162, pl. 62, fig. 1, 4, 5.
Fundulus viridescens, *Big Killifish*, DEKAY, Report, p. 217, pl. 31, fig. 99.
Fundulus zebra, *Barred Killifish*, DEKAY, Report, p. 218.
Hydrargyra pisculenta, AYRES, Bost. Journ. Nat. Hist., IV. p. 267.
Hydrargyra fasciata, AYRES, Bost. Journ. Nat. Hist., IV. p. 266.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 432.
 " " " Synopsis, p. 180.
Hydrargyra ornata, LESUEUR, Journ. Acad. Nat. Sc., I. p. 131.
 " " *Ornamented Minnow*, STORER, Report, p. 94.
 " " DEKAY, Report, p. 221.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 433.
 " " " Synopsis, p. 181.
Fundulus pisculentus, CUV. et VAL., Hist. Nat. Poiss., XVIII. p. 190.
 " " GIRARD, in Lit.
Fundulus zonatus, CUV. et VAL., Hist. Nat. Poiss., XVIII. p. 190.

Color. Female of a uniform brown color.

Male, lighter at intervals upon the sides, the appearance being presented of transverse bands. Dorsal and anal fins with black dots. Anal fin slightly emarginated posteriorly.

Description. Body oblong, stout, compressed posteriorly. Top of head and back flattened. Head one fourth the entire length of the fish. Scales upon top of head very large. Diameter of eyes equal to one fourth the length of the head. Eyes distant from each other. A series of mucous pores on each side of head above eyes, extending also in front of eyes to the anterior inferior edge; a series is also seen along lower edge of operculum. The nostrils are situated just in front of the anterior superior edge of the eye. Mouth protractile, vertical when jaws are closed. Very minute, numerous teeth in both jaws.

The dorsal fin is situated upon the posterior half of the body; it is rounded above.

The pectorals are broad and fan-shaped.

The anal fin is situated beneath the dorsal.

The ventrals are small, their rays are multifold.

The caudal fin is broad, rounded posteriorly.

The fin rays are as follows: — D. 12. P. 15. V. 6. A. 9–10. C. 20 $\frac{3}{4}$.

Length, one to five inches.

Remarks. This is the most common Minnow found in the salt marshes around Boston, and is known generally by the boys under the name of *Cobler*. It is taken in

large quantities with hand nets, being excellent bait for other fishes, more particularly for Smelts.

I have also seen a flock of the domestic duck swallowing it with the greatest avidity when thrown to them in the same manner as grain, with other species of Killifish.

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, DEKAY. Delaware river, LESUEUR. Carolina, DEKAY.

FUNDULUS NIGROFASCIATUS, *Cuv. et Val.*

The Banded Minnow.

(PLATE XXIII. FIG. 1.)

- Hydrargyra nigrofasciata*, LESUEUR, Journ. Acad. Nat. Sc., I. p. 133.
 " " *Banded Minnow*, STORER, Report, p. 94.
 " " DEKAY, Report, p. 221.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 434.
 " " " Synopsis, p. 182.
Fundulus nigrofasciatus, CUV. et VAL., Hist. Nat. Poiss., XVIII. p. 193.
 " " GIRARD, in Lit.

Color. Above, yellowish-green, with numerous minute black dots; beneath, silvery white. From ten to fourteen narrow black bars cross the sides transversely; the anterior pass to the abdomen, the posterior cross the fleshy portion of the tail entirely; opercula cupreous; a yellow spot exists at the origin of the base of the dorsal fin. Pupils black, irides silvery. In the male fish, the bars are broader.

Description. Head compressed above; its length is equal to one fourth the length of the fish. The eyes are small and circular. The distance between the eyes is equal to one half the length of the head. Jaws projectile.

The dorsal fin is situated upon the posterior portion of the body.

The pectorals are just back of the opercula.

The ventrals are very small.

The anal fin is similar in form to the dorsal, and situated opposite that fin.

The caudal fin is slightly rounded.

The fin rays are as follows: — D. 12. P. 18. V. 6. A. 12. C. 17.

Length, two to three inches.

Remarks. This species is much less common than the *pisculentus*. It is found in the vicinity of Boston, in Fresh Pond, Cambridge.

Massachusetts, STORER. Rhode Island, LESUEUR.

FUNDULUS MULTIFASCIATUS, *Cuv. et Val.**The Barred Minnow.*

(PLATE XXIII. FIG. 2.)

- Hydrargyra multifasciata*, LESUEUR, Journ. Acad. Nat. Sc., I. p. 131.
 " " *Barred Minnow*, DEKAY, Report, p. 220.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 433.
 " " " Synopsis, p. 181.
Fundulus multifasciatus, CUV. et VAL., Hist. Nat. Poiss., XVIII. p. 200.
 " " GIRARD, in Lit.

Color. The living fish is of an olive upon its whole upper portion; the sides are lighter; the lower portion of the opercles silvery; the throat and posterior portion of the abdomen are of a bluish-gray color; the body is transversely marked with numerous bluish bands, and dotted with darker minute points; the pupils are black, the irides silvery. When dead this species changes to a yellowish-green, darker above; and the transverse bands are scarcely perceptible.

Description. Body cylindrical anteriorly, more compressed posteriorly; dorsum slightly convex just anterior to the dorsal fin; its greatest depth equal to one sixth its length. The head is broad and flattened above. Its length is greater than the greatest depth of the fish, and less than one third its entire length. The distance between the eyes is equal to one third the length of the head. The eyes are large, somewhat oblong. The jaws are equal, and are armed with very minute teeth. The nostrils are large, and are situated just anterior to the upper edge of the eyes.

The indistinct lateral line is nearly straight.

The dorsal fin, which is quadrangular, commences upon the anterior half of the body. The pectorals are fan-shaped, and are equal in height to the length of the dorsal fin. They extend just beyond the origin of the ventrals.

The ventrals are small; they commence on a line with the posterior extremity of the pectorals; their third ray is the longest.

The anal fin is shorter than the dorsal, and terminates just in front of the posterior extremity of that fin.

The caudal fin is broad, and nearly straight at its termination.

The fin rays are as follows:— D. 13–14. P. 18. V. 5. A. 12–13. C. 16.

Remarks. Professor Agassiz kindly lent me a specimen of this fish taken at Concord; and a second taken at Lowell has been sent me by my friend, Mr. Charles Girard, of the Smithsonian Institute, to whom I would express my most grateful acknowledgments for his invaluable aid in the preparation of the Cyprinidæ for the press.

Massachusetts, AGASSIZ, GIRARD. New York, LESUEUR.

VII.

A History of the Fishes of Massachusetts.

By DAVID HUMPHREYS STORER, M. D., A. A. S.

Continued from Vol. V. p. 296.

FAMILY XIII. CYPRINODONTIDÆ (*continued*).

GENUS II. HYDRARGYRA, LACÉP.

Upper surface of head flattened; but the jaws are not depressed. Fine card-like teeth upon the jaws. Opening of mouth semicircular. Lower pharyngeal teeth with rounded crowns, the medio-posterior ones the largest. Branchial rays six on either side. Dorsal opposite to anal, as in the genus *Esox*. Caudal posteriorly subtruncated. Upper surface and sides of head covered with scales.

HYDRARGYRA FLAVULA, *Storer*.

The Basse Fry.

(PLATE XXIII. FIG. 5. Male. 6. Female.)

Esox flavulus, *New York Gudgeon*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 439, pl. 4, fig. 8.

Cyprinodon flavulus, VAL., in Humboldt and Bonpland, II. p. 164, pl. 62, fig. 3.

Hydrargyra flavula, *The Basse Fry*, STORER'S Report, p. 95.

“ “ AYRES, Bost. Journ. Nat. Hist., IV. p. 267.

“ “ GIRARD, in Lit.

Hydrargyra formosa, STORER, Proc. Bost. Soc. Nat. Hist., I. p. 76.

Hydrargyra trifasciata, STORER, Bost. Journ. Nat. Hist., I. p. 417.

Fundulus fasciatus, *Striped Killifish*, DEKAY, Report, p. 216, pl. 31, fig. 98.

Hydrargyra vernalis, CUV. et VAL., Hist. Nat. Poiss., XVIII. pp. 206, 207.

Hydrargyra flavula, STORER, Mem. Amer. Acad., New Series, II. p. 432.

“ “ “ Synopsis, p. 180.

Color. Female of a yellowish-green above, lighter upon the sides, and white beneath. Several longitudinal, interrupted black bands, sometimes five in number, may

be distinctly seen, at other times not more than one or two, upon the sides, extending from the gill-covers almost the whole length of the fish. At the base of the caudal fin, just at the termination of the longitudinal bands, are three or more less distinct transverse bands of a similar color.

In the male, the sides and back are of a greenish-black; the sides are crossed by numerous slate-colored, nearly black, transverse bands, varying very much in their number and width in different individuals, — some individuals exhibiting ten or twelve bands only, while in others are observed twenty, or even more. In some specimens these bands are of the same size throughout their whole length; in others, they diminish gradually from the centre to the sides towards the abdomen, upon which they are lost. In some specimens these bands are less than the sixteenth of an inch wide; in others, they are quite the eighth of an inch. The lower portion of the sides, as well as the abdomen, is of a beautiful yellowish-green color. The operculum is marked by a large black spot; the preoperculum is fuliginous, sometimes cupreous. The dorsal fin is violet-colored, with a black spot, circular in some individuals, upon the centre of the posterior three or four rays; anterior to this spot, in some of the larger specimens, are three or four broken, dark-colored blotches. The pectorals are yellowish. The ventrals are the color of the abdomen. The anal fin is almost green. The caudal fin is orange-colored, margined at its extremity with black. In the dead fish, the general color becomes much lighter, but the black spots upon the dorsal fin and operculum remain.

Description. Body elongated, slightly convex on the dorsum over the pectorals in the female, nearly straight in the male. Greatest depth of the body, which is across the pectorals, less than the length of the head. The head, which is equal in length to one fourth of the entire length of the fish, is compressed above. The mouth is protractile, with numerous minute teeth in the jaws. The eyes are circular.

The dorsal fin is situated upon the posterior half of the body. In the female, it is nearly quadrangular; in the male, the last rays are quite as high as the first, and the extremities of the rays project beyond the connecting membrane.

The pectorals are higher than the dorsal, and are rounded when expanded.

The anal fin is higher than long; in the female the rays of this fin gradually diminish in height posteriorly, while in the male the sixth and seventh rays are highest.

The caudal fin is broad and rounded when expanded.

The fin rays, in three specimens examined, were as follows: —

D. 16. P. 16. V. 6. A. 11. C. 19.

D. 15. P. 17. V. 6. A. 11. C. 20.

D. 14. P. 18. V. 6. A. 12. C. 18.

Length, one to four inches.

Remarks. This pretty species, called by Mitchill the "New York Gudgeon," and known by our fishermen as the "Basse-fry," from the resemblance of the markings of the female to those of the "Striped Basse," and called by boys the "Yellow-tail," is common in brackish waters in the vicinity of Boston. The two sexes were formerly considered distinct species.

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, DEKAY.

FAMILY XIV. ESOCIDÆ.

Body elongated. One dorsal, generally opposite to the anal: Edge of the upper jaw either formed solely by the intermaxillaries, or, if the labials enter at all into its composition, they are destitute of teeth. Intestinal canal short, without cœca. Branchial rays vary from three to eighteen. Mouth large, and without sharp teeth.

GENUS I. ESOX, CUV.

Head depressed, large, oblong, blunt; intermaxillaries small, with small, pointed teeth at the middle of the upper jaw, of which they form two bands. The maxillaries forming the sides have no teeth. The vomer, palatines, tongue, pharyngeals, and branchial arches bristled with card-like teeth. Sides of the lower jaw with a row of long, pointed teeth.

ESOX RETICULATUS, *Lesueur.*

The Pickerel.

(PLATE XXIV. FIG. 1.)

- Esox lucius*, *Pickerel*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 440.
Esox reticulatus, LESUEUR, Journ. Acad. Nat. Sciences, I. p. 414.
 " " *Common Pickerel*, STORER, Report, p. 97.
 " " *Pike*, KIRTLAND, Report, p. 194.
 " " *Common Pickerel*, DEKAY, Report, p. 223, pl. 34, fig. 107.
Esox fuscatus, *Varied Pickerel*, DEKAY, Report, p. 224, pl. 34, fig. 110.
Esox reticulatus, *Pickerel*, THOMPSON'S History of Vermont, p. 138
 " " AYRES, Bost. Journ. Nat. Hist., IV. p. 269.
 " " *Pickerel*, *Pike*, KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 233, pl. 10, fig. 2.
Esox tredecem lineatus, *Federation Pike*, MITCH., MIRROR, 1825, p. 361.
Esox tredecem radiatus, *Federation Pike*, DEKAY, Report, p. 225.
Esox reticulatus, *Pickerel*, STORER, Mem. Amer. Acad., New Series, II. p. 437.
 " " " " Synopsis, p. 185.
Le Brochet réticulé (*Esox reticulatus*, LESUEUR), CUV. et VAL, XVIII. p. 327.

Color. The color of this species varies considerably in different localities. Most commonly, however, the body is green above; the sides are of a beautiful golden-

yellow, marked over their whole extent with irregularly distributed dark, longitudinal lines, which by their union produce imperfect reticulations. The body beneath is white, the throat is flesh-colored. The pupils are black; the irides greenish, with a golden ring upon their anterior edge. Beneath the eyes, a deep black band passes perpendicularly to the lower edge of the gill-covers. The dorsal fins are of a greenish-black. The pectoral, anal, and ventral fins are flesh-colored.

Description. Body subcylindrical, much flattened upon the back. The scales are very small. The length of the head is one third less than that of the body, and it is flattened above. The snout is obtuse. The mouth is capable of very great distention. The tip of the lower jaw projects beyond the upper. Teeth on the upper maxillary small; teeth on the anterior portion of the lower jaw small, exceedingly sharp, and incurved; a few on the sides of the lower maxillary quite large, with cutting edges; the palatine bones are armed with numerous incurved teeth, the innermost row the largest; strong teeth are also seen upon the maxillary bones; the vomer, the branchial arches, and the base of the tongue, are likewise furnished with minute teeth. The eyes are moderate in size; they are irregularly oval, their longest diameter being from before, backwards. The nostrils, which are situated in a groove, are quite large; the posterior is much the larger.

The dorsal fin, which is subquadrangular, is situated a short distance in front of the tail. Its fourth and fifth rays are higher than the length of the fin; the first three rays are single, and firmer than the others; the first is about one fifth the height of the fourth; the second is as high again as the first; the third, not as high again as the second.

The pectorals commence on a line with the sixteenth branchial ray; their height is equal to the length of the dorsal fin. They are rounded when expanded.

The ventrals are situated on the anterior half of the body, and they likewise are rounded when expanded. Their rays are multifid. These fins are shorter than the pectorals.

The anus is large, and situated just in front of the anal fin.

The anal fin commences opposite the middle of the dorsal, and is of nearly the same form and size as that fin.

The caudal fin is forked.

The fin rays are as follows: — B. 17. D. 18. P. 13. V. 9. A. 17. C. 19 $\frac{7}{7}$.

Length, one to two feet.

Remarks. This fine species is the common Pickerel of Massachusetts. It is generally diffused throughout the State, and is everywhere valued. Specimens

may be met with in Boston market almost any month in the year, although greater numbers are taken in the spring and autumn, and some years during the winter. The largest specimens I have seen were brought from Brewster, Cape Cod. Individuals from that place weighing seven pounds have been sold in our market, and they are said to be taken there considerably larger even than this. They are generally caught with the hook; considerable quantities, however, are speared, in some cases through the ice; at other times individuals go out in boats in the evening with lights, the pickereel are attracted, and are speared as they collect round the boats.

Maine, Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, DEKAY. Ohio, KIRTLAND.

ESOX ORNATUS, *Girard*.

The Smaller Pickerel.

(PLATE XXIV. FIG. 2.)

Esox ornatus, GIRARD, Proc Bost Soc Nat Hist, v. p 41 1854

Color. A darkish-green, barred transversely and quite regularly with narrow blackish-brown bands, some twenty in number, which hardly reticulate; not at all posteriorly. The black band beneath the eye pointing somewhat obliquely backward. Throat stained with fuliginous.

Description. Very similar in its characters to those of the *reticulatus*. The following differences are observable. Head considerably more than one fourth the whole length of the body; in the *reticulatus* it is one fourth.

The distance of the ventrals before the anal fin is about one quarter of the whole length; in the *reticulatus* it is not one sixth.

The pectorals commence on a line with the sixth branchial ray; in the *reticulatus*, on a line with the sixteenth.

The fin rays are as follows: — D. 11. P. 13. V. 9. A. 11. C. 19.

Length, seven and a half inches.

Remarks. This species is not unfrequently noticed in Boston market, and is so similar to the *reticulatus* that it has heretofore been considered to be the young of that species.

Massachusetts, GIRARD, STORER.

GENUS II. BELONE, CUV.

Head and body greatly elongated; the latter covered with minute scales. Both jaws very much produced, straight, narrow, and pointed; armed with numerous small teeth, those of the pharynx paved. Scales not very apparent, except a longitudinal range, carinated on each side near the inferior edge.

BELONE TRUNCATA, *Lesueur*.*The Gar-fish.*

(PLATE XXIV. FIG. 3.)

Esox Belone, *Bill-fish*, MITCH, Trans Lit and Phil Soc. of N Y., I p 443*Esox longirostris*, *Long-jawed Fresh water Pike*, MITCH, Amer Month Mag, II p 322.*Belone truncata*, *Gar or Bill-fish*, LESUEUR, Journ. Acad Nat. Sc, II p 126, fig." " *Gar-fish*, STORER, Report, p 98." " *Banded Gar-fish*, DEKAY, Report, p 227, pl 35, fig 112

" " STORER, Mem Amer. Acad, New Series, II. p. 438

" " " Synopsis, p. 186.

L'Ophie à caudale tronquée (*Belone truncata*, LESUEUR), CUV et VAL, XVIII p. 422

Color. After being preserved in salt, this fish is of a light-green above; beneath silvery, including opercles and lower mandible. Just above the base of the pectorals a band of a darker color arises, and passes in a straight line to the origin of the dorsal fin. Minute fuliginous spots upon the upper portion of opercles.

Description. The body is elongated; the scales small and orbicular. The lateral line arises at the inferior angle of the operculum, and, passing gradually up to the inferior base of the pectorals, assumes thence a straight line, which is continued to the base of the caudal rays. Its greatest depth is equal to about one fifteenth its entire length; the length of the head, from the angle of the jaws to the posterior portion of the operculum, is equal to one tenth the length of the body. The jaws are armed with distant, very sharp, conical teeth, between which are numerous others very minute; the lower mandible projects beyond the upper, and is fleshy at its tip. The head is flattened above, and compressed laterally; the eyes are longitudinally oval; the distance between the eyes is equal to their longer diameter. The nostrils are situated in a triangular space just in front of the eyes.

The dorsal fin is situated on the posterior fourth of the body; its anterior rays are highest, and it is emarginated posteriorly.

The pectorals are directly back of the posterior angle of the operculum; their length is equal to one fourth the height of their longest rays.

The ventrals are situated upon the posterior half of the body; their length is equal to one fourth of their height.

The anal fin is of the same form as the dorsal; it commences just in front of that fin, and is coterminous with it; its anterior rays are longer than the corresponding ones of the dorsal fin.

The caudal fin is slightly emarginated.

The fin rays are as follows: — D. 15. P. 12. V. 6. A. 19. C. 19.

Length, one to two feet.

Remarks. The only specimens I have seen of this species were sent to me by Dr. Yale, from Holmes's Hole, where it is called "Gar-fish."

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, LESUEUR, MITCHILL, DEKAY. Pennsylvania, Rhode Island, LESUEUR.

GENUS III. SCOMBERESOX, Cuv.

Have the same structure of the jaws as the *Belone*; and are similar, also, in the form of the body and scales, with a keel-like edge to the belly; but the posterior portions of the dorsal and anal fins are divided, forming finlets, as in the Mackerel.

SCOMBERESOX STORERI, *Dekay*.

The Bill-fish.

(PLATE XXIV. FIG. 4.)

Scomberesox equirostrum, LESUEUR, Journ. Acad. Nat. Sc., II. p. 132.

Scomberesox scutellatum, LESUEUR, Journ. Acad. Nat. Sc., II. p. 132.

Scomberesox equirostrum, *Bill-fish*, STORER, Report, p. 100.

Scomberesox Storeri, *Bill-fish*, DEKAY, Report, p. 299, pl. 35, fig. 111.

" " STORER, Mem. Amer. Acad., New Series, II. p. 439.

" " " Synopsis, p. 187.

Le Scombrésoce equirostre (*Scomberesox equirostrum*, LESUEUR), CUV. et VAL., XVIII. p. 479.

Color. The dorsum is of an olive-green color; beneath this, a strongly-marked silvery band, half an inch wide, runs the whole length of the body, divided in its centre by a narrow longitudinal line of the same color as the back; the abdomen and gill-covers are satiny. The dorsal fin is greenish, as well as the finlets posterior to it. A dark-green spot is situated at the base of the pectorals, above. After death, the olive-green upon the back becomes a coppery green; the sides lose their splendor, and the fins their transparency.

Description. Body elongated, compressed, gradually lessening in depth back of the anus. Head, including the jaws, equal to one fourth the length of the body; gill-covers large, smooth; the lower jaw the longer; the jaws, at their origin, are armed

with very minute teeth. The eyes are moderate; their diameter is equal to one twelfth the length of the head; the distance between the eyes rather greater than their diameter. Nostrils large.

From the lower edge of the operculum, extending to the fourth anal finlet, forming the lateral boundaries of the abdomen, are two yellowish lines, which are continued series of scales; when raised they resemble serrations, when not erect they look like sinuses. Between these rows of scales are situated the ventrals, the anal, and the anal finlets.

The dorsal fin is small, and situated upon the posterior third of the body. It is longer than high; the first and second rays are simple; the first is about half the height of the second; the first three or four rays are articulated. Posterior to this fin are situated five, and in some specimens six, finlets.

The triangular pectorals are situated at the posterior angle of the operculum; the first ray is longer and broader than the others.

The fan-shaped ventrals are situated just back of the centre of the body.

The anal fin commences about opposite the dorsal, and terminates nearly on a line with it. Back of this fin are five or six finlets.

The caudal fin is deeply forked, the lower lobe projecting slightly beyond the upper; the rays are articulated. In the recent fish the fleshy portion of the tail is continued to the top of the central rays, presenting a large silvery patch.

The fin rays are as follows: — D. 10, v. or vi. P. 14. V. 6. A. 12, v. or vi. C. 20. Length, ten inches.

Remarks. This is one of our most beautiful species. It usually appears in the month of October, sometimes earlier and sometimes later, however, depending upon the season. Large quantities are yearly thrown upon the shore at Provincetown, and are considered worthless, while by the inhabitants of some of the other towns upon Cape Cod it is taken in immense numbers, and is considered by them very nutritious food.

In the year 1821, Lesueur read to the "Academy of Natural Sciences of Philadelphia" a description of this species; to use his own words, "taken from an individual preserved and dried in the cabinet of the Linnæan Society of Boston, under the name of *Saurus*. It cannot be regarded as sufficiently complete, but may serve to call the attention of others who may have a better opportunity of completing its description." In my "Report on the Fishes of Massachusetts," published in 1839, I had an opportunity of presenting a description drawn up from recent specimens; and under the head of this species, I made the following observations: — "Lesueur's description

shows his specimen to have been an imperfect one. I have seen no specimen in which the jaws were of equal length; the lower jaw was undoubtedly broken in the specimen seen by Lesueur, as is very apt to be the case in dried specimens of this genus, else he could not have called it '*equirostrum*'; still, as some naturalists think a specific name need not point out any particular character, and as I have no desire to detract from the labors of another, I shall merely point out the characters as they exist in the recent specimen, and leave Lesueur's name to be changed, should it ever be thought advisable, by some succeeding ichthyologist." In 1842, Dekay published his "Zoology of New York." In his volume on the Ichthyology of that State, while describing this species, he says: "The original notice of this species by Lesueur was made from an imperfect and dried cabinet specimen; and his name, of very dubious Latinity, and drawn from a false character, must be rejected. The name which I have attached to it is due to the distinguished ichthyologist who pointed out distinctly the impropriety of the appellation, and was its first accurate describer." Dr. Dekay having thus agreed with me in the opinion of the "impropriety" of Lesueur's specific name, I did not hesitate to adopt the one he proposed, in my "Synopsis of the Fishes of North America," published in 1846, however much I may have desired that it should be a different one. Valenciennes, in the eighteenth volume of his "Histoire Naturelle des Poissons," insists upon retaining Lesueur's name of "*equirostrum*," — because, having received a specimen of *Scomberesox* from Chili, and compared it with Lesueur's figure, he says "it is impossible to doubt their specific identity." He thinks, if any differences are noticeable in Lesueur's description from the Chilian fish, that they are referable to the fact that that description was made from a dried specimen. Now what are the facts? Lesueur's description was not accompanied by a figure. He himself was aware that his specimen was imperfect, and that his account could "not be regarded as sufficiently complete." Valenciennes seems to have forgotten that the most likely accident to happen to a dried specimen of this species is a fracture of the lower jaw; that it is a rare thing to find a specimen, thus preserved, perfect in this respect; and if he refers to his description of the Southern fish, he will notice the caudal fin contains twenty-seven rays, while in the descriptions of Lesueur, Dekay, and my own, there are uniformly twenty rays in that fin. Unconvinced that Dekay and myself are in error, I cannot yield my convictions to the authority of the justly celebrated French ichthyologist.

Newfoundland, LESUEUR. Massachusetts, STORER. New York, DEKAY.

FAMILY XV. FISTULARIDÆ.

Characterized by a long tube in the fore part of the cranium, formed by the prolongation of the ethmoid, vomer, preopercula, interopercula, pterygoideals, and tympanals, and at the extremity of which is the mouth, composed, as usual, of the intermaxillaries, maxillaries, and the palatine and mandibular bones. Their intestine has neither great inequalities nor many folds, and their ribs are short or wanting. Some of them, the *Fistulariæ*, have a cylindrical body; in others, the *Centrisci*, it is oval and compressed.

GENUS FISTULARIA, LACÉP.

Body elongated, cylindrical. Dorsal opposite to the anal. The intermaxillaries and the lower jaw are armed with small teeth. From between the two lobes of the caudal proceeds a filament which is sometimes as long as the body. The tube of the snout is very long and depressed. The natatory bladder is excessively small, and the scales are invisible.

FISTULARIA SERRATA, Bloch.

The Tobacco-pipe Fish.

(PLATE XXV. FIG. 1.)

*Petumbuabo Brazil, Tobacco pipe Fish, CATESBY, Hist Carol, II p 17**Fistularia serrata* (?), BLOCH, variety of *tabacana*

" " SHAW, Gen Zool, v pl. 107, fig of tube

" " *Tobacco-pipe Fish*, STORER, Report, p 80" " *American Pipe fish*, DELAY, Report, p 232, pl 35, fig 113

" " STORER, Mem Amer Acad, New Series, II p 443

" " " Synopsis, p 191

Color. Back a light drab. Abdomen silvery. A narrow brownish-blue band along the sides. Throat white. Irides silvery.

Description. Body to dorsal cylindrical, greatly elongated; between dorsal and caudal, flattened from above. Head of but little less diameter than body. Snout prolonged into a lengthened tube, the distance from the orbit to the tip of the lower jaw being nearly four times that from the orbit to the posterior angle of the operculum. Whole length of head rather more than a third of whole length of body, exclusive of caudal filament; its depth but little less than that of the body, and one ninth its whole length. Snout horny, somewhat broader than deep; strong longitudinal ridges along its top, sides, and base. The lateral ridges extend from the anterior and superior edge of the orbit to the tip of the upper jaw, and are strongly serrated nearly the whole

distance; the lower ridges with small and crowded reticulating striæ, like those of a file. Gape of mouth large in proportion to diameter of tube. Lower jaw the longer, and somewhat curved upwards. A fleshy protuberance at chin. Both jaws with numerous small, sharp, recurved teeth. Nostils double (Dekay says single), just in front of anterior superior orbital spine, the posterior being the smaller. Orbits elliptical, greatly ridged, with blunt spines anteriorly both above and below, and posteriorly above. Top of head strongly ridged. Opercula with radiating striæ.

Shoulders covered by horny plates extending deep upon the sides, and reaching posteriorly two thirds the distance between the pectoral and ventral fins. Skin slightly roughened, but no scales visible.

The lateral line commences above and a little anterior to the superior angle of the opercle, curves slowly upwards, and again downwards, to the posterior extremity of the humeral plates, just described, then, taking the middle of the side, pursues a straight course to the centre of the caudal, whence it is evidently prolonged as the longer caudal filament; from the humeral plates it gradually becomes furnished with more and more distinct broad longitudinally-flattened spines.

Dorsal small, triangular, the central rays the longer; directed sharply backwards. Situated on posterior sixth of fish. Less than one half as broad as long.

Pectorals also in breadth less than one half their length; quadrangular, and of moderate size; situated just posterior to the opercle.

Ventrals very small, oblong, three eighths of the distance between pectorals and anus.

Anal just beneath dorsal, with which it is identical in size and shape.

Caudal deeply forked. From its central point, and in continuation of the lateral line, arises a delicate jointed filament, in length nearly half that of the body; not far from its extremity this filament seems to have been broken in the specimen described, giving rise to little diverging threads, which were described by Dekay, from the same specimen, as natural bifurcations. Just beneath the long filament, and from its base, arises a second, one sixth its length and much more delicate.

The fin rays are as follows:— D. 14. P. 16. V. 6. A. 14. C. $16\frac{3}{4}$.

Length, exclusive of filament, nineteen inches.

“ including filament, twenty-eight inches.

Remarks. The only specimen I have seen of this species was procured at Holmes's Hole by the late Dr. Yale of that place. It belongs to the cabinet of the Boston Society of Natural History. It served for the description contained in my Report. I loaned it to Dr. Dekay, who described and figured it in his Report on the Fishes of New York. I now redescribe it, and Mr. Sonrel furnishes an admirable drawing.

I stated in my Report, that I considered this fish to be the *serrata*, although I had no means of ascertaining what that species was, having no works upon Ichthyology which would assist me. Dr. Dekay, under date of June 7th, 1841, wrote me that I was right in my supposition, as he had compared my specimen "directly with one he had brought from Brazil some years ago."

Massachusetts, STORER. Jamaica, CATESBY.

FAMILY XVI. SALMONIDÆ.

Body scaly. First dorsal with soft rays, the second small and adipose. Numerous cœca, and a natatory bladder. The structure and armature of the jaws vary surprisingly. Almost all of them ascend rivers.

GENUS I. SALMO, LIN.

Head smooth; teeth on the vomer, both palatine bones, and all the maxillary bones; branchiostegous rays varying in number, generally from ten to twelve, but sometimes unequal on the two sides of the head of the same fish.

SALMO SALAR, *Lin.*

The Salmon.

(PLATE XXV. FIG. 2.)

- Salmo salar*, LIN., Syst Nat (12th edit), p 509.
 " " BLOCH, I pl 20 (female), III p 98 (male)
 " " *Salmon*, PENNANT, Brit. Zool, VIII p 382.
 " " *Common Sea-Salmon*, SHAW, Gen Zool., v. p 40, fig. 102.
 " " *Salmon*, FLEMING, Brit An, p 179, sp 40.
 " " " JENYNS, Brit Vert, p. 421.
 " " " GRIFFITH'S CUV, x p. 416.
 " " " FABRICIUS, Fauna Groenlandica, p. 170
 " " *Common Salmon*, MITCHILL, Trans. Lit and Phil. Soc. of N. Y, I, p. 435.
 " " " " DE WITT CLINTON, Trans. Lit. and Phil Soc of N. Y, I, pp. 147, 498.
 " " " " RICH, Fauna Boreal. Americ, III. p. 145.
 " " *Salmon*, STORER, Report, p. 104.
 " " *Common Sea-Salmon*, DEKAY, Report, p. 241, pl. 38, fig. 122.
 " " *Salmon*, THOMPSON, Hist. of Vermont, p. 140.
 " " " STORER, Mem Amer. Acad., New Series, II. p 444.
 " " " " Synopsis, p. 192.
Salmo, CUV et VAL, Nat Hist des Pois, XXI p. 169.

Color. This species is of a beautiful, brilliant silver-color above, lighter upon the sides, white beneath; many black blotches are observed upon the sides, which are much

more numerous above the lateral line; frequently these blotches surround the outline of the scales, or occupy only a portion of each scale. Upon the scaleless head these spots are unbroken; they are of a deeper color, and are generally circular. The head is darker-colored above, than the back of this fish; the greater portion of the gill-covers is of a light silver-color. The pupils are black, the irides silvery. The inside of the jaws and the edges of the tongue are dusky. The dorsal fin is rather darker-colored than the back, and has one or two longitudinal rows of black blotches upon its base. The adipose fin is dark brown. The pectorals are dark-colored above, lighter beneath. The ventrals are dusky above, white beneath. The anal fin is white. The caudal fin is of a dark-brown color.

Description. Body elongated. The length of the head is less than one sixth the length of the entire fish; the greatest depth of the fish is equal to three ninths its length; its greatest width is less than one sixth its length. The eyes are small; their diameter is equal to one quarter of the distance between them. The nostrils are situated vertically nearer to the eyes than to the extremity of the snout. The upper jaw is the longer, and receives into a notch at its middle the prominent tip of the lower jaw. The lateral line is nearly straight, and is situated just above the middle of the body.

The dorsal fin arises upon the anterior half of the body; its first rays are nearly equal in height to the length of the fin. The *adipose fin* is situated a short distance in front of the tail; its length is equal to one third of its height.

The pectorals commence in front of the posterior angle of the gill-covers; their length is equal to one fourth their height.

The ventrals begin on a line opposite the posterior portion of the dorsal fin, and have on their sides a large axillary scale.

The anal fin is higher than long. The anus is large, and is edged by the extremities of the surrounding scales.

The fleshy portion of the tail extends considerably further forwards in its middle than on the sides, leaving the rays on the sides much the longer; the length of the central caudal rays being only about one third the length of those upon the sides.

The fin rays are as follows: — D. 12. P. 15. V. 9. A. 10. C. 19.

Length, two to three feet.

Remarks. This excellent fish is almost entirely driven from the waters of our State, by the numerous dams and manufacturing establishments which have been erected within a few years, preventing it from going up the rivers to deposit its spawn. About sixty years since it was very abundant in Merrimack River; so much so, that nine individuals have been taken in an afternoon by one person with a dip-net, and the usual

price was eight cents per pound. Between twenty and thirty years ago, two wagons, each bringing from thirty to forty salmon from the Merrimack River, supplied the Boston market every week during the season of the fish. The few individuals now taken in our rivers are looked upon as rarities, and our market is supplied by the fisheries of the Kennebec River and Nova Scotia. The average weight of the Merrimack salmon was from nine to twelve pounds, and from sixteen to twenty-two pounds. The largest weigh from thirty to forty pounds. They have been caught during every month of the year. The greatest run of salmon up the rivers is about the first of June. The fishermen say the young salmon are never seen on their return.

The price of salmon has varied in Boston market of late years from two dollars to twenty cents per pound. The largest specimen I have heard of being sold in the market here weighed thirty-five pounds; and the greatest price ever received for one individual in the same market was fifty dollars.

Labrador, Canada, Newfoundland, and Nova Scotia, RICHARDSON, DEKAY. Maine, New Hampshire, and Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

SALMO FONTINALIS, *Mitchill*.

The Common Brook-Trout.

(PLATE XXV. FIG. 3.)

- Salmo fontinalis*, *Common Trout*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 435.
Salmo nigrescens, *Black Trout*, RAF., Ichth. Ohien., p. 45.
Red-spotted Trout, DOUGHTY, Cabinet of Nat. Hist., I. p. 145, pl. 13.
Salmo fontinalis, RICH., Fauna Boreal. Americ., III. p. 176, pl. 83, fig. 1; pl. 87, fig. 2 (head).
 " " *Common Brook-Trout*, STORER, Report, p. 106.
 " " *Speckled Trout*, KIRTLAND, Report, pp. 169, 194.
 " " *Brook-Trout*, THOMPSON, Hist. of Vermont, p. 141.
 " " " DEKAY, Report, p. 235, pl. 37, fig. 120.
Baione fontinalis, *Spotted Troutlet*, DEKAY, Report, p. 244, pl. 20, fig. 58.
Salmo fontinalis, *Brook-Trout*, AYRES, Bost. Journ. Nat. Hist., IV. 273.
 " " *Common Brook-Trout*, KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 305.
 " " " " STORER, Mem. Amer. Acad., New Series, II. p. 444.
 " " " " " Synopsis, p. 192.
 " " CUV. et VAL., Nat. Hist. des Pois., XXI. p. 266.

Color. The upper part of the body is of a pale-brown color, mottled with darker undulating, reticulated markings; the sides lighter, with a great number of circular yellow spots, varying in their size from a small point to a line or more in diameter, and many of them having in the centre a bright-red spot; sometimes, the yellow color sur-

rounding them having partially disappeared, they seem distinct from the circular spots, or are surrounded by a dull-bluish halo; these red spots differ exceedingly in number in different specimens; in some, three or four only are observable, and these are situated below the lateral line; in others, twenty or more are seen, scattered above and below the lateral line indiscriminately, presenting a beautiful appearance. The body beneath is white, yellowish-white, slightly or dark fuliginous. Head above, darker than the back of the fish. Gill-covers golden, with fuliginous. The dorsal fin is yellow, with irregular transverse black bands. The first ray of the pectorals and ventrals is white, the second is dark-colored, the remainder red. The first ray of the anal fin is white; the remainder of the fin is generally red. The caudal fin is of a dirty reddish-brown, mottled with black spots.

Description. Body elongated, compressed. The length of the head is equal to about one fifth the whole length of the fish; the top of the head is flattened; the snout is obtuse. The eyes are large and circular. The distance between the eyes is equal to one fifth the length of the head. The jaws are equal in length; the gape of the mouth is large; the teeth are sharp and recurved; the teeth on the tongue are larger than those in the jaws; there are teeth also on the palatines and vomer. The scales are very small; those on the lateral line, which pursues a straight course, are larger than those on the rest of the body.

The quadrangular dorsal fin is situated upon the anterior half of the body; the adipose fin is quite small, and near the tail.

The pectorals arise in front of the posterior angle of the operculum; their length is equal to one quarter of their height.

The fan-shaped ventrals commence opposite the middle of the dorsal fin; when unexpanded, their extremities together form a sharp point.

The anal fin arises in front of the adipose fin, and is higher than long.

The caudal fin is deeply emarginated.

The fin rays are as follows: — D. 11. P. 13. V. 8. A. 11. C. 19.

Length, eight to twenty inches.

Remarks. This is quite a common species in our waters. It is frequently met with in the market, where it is readily sold. It is a delicious fish, and is much valued by epicures. It is taken at Sandwich in considerable quantities, not less than one thousand pounds yearly. It is quite common to find them in the wells in the vicinity of Sandwich, living there for years and attaining a large size.

It varies from a quarter of a pound to a pound and a half. Dr. Dekay speaks of a specimen weighing four and a half pounds; and Mr. Henry Blood, of New Bedford,

informed me that he caught one at Enfield, New Hampshire, which weighed nine pounds.

The following interesting observations upon the habits of this species were sent me by my friend, J. B. Forsyth, M. D., of Chelsea, formerly of Sandwich, and with his consent were published in the fifth volume of the Boston Journal of Natural History.

“The few observations I have to communicate upon the habits and peculiarities of the Salmon-Trout were made during a residence of ten years in Sandwich, Cape Cod, where the facilities for that purpose are abundant.

“It may be well to premise, that the distance, at this point of the Cape, from one bay to the other, varies from five to ten miles, and the land is gradually elevated from each shore till it reaches the centre, and consequently the streams, for the most part arising from springs, are short, terminating in creeks upon the marshes. Many of these are of sufficient magnitude for mill-sites, and are therefore crossed by permanent obstructions; and hence it frequently happens, in the short space of a quarter of a mile, you find specimens of both, as they are familiarly called, the fresh and salt water trout.

“The following varieties in color and appearance have been observed.

“1st. Those having the upper part and sides of a pale-brown, gradually becoming less so till it terminates in white on the under part, having a silvery appearance when first taken from the water, and covered with small, distinct scales, the circular yellow and red spots very indistinct; generally found in the marshy creeks or open streams, where the sun has free access. They are well fed upon minnows and shrimps, have a plump appearance, and are the variety mostly sought after by those who desire the trout, in its highest perfection, for the table. They are taken mostly between the months of January and July. They vary in size from one fourth of a pound to four pounds; but I have never seen one to exceed two and a half.

“2d. Those having the upper part and sides of a dark brown, having a dark-green appearance, terminating in white or orange underneath, and covered more or less with round yellow spots, with a bright-red centre, color varying according to the location, and generally not so plump and well fed as those above mentioned.

“3d. Those having the upper part and sides of either a light or dark brown, with spots more distinctly marked on the dark than the light; underneath, the color uniformly ferruginous or orange.

“Each of these varieties is found both in the streams communicating with the salt marshes, and in those which are entirely cut off from them by permanent obstructions. The first-named variety, however, is nowhere found in so great perfection as in close

approximation to the salt creeks. The difference between the salt and fresh-water trout, in this vicinity, seems to be only in name, so far as I have been able to determine, with ample opportunities in taking them, and with specimens before me. The peculiarity of these varieties seems to depend entirely upon the location, and the nature of the soil at the bottom of the stream they inhabit. The first variety is found in clear water, with light gravelly bottom, and where the banks are not shaded by shrubbery, but where they are almost constantly exposed to the rays of the sun. The second variety inhabits streams which are for the most part shaded by trees, or which take their rise in or pass through peat-bogs. Thus, in one stream, the trout caught at the head of it were always of a very dark brown, almost black, highly marked with yellow and red spots, while those taken near the mouth of the stream were of a light color. One of these streams arises from a deep basin of dark water, thirty feet in diameter and ten feet deep, surrounded by a peat-bog, where the fish taken, so far as I know, have been uniformly of a dark brown. In other streams, having a bottom of iron ore, they are uniformly marked with orange beneath, the color of the upper part and sides appearing to depend upon the amount of exposure to the sun's rays. These observations are made independent of any of the changes of color or markings which take place during the spawning season.

“About the first of January, these fish are found congregated together at high-water mark, and seem to have come down the stream for the purpose of locating themselves in the marshes, where they can obtain food. So uniform are they in this, that for a number of years it was my custom to visit one particular stream during this month; and I was always sure to find them assembled in waiting for me, within a few rods of the same spot, in number I cannot say how many, but I would take of them varying from sixty to seventy-five.

“During the months of February, March, and April they become separated, and are distributed the whole length of the creeks, and about the first of May begin again, in small numbers, to ascend the stream. This they continue to do as the season advances, and their means of sustenance increases (which is principally insects and flies), till about the middle of October, when they are found in great numbers as near up as they can conveniently get to the origin of the stream. This is their spawning season; and having deposited their spawn, they begin to wend their way down the stream, for the most part in a body, till they again reach the marshes.

“These fish were formerly taken in considerable numbers with a kind of net used in the herring fishery; but this method of taking them is, I believe, prohibited by legislation. They are now taken, for the most part, with line and hook, baited with minnow,

shrimp, or earth-worm; or at some seasons of the year, with the artificial fly, more especially in the fresh ponds.

“Two other methods of taking them have been resorted to in the small streams, both of which deserve a passing notice; the first is by titillation, so called, and the second, hooking them up by the caudal extremity, decidedly the meanest way of taking them.

“The method of taking them by titillation is this. About the spawning season they are found, for the most part, in the small and narrow head streams, and seem more sluggish than at any other season of the year, and less inclined to take the bait. Having arrived at the edge of the stream, the hand is carefully and gently passed along under the banks, till it comes in contact with the fish, generally near the tail. The titillation then commences, and the hand is made to approach towards the head, till sufficiently forward to prevent slipping through the fingers, when by a sudden grasp it is landed upon the shore, the fish remaining perfectly quiet during the process. This mode of taking them I have practised in one stream three years in succession, and taken many fine trout.

“The unscientific mode of hooking them up by the caudal extremity is also practised at the spawning season, when they are averse to taking the bait, and when and where the stream is deeper and wider. The manner is as follows. A large-sized hook, made very sharp, is fastened to the end of a long, straight stick or piece of whalebone. The fish is then sought, and generally found beneath the root of an old tree, or under the shadow of a log, with the head and part of the body out of sight; the hook is then carefully introduced near the extremity of the fish, and by a sudden jerk is inserted so as effectually to secure him.”

Labrador, H. R. STORER. Maine, Massachusetts, STORER. Connecticut, LINSLEY, AYRES. Vermont, THOMPSON. New York, MITCHILL, DEKAY. Pennsylvania, DEKAY. Ohio, KIRTLAND. Lake Huron, RICHARDSON.

GENUS II. OSMERUS, ARTEDI.

Body elongated, covered with small scales; two dorsal fins, the first with rays, the second fleshy, without rays; ventral fins in a vertical line under the commencement of the first dorsal fin. Teeth on the jaws and tongue very long, two distinct rows on each palatine bone, none on the vomer, except at the most anterior part. Branchiostegous rays, eight.

OSMERUS VIRIDESCENS, *Lesueur*.*The Smelt.*

(PLATE XXV. FIG. 4.)

Salmo eperlanus, *Smelt*, MITCH, TRANS Lit and Phil Soc of N Y, I p 435*Osmerus viridescens*, LESUEUR, JOURN Acad Nat Sc, I p 230*Salmo (Osmerus) eperlanus*, RICH, FAUNA BOREAL AMERIC, III p 183*Osmerus eperlanus*, *Smelt*, ART, STORER'S REPORT, p. 108*Osmerus viridescens*, *American Smelt*, LESUEUR, DELAY'S REPORT, p 243, pl 30, fig 124

" " STORER, MEM AMER ACAD, NEW SERIES, II. p 449

" " " SYNOPSIS, p 197

" " CUV et VAL, HIST NAT POISS, XXI p 388.

Color. When alive, this species, above the lateral line, is of a yellowish-green color with cupreous reflections, the scales being ornamented with exceedingly minute black dots; the sides, beneath the lateral line, are of a silvery-white; the abdomen, of a milky-white; the upper portion, beneath the lateral line, presents the appearance of a satin band the entire length of the body; the upper edge of this band is of a beautiful violet tint. Opercles golden. The dorsal and caudal fins are of the color of the back; the ventrals and anals are white; the pectorals are yellowish-white.

Description. Body elongated, cylindrical. Its greatest depth is just in front of the dorsal fin; its depth at the base of the caudal fin is less than half the depth of the head across the operculum. The length of the head to the whole length of the fish is as 1 to 5. The head is destitute of scales. The lower jaw is longer than the upper, with several sharp, recurved teeth; the front upper teeth much larger than the others, and very sharp. A single row of sharp teeth on the palatine bones. Three or more teeth on each side of the tongue; a tooth at the tip of the tongue much larger than the others. Labials delicately denticulated throughout the whole extent. Gape of the mouth wide. Nostrils large, double; the posterior the longer. Eyes circular, pupils black, irides silvery. Diameter of the eye equal to three fourths the distance between the eyes.

The lateral line commences at the superior angle of the operculum, and is continued in a straight course to the tail, being more obvious in front of the dorsal fin.

The dorsal fin arises opposite the ventrals. The first ray is one third as high as the second ray; the second ray is one third higher than the length of the fin. The rays are branched at their extremities. The adipose fin, which is quite narrow, is situated over the posterior portion of the anal fin, at a distance greater than the length of the head, back of the first dorsal fin.

The pectorals are situated just beneath the inferior angle of the operculum. Their

first ray is of a dark-brown color; they are of the same height as the first rays of the dorsal fin.

The ventrals commence on a line with the origin of the dorsal fin, and are not quite as high as the pectorals; their rays are multifid.

The anal fin is situated at the same distance back of the ventrals that the ventrals are back of the pectorals; it is longer than high, and its length is equal to the height of the pectorals.

The caudal fin is deeply forked.

The fin rays are as follows: — D. 11. P. 14. V. 9. A. 15. C. 19.

Length, three to ten inches.

Remarks. This beautiful species is brought to Boston market in the spring and autumn in large quantities, and is highly esteemed as an article of food. In the spring it is taken in nets up the rivers, and in winter with the hook beneath the ice. In Watertown alone, about 750,000 dozen are taken annually in scoop-nets, from the first of March to the first of June. The largest specimens I have seen were taken in Milton River in the latter part of December, 1837. Four specimens taken, without regard to size, weighed one pound and a half.

Maine, Massachusetts, LESUEUR, STORER. New York, MITCHILL, DEKAY. "From the waters of Huron to the coast of Labrador," DEKAY.

GENUS III. SCOPELUS, Cuv.

Body long, slender; the principal dorsal fin over the interval between the ventral and anal fins; a second dorsal, so small as to be scarcely perceptible. The head short; the mouth and gill-aperture large; small teeth on both jaws; palate and tongue smooth.

SCOPELUS HUMBOLDTII, Cuv.

The Argentine.

(PLATE XXV. FIG. 5.)

- Argentina sphyraena*, *Argentine*, PENN., Brit. Zool., III. p. 286, fig.
Scopelus Humboldtii, CUV., An. King., Eng. edit., x. p. 432.
 " " YARRELL, Brit. Fish., 1st edit., II. p. 94, fig.; 2d edit., II. p. 161, fig.
 " " *The Argentine*, STORER, Report, p. 110.
 " " " DEKAY, Report, p. 246.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 450.
 " " " Synopsis, p. 198.
 " " CUV. et VAL, Nat. Hist. des Pois., XXII. p. 431.

Color. Back, to depth of a line, dark brownish-green. Sides, opercula, and beneath orbit silvery, as also irides. A row of large circular golden spots on a bluish-metallic

ground, five in number, runs along each side of the throat. A similar row of twelve, somewhat smaller in size, on each side of the belly from before pectorals to ventrals. Above these, on the sides, another row of eight, still smaller ones, between base of pectorals and a point perpendicularly over ventrals; between ventrals and anal, five; above anus, one, breaking the row, which is continued from the anus to base of tail by a series of twenty-four, gradually decreasing in size to a mere speck; about two thirds this distance, a single spot omitted on each side.

Description. Body compressed, elongated. Its depth, which to near the ventrals is equal, is about one fourth the whole length, and about the length of the head, of which the diameter of the large eye is but little less than one third. Nostrils double, situated just anteriorly to upper edge of orbit. Mouth widely cleft, its gape transverse, lower jaw being much the longer when expanded. Lateral line nearly straight for the posterior two thirds, and about midway of the body; in its anterior third, rising to upper third of operculum; almost imperceptible.

Dorsal situated at about the middle of the back, on a line between the ventrals and anal; moderate in size.

The adipose fin about equidistant from dorsal and caudal; hardly perceptible; apparently little more than a membranous ridge.

Pectorals much elongated; their rays gradually increasing in length upwards and outwards.

Ventrals and anal small, and situated very near each other.

Caudal deeply forked.

The fin rays are as follows: — D. 10. P. 17. V. 8. A. 15. C. 19.

Length of specimen of 1856, one inch and six lines; of that of 1837, two inches and one line.

Remarks. In December, 1837, I received from Mr. Jonathan Johnson, of Nahant, a specimen of this fish, which he had just previously found alive on the beach at that place. Although a fisherman from his youth, he had never seen a living specimen before, but he had repeatedly found partially decomposed specimens in the stomachs of haddock.

Several years afterwards, my son, Horatio R. Storer, found a mutilated specimen in the stomach of a cod at Provincetown.

Captain Atwood brought me a specimen in July, 1856, which had been found alive a few days before upon the beach at Provincetown. This specimen has enabled Mr. Sonrel to furnish me with a figure, and allowed me to redescribe the species. Our fish agrees almost precisely with the very thoroughly and carefully drawn description

given by Dr. Clarke, in Yarrell's "British Fishes," from a specimen taken in 1833, in the Frith of Forth, and there can be little doubt of their identity.

Soon after I had received my specimen from Provincetown, Captain Atwood found five other individuals alive on the beach at that place.

FAMILY XVII. CLUPEIDÆ.

No adipose fin. The upper jaw is formed as in the Trout, at the middle by intermaxillaries, without pedicles, and on the sides by the maxillaries. Their body is always very scaly.

GENUS I. CLUPEA, Cuv.

Body compressed; scales large, thin, and deciduous. Head compressed; teeth minute or wanting. A single dorsal fin. Abdominal line forming a sharp, keel-like edge, which in some species is serrated; branchiostegous rays, eight.

CLUPEA ELONGATA, *Lesueur*.

The Common American Herring.

(PLATE XXVI. FIG. 1.)

Clupea harengus, *Herring of Commerce*, MITCHILL, Amer. Month. Mag, II. p. 323.

Clupea elongata, LESUEUR, Journ Acad. Nat. Sc, I. p. 250.

" " *Common Herring of Massachusetts*, STORER, Report, p. 111.

" " *Common American Herring*, DEKAY, Report, p. 250

" " STORER, Mem Amer. Acad, New Series, II. p. 456

" " " Synopsis, p. 204.

Le Hareng de New York (*Clupea elongata*, LESUEUR), CUV et VAL, XX. p. 247.

Color. Above, of a deep blue tinged with yellow; sides silvery, with metallic reflections; opercles brassy, with metallic reflections; beneath, silvery. Pupils black, irides silvery.

Description. Body elongated, fusiform, compressed. The depth of the fish at the origin of the dorsal fin is equal to one sixth its entire length; its width, at the commencement of the dorsal, is about one twelfth its entire length. The scales are large, silvery, nearly smooth, deciduous. The abdominal ridge is indistinctly serrated. About thirty serrations are seen in front of, and fifteen back of, the ventrals. The length of the head, when the mouth is closed, from the extremity of the chin, is equal to about one sixth of the entire length; head naked, with a depression above, extending from occiput anteriorly, exhibiting numerous mucous pores. Teeth on lower jaw, vomer, and

centre of tongue. Vertical gape of mouth equal to half the length of the head. Eyes large, circular, provided with a nictitating membrane; distance between the eyes less than the diameter of the eye. Nostrils situated in a groove, nearer the snout than the eyes.

The subquadrangular dorsal fin arises on the anterior half of the body.

The fan-shaped pectorals are one third as long as high.

The ventrals are situated opposite the dorsal, and are two thirds as high as that fin.

The anal fin is about as long as the dorsal; its first rays are one third as high as its length.

The caudal fin is deeply forked; scales are continued upon the base of its rays.

The fin rays are as follows: — D. 18. P. 19. V. 9. A. 17. C. 22.

Length, twelve to fifteen inches.

Remarks. This species, incorrectly called by our fishermen "English Herring," is taken in great numbers on some parts of our coast. At Edgartown, it is abundant from March to May; on the south side of that place, sometimes five hundred or six hundred barrels are taken in a single night. These are sold fresh, salted, or smoked. When it first makes its appearance, it is sold to fishing-smacks for \$1.50 per hundred for bait; when it is abundant, it does not sell, for the same purpose, for more than twenty-five cents per hundred. When salted, it brings three dollars per barrel.

Until within the last twenty years, this species was exceedingly abundant at Cape Cod. It came into Massachusetts Bay and Provincetown harbor in myriads from about the 20th of March to the 1st of April, and continued there until June, and would then leave the coast and not be seen again until the autumn. Now, it has become so rare that at some seasons it is scarcely seen at all. Within the last few years, it is perhaps slightly increasing. While I was visiting Race Point, Provincetown, June 25th, 1847, the crews of two boats captured with sweep-nets, the one a hundred and fifty barrels, the other thirty-five barrels, of full-sized herring. They had never been known to be taken at that season, but are generally captured there early in May. They would sell for one dollar per barrel for bait, and two dollars per barrel salted. The nets by which they are taken are carried out in boats a short distance from the shore, and when a school of fish make their appearance, they are thrown overboard outside of the fish, and thence drawn towards the shore, forcing the fish forwards into shoal water. The young of this species are called *Spirling*, and serve as excellent bait for codfish. They are taken in nets which are about forty yards long and fifteen feet deep, with meshes an inch and a half across. Within the last few years these young fishes, which in the fall of the year are three or four inches long, have been met

with in increased numbers; they disappear during the unpleasant weather in November. At George's Banks, these immature fishes are not found; there, the herring are full grown.

In different portions of Massachusetts Bay the herring has been taken by "torching"; and it is the opinion of many intelligent fishermen, that this method of capturing them has been one of the means of their being less frequent upon our coast than they were formerly. They are thus taken. A large torch is attached to the bows of the boat, which is rowed very fast; the fish, attracted by the light, follow the boat, and with a dip-net are caught in large numbers.

The *Clupea minima*, PECK, is undoubtedly the young of this fish. They are found from half an inch to over a foot in length. When half grown they are called Spirling, and are much sought for cod-bait, being preferred to anything else by all fish. A man can frequently catch many fish with these when he has not had a bite with clams and mussels.*

Massachusetts, LESUEUR, STORER. New Hampshire, PECK. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

GENUS II. ALOSA, CUV.

Upper jaw with a deep notch in the centre; in other respects like the *Clupea*.

ALOSA PRÆSTABILIS, *Dekay*.

The American Shad.

(PLATE XXVI. FIG. 2.)

Clupea sapidissima, WILSON, Rees's Encyclopæd (Amei. edit), catalogued, but not described

" " RAF, Amer Month Mag, II p 205.

Clupea alosa, *Shad*, BELKNAP, Hist. New Hampshire, III. p. 130.

" " " MITCH, Trans. Lit and Phil Soc. of N. Y., I. p 449.

Clupea indigena, *Sprat Herring*, MITCH, Trans. Lit. and Phil. Soc. of N Y., I. p. 454 (young)

Alosa vulgaris, *Common Shad*, STORER, Report, p 116.

Alosa præstabilis, *American Shad*, DEKAY, Report, p 255, pl. 15, fig. 41

Alosa sapidissima, *Shad*, LINSLEY, Cat of Fishes of Connecticut, Silliman's Journal, XLVII

" " STORER, Mem Amer. Acad, New Series, II. p 458

" " " Synopsis, p. 206

L'Alose savoureuse, *Alosa præstabilis*, CUV. et VAL., XX p. 421

Color. The upper portion of the sides, including the opercula, cupreous; the lower portion of the sides silvery, with a greenish tinge; the abdomen is pearly; the top of

* Although the young of this species is so acceptable to the cod and haddock, yet they will not touch young alewives, nor in fact any fish that is spawned in fresh water.

the head and back bluish. At the posterior angle of the operculum is a black blotch of considerable size, which in some specimens is very indistinct until the scales are removed, when it is obvious. Pupils black, iides silvery. The dorsal fin is transparent; the tips of its rays are tinged with brown. The pectorals are silvery; their outer rays are fuliginous beneath. The ventrals are of the same color as the abdomen.

Description. Body oblong, compressed. Covered throughout with large deciduous scales, with the exception of the head, which is naked. Head equal in length to one sixth of the entire fish; the greatest depth of the body exceeds the length of the head. The upper jaw is notched in its centre; its lateral edges are slightly crenated. The eyes are large; the diameter of the eye is less than half the distance between the eyes. The nostrils are nearer to the anterior angle of the eye than to the snout. The abdominal ridge is serrated throughout, from the inferior angle of the operculum to the anus; the serrations are more prominent back of the ventrals.

The quadrangular dorsal fin, which shuts into a groove, is situated on the anterior half of the body; the height of the first rays is equal to two thirds the length of the fin. The first rays are simple; the succeeding, multifid; the fourth and fifth rays are longest.

The length of the pectorals is equal to about one third of their height; all the rays except the first, which is simple, are bifid.

The triangular ventrals are situated opposite the middle of the dorsal fin. They have at their base, on each side, a large accessory scale.

The anal fin is low, emarginated above, and, like the dorsal, is partially received into a groove when not erected; its fourth ray, which is highest, is less than one sixth the length of the fin.

The caudal fin is deeply forked; at the base of each lobe is a patch of small scales. At the base of this fin are two membranous appendages, one on each side of its centre.

The fin rays are as follows:— D. 17 to 19. P. 16. V. 9. A. 20 to 22. C. 20.

Length, twenty inches.

Remarks. In my "Synopsis of the Fishes of North America," I adopted Wilson's scientific name of this species. As, however, a name was merely proposed by him, and no description given, I feel that to him belongs the honor who first presented an accurate description at the same time that he considered it a new species. I therefore accept Dr. Dekay's as more appropriate.

In the spring of the year, this excellent fish is brought to Boston market from the mouths of the neighboring rivers in considerable quantities, and meets with a ready sale. At first they sell for fifty cents apiece; as the season advances, for twenty-five

cents, and at last may be bought for about twelve cents. Many of this species are packed and inspected. In the year 1832, 100 barrels were inspected; in 1833, 321; in 1834, 3; in 1835, 310; in 1836, 527; in 1837, 652; in 1838, 390; in 1839, 773; in 1840, 856; in 1841, 3,910; in 1842, 513; in 1843, 903; in 1844, 1,679; in 1845, 1,338; in 1846, 517; in 1847, 474; in 1848, $228\frac{3}{4}$; in 1849, 415; in 1850, 705; in 1851, $180\frac{3}{4}$; in 1852, 195; in 1853, $16\frac{5}{8}$; in 1854, $225\frac{3}{8}$; in 1855, $238\frac{1}{2}$; in 1856, 265; in 1857, $473\frac{1}{2}$.

The quantities taken in Charles River, at Watertown, for the five years preceding 1838, averaged about 6,000 per annum. From 3,000 to 4,000 are yearly caught at Taunton. Sixty years ago this fish was very scarce in the Merrimack River, and remained so for about five years; previous to that time they had been very abundant, and it is said that 10,000 were caught at one haul. After the scarcity they became again abundant, and continued so till about the year 1810, when they were again scarce for two or three years. They then became plentiful, and still continue so. This species goes up the river during the whole of May. Its greatest run is when the apple-trees are in full blossom. The old shad return in August; the young, three or four inches long, in September. It is said that the Concord River water is warmer than that of the Merrimack, and that Concord shad were caught a month earlier than those of the Merrimack above its junction with the Concord. The Concord shad have almost entirely disappeared, their ascent being cut off by dams.

Maine, Connecticut, LINSLEY. New Hampshire, BELKNAP. Massachusetts, STORER. New York, MITCHILL, DEKAY. South Carolina, Virginia, DEKAY.

ALOSA TYRANNUS, Dekay.

The Alewife.

(PLATE XXVI. FIG. 3.)

Clupea serrata, PECK, Belknap's Hist. of New Hampshire, III. p. 133.

Clupea tyrannus, *Bay Alewife*, LATROBE, Amer. Phil. Soc. Trans., v. p. 77, pl. 1.

Clupea vernalis, *Spring Herring or Alewife*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 454.

Alosa vernalis, *Spring Herring or Alewife*, STORER, Report, p. 114.

Alosa tyrannus, *American Alewife*, DEKAY, Report, p. 258, pl. 13, fig. 38.

Alosa vernalis, LINSLEY, Cat. of Fishes of Connecticut, Silliman's Journal, XLVII.

Alosa tyrannus, STORER, Mem. Amer. Acad., New Series, II. p. 459.

“ “ “ Synopsis, p. 207.

L'Alose tyran, *Alosa tyrannus*, CUV. et VAL., Hist. Nat. des Pois., XX. p. 419.

Color. Back, bluish purple; sides more or less cupreous; beneath silvery and beautifully iridescent. Four or five, and sometimes even more, indistinct greenish-brown

longitudinal lines extend from the operculum to the tail. These lines are much more clearly seen when the fish is looked at from either extremity, the eye being placed on a line with the fish. The opercula are cupreous, and marked by numerous vessels, which give them a beautiful arborescent appearance.

Description. Body elongated, compressed. The head is about one sixth the whole length of the fish; the depth of the fish at the origin of the dorsal fin is rather less than one fourth its entire length. Eyes large; their diameter equal to one fourth the length of the head. Pupils black, irides silvery. Mouth very large. The upper jaw notched at its centre; the lower jaw slightly the longer; the intermaxillaries very protractile. Jaws edentate. Nostrils large, situated just back of the snout. Back of the posterior angle of the operculum, upon the shoulder, is a deep black blotch. The scales are very large and deciduous, marked with concentric striæ. The entire abdominal edge is strongly serrated with projecting bony spines; these serrations are larger back of the ventrals, between them and the anus.

The dorsal fin is quadrangular, slightly longer than high.

Height of the pectorals a little greater than the length of the dorsal fin.

The ventrals are very small.

The anal fin is low, slightly emarginated, and equal in length to the dorsal fin.

The caudal fin is deeply forked.

The fin rays are as follows: — D. 18. P. 15. V. 9. A. 18. C. 21.

Length, eight to twelve inches. Weight, about half a pound.

Remarks. In several portions of the State, where the alewife was formerly most abundant, the various encroachments of man have sensibly diminished its numbers; it is still, however, in some places taken in immense quantities. In Taunton, the fishermen commence taking it the last of March or the first of April, and continue to take it until the middle or the last of May, at which time it has so much diminished in numbers, and has become so inferior in its quality, that the business is not a lucrative one. The last of the *run* are of a very small size, and are called "Black-bellies."

At Watertown, the average quantity of alewives taken, for the two years preceding 1839, was seven hundred barrels.

They are first pickled, then salted and barrelled, and sent to the West Indies. They sell for from \$1.50 to \$2 per barrel. At Taunton, which was at one time so celebrated for its fishery, the alewives are gradually lessening. Forty years since, they were taken in such abundance at Taunton that they sold for twenty cents per hundred, and a great business was carried on in barrelling and shipping them to the West Indian market. At the present time, when first taken, they sell for one dollar per hundred;

and, as the season advances, diminish gradually in price to fifty cents. Most of the fish are disposed of at the seines (flesh), and cured by the purchasers. Two or more dams across the "Great River," at Taunton, impede the progress of this species very much; and on the "Little River," where many dams and factories have been erected, and where forty years ago thousands were taken, not one is now to be seen. In the Merrimack River, too, they have been diminishing in numbers for the last twenty years; the fishermen think this is owing to the small ponds emptying into the river having been dammed up. A pond in Manchester and Chester was formerly famous for its alewives. At some seasons, large quantities are taken in Mystic River; thus, fifty thousand were taken at one haul at Medford, in April, 1844.

A larger quantity of alewives is packed than of any other species of this family. In 1832, 1,730 barrels were inspected; in 1833, 2,266; in 1834, 4,320; in 1835, 5,600; in 1836, 5,000; in 1837, 1,182; in 1838, 604; in 1839, 2,769; in 1840, 1,474; in 1841, 2,840; in 1842, 3,580; in 1843, 5,554; in 1844, 6,380; in 1845, 4,714; in 1846, 2,626½; in 1847, 3,843; in 1848, 1,899¼; in 1849, 2,189; in 1850, 1,629; in 1851, 1,358½; in 1852, 1,604; in 1853, 1,580; in 1854, 1,645; in 1855, 2,775; in 1856, 2,740½; in 1857, 2,497.

New Hampshire, PECK. Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY. Chesapeake Bay, MITCHILL.

ALOSA MENHADEN, Storer.

The Menhaden.

(PLATE XXVI. FIG. 4.)

Clupea menhaden, *Bony-fish, Hard-heads, or Marsh-bankers* of New York, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 453, pl. 5, fig. 7.

Alosa menhaden, *Menhaden, Hard-head*, STORER, Report, p. 117.

" " *Moss-bonker*, DEKAY, Report, p. 259, pl. 21, fig. 60.

" " AYRES, Bost. Journ. Nat. Hist., IV. p. 275.

" " STORER, Mem. Amer. Acad., New Series, II. p. 459

" " " Synopsis, p. 207.

L'Alose menhaden, Alosa menhaden, CUV. et VAL., Hist. Nat. des Pois., XX. p. 424.

Color. Upper part of body of a greenish-brown, darker upon the top of the head and at the snout; upper part of the sides in the living fish roseous, and mottled with indistinct bluish oscillations, which disappear in death; abdomen silvery; gill-covers cupreous, with a rosy tint; space in front of the eyes translucent; a black spot, more or less distinct, upon the shoulders; whole surface of the fish iridescent.

Description. Body elongated, compressed. Its depth across, at the base of the pectorals, less than one fifth the length of the fish. Length of the head more than one third the length of the fish. Gill-covers very large. Opercula with numerous deeply-marked striæ, which commence just beneath a large green blotch, situated some distance back of the eye and on a line with it, and pass obliquely backwards and downwards to its lower edge; subopercula and interopercula smooth; preopercula presenting an arborescent appearance of vessels upon their surface. Eyes circular, moderate in size, furnished with a nictitating membrane. Gape of mouth very large; lower jaw shorter than the upper; the middle of the upper jaw deeply emarginate. Back slightly arched in front of the dorsal fin.

The dorsal fin commences upon the anterior half of the body; it is nearly as long again as high, and is emarginated above; at its base is a membranous prolongation or sheath, by which it is almost entirely covered when unexpanded. The first three rays of this fin are simple; the first articulated rays are higher than the remainder, the most posterior higher than the eight or nine preceding.

The pectorals are situated just beneath the posterior inferior angle of the operculum; the first three rays are the longest; the first ray is simple. Outside of this fin is an axillary plate, more than two thirds the length of the fin; a broad scaly shield at the base of the pectorals covers a portion of the inferior edge.

The ventrals are very small, and fan-shaped; their rays are multifid; on each side of these fins is an axillary plate.

The anal fin is shorter than the dorsal, low, and slightly emarginated above; its anterior rays are highest; the first ray is simple; it is sheathed at its base, like the dorsal.

The caudal fin is deeply forked; the depth of the fin at its extremities, when expanded, is equal to the height of the outer rays.

The fin rays are as follows:—D. 19. P. 15, 16, or 17. V. 6. A. 20, 21, or 22. C. $20\frac{4}{4}$.

Length, eight to fourteen inches.

Remarks. This valuable species comes into Massachusetts Bay about the middle of May, and leaves it in November; and is taken in immense quantities for the various uses to which it is appropriated, viz. bait for other fishes, manure, oil, and food.

The fishermen who supply Boston market with codfish set their nets about the outer islands in the harbor each night as they come up to the city, and examine them in the morning as they go out for the day's fishing. Large numbers are thus taken, frequently one hundred barrels at a haul, and such as are not used as bait are sold to the poorer classes for food, at about six and a quarter cents per dozen. It is not very pal-

atable, having an oily or muddy taste. It is also considered a very good bait for halibut. At Provincetown, this species is used only for mackerel bait; and for this purpose they are worth from seventy-five cents to four dollars per barrel, in proportion to the demand. In the year 1836, 1,500 barrels were used as bait for other fishes. While I was visiting Race Point, in the latter part of June, 1847, a large number of barrels of this fish were taken by the fishermen in their sweep-nets from the shore. I learn from Captain Atwood, that a much smaller number are taken in the sweep-nets than formerly, as they stay off in deeper water, for the most part out of reach of the nets, and but few are caught in the mackerel nets.

Being a very oily fish, it is valuable as an article of manure. In some places they are taken for this purpose only. At Lynn, in 1836, 1,500 barrels full were thrown upon the land. At Sandwich, where they are very abundant, the inhabitants strew them upon their land by the cart-load, and thus for miles immense quantities enrich the soil. It is computed that a single menhaden, of ordinary size, is equal in richness to a shovelful of barn-yard manure. Upon some portions of Cape Cod, menhaden are sold to the farmers for one dollar per thousand for manure; they average about one pound each, and twenty-five hundred are considered a proper quantity for an acre.

Dekay states, that in the counties of Suffolk, King's, and Queen's, in New York, it is used as an article of manure in the following ways: — "For Indian corn, two or three are thrown on a hill; for wheat, they are thrown broadcast on the field and ploughed under, although it is not uncommon to put them in layers alternately with common mould, and when decomposed to spread it like any other compost. Its effects in renovating old grass-fields, when spread over with these fish at the rate of about two thousand to the acre, are very remarkable."

That the air, however, must be exceedingly deteriorated, if not rendered decidedly unhealthy by them, is shown by the following extract of a letter from my friend, J. B. Forsyth, M. D., formerly of Sandwich, now of Chelsea, dated November 8th, 1837. "For two or three miles below me, on the Barnstable road, the stench from the decomposing fish was a great nuisance to travellers passing along the road, so much so that I feared they might be instrumental in the production of disease; but whether they were so or not, I am not now prepared to say. But certain it is, there have been more cases of autumnal fever and dysentery this season in this district, than in all the rest of the town."

It is also taken for its oil. In the year 1845, four or five hundred barrels of oil were obtained at the Elizabeth Islands, by grinding up these fishes by machinery. This oil is used by the painters, and is considered preferable to linseed oil.

Within a few years numbers have been packed and inspected for exportation as an article of food. In 1832, 300 barrels were inspected; in 1833, 480; in 1834, 1,008; in 1835, 1,443; in 1836, 1,488; in 1837, 461; in 1838, 1,164; in 1839, 1,083; in 1840, 1,427; in 1841, 2,138; in 1842, 566; in 1843, 854; in 1844, 476; in 1845, 272; in 1846, 585; in 1847, 132; in 1848, 137; in 1849, 78; in 1850, 137; in 1851, 0; in 1852, 107; in 1853, 0; in 1854, 0; in 1855, 0; in 1856, 63; in 1857, 203.

This species is much more numerous along our coast in some years than in others; thus, in the year 1845 they might readily be purchased for from twenty to thirty cents per barrel, while in 1847 the fishermen would willingly have offered one dollar per barrel.

Maine, Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHELL, DEKAY.

ALOSA CYANONOTON, Storer.

The Blue-back.

(PLATE XXVII. FIG. 1.)

Alosa Cyanonoton, STORER, Proc Bost Soc Nat. Hist, II p 242

Color. Above bluish, cupreous upon the sides and the opercula; silvery beneath. When the large deciduous scales are removed, the entire upper portion of the body is of a deep greenish-blue color. A large, circular black spot exists just back of the posterior angle of the operculum; the opercula present a beautiful arborescent appearance. Pupils black, irides golden.

Description. Body stout, elongated. The abdominal ridge is serrated, the serrations being stronger back of the ventrals. Twenty serrations exist anterior to, and fifteen back of, the ventrals. The length of the head is less than one fifth the length of the body; the greatest depth of the fish is equal to about one fourth the length of the body. The jaws are equal. The eyes are moderate-sized and circular. The nostrils are large, near the snout.

The dorsal fin arises on the anterior half of the body; it is quadrangular, and emarginated above.

The pectorals are falciform, and equal in height to the length of the dorsal, with accessory plates at their base.

The ventrals are fan-shaped, and have accessory plates.

The anal fin is low, and longer than the dorsal.

The caudal is deeply forked, and has at its base two membranous pouches.

The fin rays are as follows: — D. 17. P. 18. V. 10. A. 17. C. 20.

Length, ten inches.

Remarks. This species is called "Blue-back" and "Kiouk," by the fishermen at Provincetown. It is seldom met with more than ten inches in length. A few make their appearance in May; they are then quite small and scattered; they are numerous before the 10th of June. They are occasionally taken, in small numbers, in mackerel-nets; but few only are thus captured, as their size allows them to swim through the meshes of the net. They remain along the coast for only a short time. Some years since, they were found in much larger numbers than at present, and a hundred barrels full of them would be taken at the drag of a net. They are used as bait for mackerel, and are worth about a dollar a barrel for that purpose. Captain Atwood thinks this species is never found in rivers.

This fish is very fat, almost too much so to eat; and, appearing at a season when other favorite species are so common, no use is made of it as an article of food.

Massachusetts, STORER.

ALOSA LINEATA, Storer.

The Hickory-Shad.

(PLATE XXVII. FIG. 2.)

Alosa lineata, STORER, Proc. Bost. Soc. Nat. Hist., II. p. 242.

Color. The sides of this fish are silvery, with six or eight indistinct bluish bands running from the head to the tail, which are light-colored after death. The opercula are cupreous; the pectoral and caudal fins are of a dark-brown color, the pectorals being fuliginous beneath; the anal and ventral fins are nearly white.

Description. Body elongated, compressed. The head is equal in length to about one fifth the entire fish; the lower jaw is the longer; the chin is prominent; the eyes are large and circular, their diameter equal to about one sixth the length of the head; the space between the eyes, from the nostrils to the occiput, is translucent. The opercula and preopercula are beautifully striated; the interopercle is but slightly roughened. The abdomen is serrated; about fifteen serrations between the ventral and anal fins, more strongly marked than those anterior to the ventrals. The scales are large and rounded; their concealed portion is covered with concentric striæ, and delicate radiations are seen passing to their circumference upon their exposed portions.

The dorsal fin arises upon the anterior portion of the body; its height is equal to two thirds its length.

The pectorals are rather higher than the length of the dorsal fin ; at their base, they have on each side a broad axillary plate, concealing a considerable portion of their extent.

The ventrals arise opposite the anterior portion of the dorsal ; they have at their bases, also, axillary plates.

The anterior portion of the anal fin is as high again as the posterior portion ; it is rather longer than the dorsal fin.

The caudal fin is deeply falcate ; the scales are continued high up on its central rays, which are transparent and exceedingly delicate ; the rays are articulated. Caudal pouches.

The fin rays are as follows : — D. 17. P. 16. V. 8. A. 20. C. 20.

Length, fifteen inches.

Remarks. This species, which does not appear in great numbers, is known at Provincetown by the name of "Hickory-Shad." It is taken in nets while fishing for mackerel, in May and June. It is a lean fish, and is not used for food.

Massachusetts, STORER.

GENUS III. ENGRAULIS, CUV.

Body rounded or compressed. Mouth large ; snout protruded beyond the lower jaw. Intermaxillaries very small, and hidden under the snout ; maxillaries slender, stretching over the cheeks ; a few teeth on front of the vomer ; palatine and pterygoidian teeth sometimes reduced to mere asperities. Gill-openings very large, and continuous under the throat. Branchiostegal membrane narrow, and hidden under the jaw ; its rays being short, and variable in number. Caudal fin forked. Dorsal fin rather small. Insertion of pectorals near the gill-openings. Ventrals very small.

ENGRAULIS VITTATA, *B. and G.*

The American Anchovy.

(PLATE XXVII. FIG. 3.)

Clupea vittata, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 456.

Clupea cærulea, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 457.

Clupea vittata, DEKAY, Report, p. 254.

" " STORER, Mem. Amer. Acad., New Series, II. p. 457.

" " " Synopsis, p. 205.

Clupea cærulea, DEKAY, Report, p. 254.

" " STORER, Mem. Amer. Acad., New Series, II. p. 457.

" " " Synopsis, p. 205.

Engraulis Mitchilli, VAL., CUV. et VAL., Nat. Hist. des Pois., XXI. p. 50.

Engraulis vittata, B. and G., Smithsonian Institution's Ninth Annual Report, p. 33.

Color. Top of the head bluish-slate; back light-green, dotted with fuliginous. A greenish-blue stipe high up on the side, shadowed out on the head from the upper orbit of the eye, more defined above the posterior opercle, and thence extending nearly to the tail. Sides below greenish-silvery, with metallic reflections. Gill-covers and abdomen silvery, with nacreous iridescence.

Description. Outline of the body ascending from the tip of the snout to the origin of the dorsal fin, thence descending in an equal curve; hence, the dorsum is regularly gibbous, while the thoracic and the abdominal plane is nearly straight, or with a slight double curve; convex anteriorly, concave posteriorly. Head elongated, sharp, wedge-shaped; broad above posteriorly, attenuated below. Length of the head one fifth the length of the body, and a third longer than the greatest depth of the body; its greatest width above, one third its length; its width below, a mere line. Eyes large, situated on the anterior third of the head; their diameter is equal to two thirds of the distance between them. Jaws unequal; the upper much the longer, and nearly concealing the lower, which shuts into it as into a groove; jaws armed with very minute teeth. Gill-covers elongated, yet rounded. Scales very large and deciduous.

First dorsal commencing just anterior to the median line; its first ray the longer; subquadrangular.

Pectorals rather small, situated low, and just posterior to the opercula, with an elongated scapular scale at the base; this is nearly its own length.

Ventrals commence a little anterior to a perpendicular from the commencement of the dorsal fin. The basic iliac scale is also elongated, and nearly its own length.

Anal about as far posterior to the ventrals as these were to the pectorals; about twice the length of the dorsal.

Caudal fin deeply forked.

The fin rays are as follows: — D. 8. P. 17. V. 5. A. 14. C. 18.

Length, three and a half inches.

Remarks. A fine specimen of this species was brought to me in November, 1852, from Provincetown, by Dr. Charles Girard, now of Washington, D. C. I have retained the specific name originally given it by Mitchill, and very properly affixed by Girard, although Valenciennes has thought proper to change it.

Mr. Baird, in his "Report to the Secretary of the Smithsonian Institution on the Fishes of the New Jersey Coast, as observed in the Summer of 1854," remarks that "the Anchovy made its appearance early in August, in the shallow waters along the beach, although of very small size. They became subsequently more abundant; and towards the end of the month, while hauling a large net in the surf, many were taken

measuring over six inches in length. As the meshes of the net were very large, the greater portion readily escaped; but with a seine properly constructed, enough could be readily procured to supply the American markets."

Massachusetts, STORER. New York, MITCHILL, VALENCIENNES. New Jersey, BAIRD.

JUGULARES.

Ventrals attached under the pectorals, and the pelvis immediately suspended to the bones of the shoulder.

FAMILY XVIII. GADIDÆ.

Body elongated, but little compressed, covered with soft scales not very voluminous. The head well-proportioned, and without scales. All their fins soft. The jaws and the front of the vomer are armed with pointed, irregular teeth, middling or small-sized, in several rows, forming a sort of currycomb or rasp; their gills are large, with seven rays. Ventrals separate, jugular. Almost all have two or three fins on the back, one or two behind the anus, and a distinct caudal. Their stomach is in the form of a large and strong sac; their cœca are very numerous, and their caudal tolerably long. They have a large air-bladder, with strong parietes, and frequently dentated in the sides.

GENUS I. MORRHUA, CUV.

Three dorsal fins; two anal; ventrals pointed. A barbel at the end of the lower jaw.

MORRHUA AMERICANA, Storer.

The American Cod.

(PLATE XXVII. FIG. 4.)

Gadus callarias, *Common Cod of New York*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I p. 367

Morrhua Americana, *American Cod*, STORER, Report, p. 120.

" " DEKAY, Report, p. 274, pl. 44, fig. 140

" " STORER, Mem. Amer. Acad., New Series, II p. 467.

" " " Synopsis, p. 215.

Color. An individual twenty-eight inches in length presents the following appearances. Back ash-colored; sides lighter; back, sides, and part of the head covered with yellowish spots, which are rather larger and more distinct upon the sides; beneath, dusky-

white. Pupils black; irides a beautiful silver. All the dorsal fins are of a greenish-blue color, and spotted, like the body. The ventrals, as well as the anals, are rather darker than the abdomen. The caudal is spotted like the rest of the body.

The color of this species is very variable. In the same stall in our market may frequently be seen specimens with equally obvious spots over their entire surface; or they may be much more perceptible on the sides; or they may be scarcely observed at all, and the entire fish appear of a uniform gray; or, again, of a beautiful bright-red; and I have seen a single specimen which was of a lemon-yellow.

Description. The greatest depth of the body is nearly equal to one fifth its length; the length of the head is equal to one fourth the entire length of the fish; the distance of the extremity of the snout from a line on a plane with the anterior angle of the eye, is nearly equal to one third the length of the head; diameter of the eye equal to one sixth the length of the head; the distance between the eyes is nearly equal to one third the length of the head. Nostrils double, the posterior lower and larger. The upper jaw projects beyond the lower. In the lower jaw are two rows of teeth; those of the larger row, which are in the back part of the jaw, are larger and incurved; while those in the fore part of the jaw are much smaller. In the upper jaw are several rows of card-like teeth, of which the outermost is much the largest. There are teeth on the vomer and pharyngeal bones. A single barbel, about an inch long, upon the chin. The lateral line, arising above the operculum, makes a very gradual slope upwards, and as gradually curves downwards, until, opposite the anterior third of the second dorsal, it commences a straight course, which is continued to the tail; this line, which is lighter-colored throughout its whole extent than the body, is wider and more conspicuous after assuming a straight course.

The first dorsal fin arises just back of the pectorals; the second dorsal is much longer, and the third is but little longer, than the first.

The pectorals are rounded; their length is nearly equal to half their height.

The ventrals are situated in front of the pectorals; their two outer rays are free, the second being the longer.

The first anal fin is about equal in length to the second dorsal; the second anal is much the shorter.

The height of the caudal fin is about twice its length.

The fin rays are as follows: — D. 14, 21, 21. P. 18. V. 6. A. 14, 19. C. 38. In another specimen, — D. 15, 22, 19. P. 19. V. 6. A. 22, 19. C. 40.

Length, two to eight feet.

Remarks. The great value of the cod-fishery to the State of Massachusetts requires

that I should offer here something more than a few cursory observations. Among the earliest enterprises undertaken in New England, it has at all times been zealously prosecuted and liberally encouraged; those engaged in it have always been among our most industrious, respectable citizens, and its existence and prosperity have ever been a subject of State pride. The rise, progress, extent, and value of this fishery are full of interest, and I shall offer no apology for presenting the following valuable article, by Benjamin W. Hale, Esq., of Newbury, from the "Newburyport Herald" of February 12, 1840.

"The commencement of this fishery takes its date prior to the landing of the Pilgrim Fathers, and it is believed to be the first, if not the only business, the prosecution of which they encouraged by a bounty.

"The first fishing company in New England was established at Gloucester in 1624, which continued its operations but two years. It was, however, incorporated as a fishing plantation in 1639, and that the early operations in this branch of business were successful appears evident, as its products are mentioned as forming the first of four articles of export as early as 1655, and in 1668, when the trade of the Colony was represented as being in a very flourishing condition, there being upwards of one hundred and thirty vessels, of all descriptions, owned in the Colony, it was assigned the first place in the list of exports to the West Indies and Europe, and was considered the most lucrative branch of industry carried on in the Colony.

"In a report of the commerce and resources of the Colony, in 1763, the number of vessels of all classes employed in this business is stated to be three hundred sail, and its products still occupy the first place on the list of exports to the West Indies and Europe.

"The principal ports in Europe to which shipments were made, were those in the Bay of Biscay, Cadiz, and Lisbon. This trade was prosecuted for several years, before and after the war of the Revolution, so extensively from Marblehead (their operations being confined to the Grand-Bank Fishery, the products of which were suitable for those markets), that they not only shipped what was cured in that town, suitable for those markets, but purchased from other ports in the State.

"The increase of business was rapid after the peace, from the encouragement of a bounty granted by government; and from the representations of some Nova Scotia fishermen, who settled in this district and prosecuted the salmon-fishery on the coast of Labrador, a vessel was fitted out in 1799 for cod-fishing, which was the first attempt from the United States on that coast. This voyage proving successful, one or two others fitted out the next year; and the success attending these operations encouraged others to engage in the business. Discoveries were extended, and new fishing-grounds explored, so that, in 1807, four vessels from Newburyport (the first from the United

States), took their fares in Esquimaux Bay ; and the increase of the business was such, that, the season the attack on the Chesapeake frigate took place, upwards of forty vessels were employed on that coast from this district, and the whole number from the United States was probably seven hundred, giving employment to nearly ten thousand men.

“ Large shipments of the products of this business were made to the West Indies, principally to the French ports ; eighteen sail of vessels were at one time lying in Point Petre from Newburyport, a large proportion of the eastern cargoes of which were fish, the returns of which, being transshipped to Europe, afforded them profitable results, which were the foundation of the great estates of the merchants of that time, some of whom were then, and had been previously, engaged in this business themselves.

“ The shipments to the Mediterranean and other ports in Europe were still more extensive. These, with those to the West Indies and South America, for the five years from 1803 to 1807 inclusive, were but little short of \$ 2,500,000 annually, and in 1804 they exceeded \$ 3,000,00, owing to the products of the Labrador fishery, both in fish and oil, being peculiarly adapted to the markets. Such were the advantages attending the operations of the American fishermen, in consequence of the European war, which in its effects operated to make them fishermen for the world, that an investment in this fishery, with the shipment of its proceeds to these markets, generally gave returns of from fifty to one hundred per cent profit. Aside from accident or mismanagement of the voyage, the annual supply from 1803 to 1808 was probably 700,000 to 800,000 quintals.

“ The long embargo, as it has been termed, took place at an inauspicious season of the year for the interests of those engaged in this business. It found them with a year's stock on hand, and, by stopping all exports, the article was reduced to fifty per cent of its former value. But no extensive sale could be made ; the holders were compelled to keep them during its continuance, and at its repeal the damage by depreciation in quality, and the glut of all foreign markets in consequence of large shipments at the same time, resulted in great loss, and the ruin of many of those engaged in the business.

“ At the commencement of the war with Great Britain, in 1812, nearly all the larger and more valuable class of vessels, as they returned from their voyages, were laid up and dismantled. Some few of the others pursued the business during the first season, with but little interruption ; but during the succeeding years, the policy of capturing and destroying all such as were found ‘ on his Majesty's waters ’ prevailed ; which resulted in the entire abandonment of the business, except by market-boats in the vicinity of ports, which afforded them opportunity to escape on the appearance of British cruisers. The whole amount of bounties paid to fishing-vessels, in 1814, was but \$ 1,312, including the export bounty on pickled fish.

“ Since the peace, which was concluded by the negotiations at Ghent, difficulties have attended the pursuit of this business on some parts of the coasts of the British Provinces, in consequence of an abandonment of some of the previous privileges on the western coasts of those Provinces, or an ambiguity in the provisions of the treaty, which has produced feelings of acrimony between the fishermen of the two nations.

“ It has been pursued with various degrees of success at different periods. For a few years succeeding the peace, the stock of fish on the Grand Bank, Labrador Coast, and other fishing-grounds, appeared to have been greatly replenished; operations in the business were successful, and its pursuit became generally extended. The tonnage employed in 1815 was about 8,000 tons, and in 1816 about 18,000 tons.

“ A laudable spirit of enterprise, and a conviction of the advantages resulting to the laboring classes from its prosecution, determined the citizens of Newburyport and other towns to attempt its further extension. Companies were formed in several of our seaports, with extensive capitals, and managed by agents selected for their experience in the business; but owing to ill-success in some of their voyages, the depressed prices of its products, and their shipment to European and other foreign markets, which derived sufficient supplies from their own fisheries and those of other nations (which, owing to the general peace in Europe, were enabled to resume the business), they all proved unsuccessful, and the results were generally disastrous to the stockholders; — furnishing good evidence that, in a country like our own, individual enterprise offers the surest prospect of success in all branches of business, where the amount of capital or the particular location requisite for its prosecution does not prevent the attainment of its means, and thereby render a resort to combined effort necessary for its accomplishment.

“ Of late years, an entire change of markets for the products of this fishery, so far as it respects the large-sized fish, has taken place. Since the opening of the Erie Canal, and the increase of population and means of conveyance consequent thereto, an increasing demand for this article has taken place in that quarter; so that New York and Albany markets, which previously required a few thousand quintals for their annual supply, now afford a demand, for their own markets and those above, for nearly 150,000 quintals; as their annual supplies, and the increasing facilities for transportation by canals and railroads from other Southern and Western cities, create an increasing demand for the supply of those markets.

“ The foreign export has diminished in a ratio proportionate to the increase in demand for domestic markets; — from upwards of \$ 2,500,000 from 1803 to 1806, it has been less than \$ 1,000,000 for the last ten years. . . . The products of this fishery, in Essex County, exceed \$ 600,000 annually.

“The quantity of codfish taken for the last five years is probably as great as that of any preceding five, with the exception of those from 1803 to 1807 inclusive, when the Labrador fishery was carried to its greatest extent. The quantity taken in this State, with those in New Hampshire, Maine, and some in other States, will give an annual amount exceeding 700,000 quintals, and, with its oil and other products, exceeding \$2,000,000 in value.”

The above has evidently been prepared with care, and is unquestionably accurate. In some portions of the State, this fishery is entirely superseded by the taking of *whales*. Thus, while every town in the county of Barnstable is more or less engaged in this business, and collectively they exhibit an aggregate of two hundred and twelve vessels, but *a single fishing-smack* was licensed in Dukes County in 1836, and *not one* in the county of Nantucket, — the attention of the inhabitants of the last two counties being entirely engaged in whaling. I have ascertained that, in 1836, there were engaged in the cod-fishery, from Gloucester, Marblehead, Provincetown, Wellfleet, Cohasset, Duxbury, Plymouth, Manchester, Salem, and Beverly, being *ten* towns, 561 vessels, having crews of 3,816 men, and that by these vessels there were taken 263,454 quintals of fish. To these may be added the ports of Newburyport, Lynn, Falmouth, Holmes’s Hole, and Sandwich (in which I have not been able to learn the number of vessels *exclusively* employed in this fishery), which furnished, in 1836, 16,265 quintals; thus exhibiting 279,718 quintals of codfish taken by the enterprise of the citizens of fifteen towns. When it is mentioned that about 3,500 of the codfish from the Grand Bank (which are generally much larger than those from the Straits of Belleisle) constitute *one hundred quintals*, some conception may be formed of the immense numbers taken. At the usual price of these prepared fish, the above-mentioned number of quintals would sell for \$839,154.

According to the returns of the assessors of the several towns, it appears that there were taken, in 1836, 510,554 quintals of codfish, which were valued at \$1,569,517. These fish were from the following counties: — Essex, 159,424 quintals, valued at \$501,363; Barnstable, 134,758 quintals, valued at \$392,930; Suffolk, 127,250 quintals, valued at \$408,510; Plymouth, 64,172 quintals, valued at \$193,664; Norfolk, 15,950 quintals, valued at \$46,050; Middlesex, 9,000 quintals, valued at \$27,000.

The statistics, derived from the same sources, for the year ending April 1st, 1845, prepared by the Secretary of State, present us with the following facts. Whole number of quintals taken, 334,901, valued at \$746,263. From Essex County, 175,273 quintals, valued at \$374,815; Barnstable, 84,503 quintals, valued at \$190,267; Plymouth, 61,007 quintals, valued at \$146,665; Suffolk, 6,600 quintals, valued at

\$15,840; Norfolk, 3,771 quintals, valued at \$9,485; Middlesex, 2,100 quintals, valued at \$5,040; Bristol, 1,400 quintals, valued at \$3,500; Dukes, 247 quintals, valued at \$651.

The minutiae of a fishing-voyage to the Grand Bank are described in an interesting manner, in the following communication, by an anonymous writer, in a number of the "Boston Centinel and Gazette," for September 4, 1839.

"There are about eighty vessels, all schooner-rigged, employed in the Bank fishery, which are built principally of oak, in Massachusetts. They are strong, stanch, and comfortable sea-boats, averaging in burden from sixty to one hundred and ten tons; but the principal part of them are from seventy-five to eighty tons' burden, and cost from \$3,500 to \$4,000 each. They make two fares in a year; the first fare commencing early in April, at which time they sail for the Bank of Newfoundland, commonly called the 'Grand Bank.' The second fare commences early in September. The duration of each fare depends, of course, on the degree of success attending it; but four months must be passed each season in fishing, in order to secure the bounty offered by the general government for the encouragement of the fisheries, amounting to four dollars per ton on all vessels of ninety tons and under; no allowance being made for any excess of burden. Each vessel takes from one hundred and twenty to one hundred and thirty hogsheads of salt for a fare, at from \$3 to \$3.25 per hogshead. Cadiz salt is preferred, but occasionally other kinds are used. More salt is now expended in curing the fish than formerly; and one hundred quintals of fish require about thirteen hogsheads of salt. Occasionally, though but seldom, a 'spring fare' is made; when the vessel is expected to return by old 'Election-day.' This fare is called 'Spring-fish,' and usually consumed in the neighborhood, being of superior quality. The word '*fare*' applies as well to the cargo or lading of the fish, as to the voyage.

"The 'shoresman,' as the title implies, and who is generally sole or part owner of the vessel, superintends all operations on shore relative to the fare. In addition to the vessel, he furnishes the salt and bait; the latter article being either salted clams or mackerel, in barrels. He also supplies the knives for splitting the fish, mittens for the crew while splitting and salting, and trousers of oil-cloth or canvas for the 'salter.' This part of the outfit is called the 'great general,' three eighths of which is paid for by the shoresman, and five eighths by the crew (consisting generally of a skipper and five men), at the final settlement of the fare. In contradistinction to the 'great general,' the 'small general' is furnished by the crew, consisting of their sea-stores, the expense of which is entirely defrayed by themselves; and each man provides his own fishing-apparatus.

Barrels are provided by the shoresman to contain their store of fresh water, but all subsequent cooorage is paid for by the crew.

“A fair passage to the Bank is made in a week; and on their arrival there, they generally ‘lie-to, and try for fish’; and when they ‘strike a school,’ as the phrase is, they anchor. The depths at which they fish are various, from thirty to sixty fathoms; but generally from thirty-five to fifty fathoms. When fish are plenty, a fare is made up in about six weeks; that is, when they have *wet*, or expended, all their salt. Fish caught with mackerel-bait are larger than those caught with clams, for the supposed reason that a larger bait of mackerel can be put upon the hook than of clams; and the largest fish take the largest bait. Whatever may be the reason, however, the fact is incontrovertible; and the proportional difference is about thus: fish caught with clam-bait will average about twenty-five quintals to the thousand fish, and those caught with mackerel-bait about forty quintals to the thousand.

“This is a general result; but there are occasional variations from various causes, the principal of which is in the different depths at which the fish are taken, — the largest fish being taken in the deepest water. The flesh of a sea-bird called a ‘hag-don’ is a fine bait for codfish, and is frequently used.

“The equipment of the fishermen is singular and grotesque. Over their common dress they wear a pair of ‘petticoat-trousers,’ made very wide, and descending to the calf of the leg; generally they are made with an insertion for each leg, but sometimes like a woman’s petticoat, with no intersecting seam, and are of course canvas or oil-cloth. A pair of thick cowhide boots, of a russet color, and with soles an inch or more thick, reach quite to the knees, with tops to turn up and cover the thighs. The barvel, or leather apron, extending from the breast to the knees, and the tarpauling hat, complete the costume, which secures to the occupant perfect immunity from the assaults of the element in which he procures his subsistence. The hands are preserved from the cutting of the fishing-lines by a sort of digitless woollen mittens, called ‘nippers.’ Each man tends two lines, and they generally fish near the bottom of the sea; but sometimes the codfish will ascend to mid-water, or even much higher, in pursuit of herrings, capelins, and other fishes of that class, which swim in immense shoals near the surface; and in such cases the labors of the fishermen are much lightened, and the fish taken with much greater celerity.

“In the day-time, during the first fare, all hands generally fish; and at night, the crew is divided into watches that fish alternately; but circumstances create variations in this mode; such as the scarcity or abundance of fish, the inclinations of the skipper and crew, &c. During the season of the second fare, the fish feed principally in the

night, at which time most of them are taken ; and on the succeeding day they are prepared and secured below. At any time, however, when the decks are full of fish, they proceed to cure them ; and this is the process. The operators being placed in juxtaposition before a bench or platform, about mid-height, the 'cut-throat,' wielding a sharp two-edged knife, which bears the same sanguinary and ominous name, seizes the fish, and, separating the connecting integuments between the head and the body, he then passes his knife through from the nape to the vent, and abstracts the viscera. He then passes it to the 'header,' who, by an adroit process, separates the articulation of the spine at the shoulder, and detaches the head from the trunk, which he passes to the 'splitter' ; who, commencing at the shoulders, proceeds to lay the fish open to the tail, and detach the sound-bone. The fish, being thus prepared, is thrown into the hold, to the 'salter,' who strews on the salt and stows it neatly away, in compact layers, with the skin down. And in this manner they proceed daily till all the salt is wet, if they are so fortunate as to get a full fare. They are sometimes obliged, however, by the scarcity of fish, by losing their anchors, by sickness or casualty on board, or other causes, to return without wetting all their salt.

“ Besides the bodies of the codfish, and the bounty, there are other emoluments accruing to the adventurers ; such as the oil extracted from the livers of the cod, of which about fifteen barrels to eight hundred quintals of fish is produced, and is sold at about fifty cents per gallon ; and halibut, which was mostly thrown away formerly, but now constitutes a considerable proportion of the profits. It is salted like the codfish, and sold *green* from the vessel, on arrival, at about two dollars per quintal ; the subsequent processes of drying and smoking for the market being performed by the purchasers. This article is mostly derived from the second fare ; and about fifteen thousand quintals are annually brought into Marblehead, and, with the oil, are divided in the same proportions as are the codfish and the bounty. As regards the proportional proceeds of the fare, on return of the vessel to port, one quarter part is considered to be the property of the shoresman, and the other three quarters of the crew ; but the shoresman is allowed one eighth part more on articles that it is his province to prepare for the market, such as drying the codfish, &c. The sounds, or air-bladders, and the tongues of the codfish, with the fins of the halibut, collectively called 'garney,' are the perquisites of the crew, but of which the shoresman is allowed some proportion, according to mutual convention. From twenty to thirty barrels to a fare are saved ; the fins selling for about eight dollars per barrel, and the sounds and tongues for from six to seven dollars. When the vessel returns, she is moored, head and stern, at about a cable's length from the shore, and the crew proceeds to 'wash out' the fare ; which is done by unlading it into boats,

taking it into about eighteen inches' depth of water, and throwing it out, when it is washed clean, and then transported to 'the fence,' as the enclosure is called where the fish are dried. It is then placed in 'water-horse'; that is, it is staked up in a pile, with the skin up, to drain; thence it is taken to 'the flakes,' to be dried. The flakes are a series of horizontal hurdles, at a convenient height from the earth for the shoresman and his hired men to spread, turn, and take off the fish, — the labors of the vessel's crew ceasing with the 'washing-out.'

“Two good 'fish-days,' with a subsequent airing of a few hours, — when the fish are sold, they being now more heavily salted than formerly, — are sufficient to preserve them, and this process is called 'Albany drying'; it is, however, by this mode now considered sufficiently cured for any market. Last year, the fish thus prepared was sold at from 19 shillings, or \$ 3.16 $\frac{2}{3}$, to \$ 3.50 per quintal; this year it commands about \$ 3 $\frac{3}{8}$ per net hundred-weight, and is always sold for cash.”

Besides these immense quantities of codfish which are taken at the Grand Bank and salted and dried, large numbers are brought fresh into all the markets along the seaboard, and thence are distributed throughout the interior of the State. At Duxbury, in 1836, there were *ten* market-boats, having forty men on board, which took from 48,000 to 50,000 fish. At Provincetown there were also *ten boats* thus engaged. Boston market is supplied with codfish by about fifteen or twenty small schooners and a large number of boats.

By the kindness of Captain Nathaniel Blanchard, of Lynn, master of one of these smacks, I am enabled to furnish the following facts, by which some idea may be formed of the amount of *fresh codfish* brought to our market. He has presented me the result of his labors with a vessel of twenty-five tons, and a crew of six men, for nearly five months, commencing October 24, 1836, and terminating March 20, 1837. His account exhibits the number of fish taken, and the price obtained for the same, for each day during that period. From this minute statement, I am able to ascertain that the *largest quantity* taken any one day was 7,124 pounds, on the 13th of December, which sold for five shillings per hundred = \$ 59.39. The *smallest quantity* taken any one day was 337 pounds, on January 16th, which sold for twelve shillings = \$ 6.67. The smallest receipts were on March 20th, when 359 pounds were taken, which sold for ten shillings six pence = \$ 5.92. The whole number of pounds taken during the period mentioned was 194,125. The entire receipts for the same were \$ 3,026.14.

My old friend, Captain Nathaniel E. Atwood, has also furnished me with an account of his cod-fishing, with a crew of five men, from December 26, 1846, to May 8, 1847.

Arrival in Boston.	No of Cod	Whole Weight.	Price at Wholesale	Whole Stock.
January 4,	326	3,931	8s. 6d.	\$ 55.20
“ 16,	315	3,637	6 9	40.55
February 11,	840	10,823	9 0	162.34†
“ 19,	824	10,933	8 0	144.36
March 1,	293	5,395	10 6	94.39
“ 8,	591	8,093	8 0	108.12
“ 20,	260	2,862	8 3	40.77
April 2,	420	4,651	10 0	75.48
“ 12,	130	938	8 0	12.97
	<hr/> 3,999	<hr/> 51,263		<hr/> \$ 734.18

The above were taken north of Cape Cod.

	No of Cod	Weight	Split Cod.,	Stock
April 20,	902	620	5,055	\$ 81.76
“ 27,	299	1,061	1,418	42.06
May 3,	530	1,953	2,038	62.79
“ 8,	474	373	3,568	53.82
	<hr/> 2,205	<hr/> 4,007	<hr/> 12,079	<hr/> \$ 240.43

The above were taken south of Cape Cod. On the 18th of April, Captain Atwood himself caught one hundred and seventy-three codfish and two halibut in twenty-nine fathoms of water.

The following extract from a letter of Captain Blanchard will show the success of a single half-day. “This day,” November 25, 1846, “eleven fishing-smacks have been out fishing, manned by seventy-five men; they have taken 75,000 or 76,000 pounds of fish, making an average of a little more than a thousand weight to each man. We fished but half of the day, on account of the snow-storm.”

Generally speaking, this species “schools” but little, and is met with straggling all along the coast. It is a very voracious fish, eating almost every kind of food it can obtain. The fishermen consider the *herring* the best bait they can use in fishing for it, although they frequently catch them with *young flounders*, *cuttle-fish*, &c. When fishing on a *muddy bottom*, it is some time before the cod begins to take the hook; when, however, they are fished for upon a rocky bottom, they seize the bait at once. The hook should be suspended from three to five feet above the bottom of the sea, else the bait is taken off by skates.

* Two days' fishing.

† The split fish were sold by contract for eight shillings per hundred; none being split which could be sold entire.

As well as the Bank fishers, our shore fishers preserve the livers of this species for their oil. A good-sized cod liver yields half its weight of oil. Three barrels of livers yield one barrel of oil; almost all the remainder of the liver is water. A barrel of *cod oil* is worth from eleven to fourteen dollars. The oil furnished by the *cod upon our coast* is called shore oil, which is inferior to the Labrador or Bank oil. It is the habit of our fishermen to mix the livers of all the fishes which furnish oil together, and sell them for shore oil, — such as those of the pollock and hake, both of which furnish more oil than the liver of the cod, and that of the haddock, which yields but little oil.

Specimens of the cod are occasionally taken which are more or less mutilated; and sometimes, also, suffering from disease. The ventral or pectoral fins are lost. Captain Atwood has seen a cod with an injured spine, causing a distortion of the head to one side. Frequently specimens are caught much scarred, and with large sores upon their surface. Sometimes the sore becomes very hard, the surrounding parts inflame, and the fish emaciates; or the gall-bladder becomes enlarged, and the bile hardened, so that it can scarcely be cut with a knife.

In the month of February, the cod leaves the vicinity of the land, and goes off into deeper water. There are several varieties, differing in their color and markings, probably produced by difference of locality or food, which are known by the names of “Rock-Cod,” “Shoal-Cod,” &c.

The American cod grows to a very great size. Yarrell states that the largest cod of which he has any record weighed *sixty pounds*. Pennant refers to one weighing *seventy-eight pounds*. Captain Nathaniel Blanchard, of Lynn, has seen a cod weighing *eighty-six pounds*. Mr. Jonathan Johnson, Jr., of Nahant, has seen one taken weighing *eighty-eight pounds*. A cod weighing *one hundred pounds and a half* was taken at Provincetown in the winter of 1846–47, by one of the crew of Captain Emery’s fishing-smack. The largest specimen of which I have any certain information, Mr. Anthony Holbrook, fishmonger in Boston Market, assures me he saw caught, in the spring of the year 1807, at New Ledge, sixty miles southeast of Portland, Maine; it weighed *one hundred and seven pounds*. Captain Atwood has *heard* of one said to weigh *one hundred and twelve pounds*.

In a Portland paper of September 13th, 1840, is an account, copied from the “Halifax Recorder,” of a codfish exhibited in the fish-market at that place, measuring eight feet three inches in length, and forty inches in circumference.

MORRHUA ÆGLEFINUS, *Lin.**The Haddock, Cuv.*

(PLATE XXVIII. FIG. 1)

- Gadus aeglefinus*, LIN, Syst Nat (12th edit), p 435
 ‘ ‘ *Haddock*, BROCH, II p 125, pl 62
 “ “ SHAW, Gen Zool, IV p 136.
 “ “ PLANNET, Brit Zool, III p 241
 “ ‘ “ JENYNS, Brit Vert, p 441
 “ ‘ “ MITCH, Trans Lit and Phil Soc of N Y, I p 570
Morrhua aeglefinus, *Haddock*, GRIFFITH'S CUV, V p 484
 “ “ “ YARRELL, Brit Fish, 1st edit, II p 153, fig, 2d edit, II p 233, fig
 “ “ “ STORER, Report, p 124
 ‘ “ “ DEKAY, Report, p 279, pl 43, fig 138
 “ ‘ ‘ STORER, Mem Amer Acad, New Series, II p 467
 “ ‘ “ “ Synopsis, p 215

Color. This species is of a dark-gray color above the lateral line, and of a beautiful silvery-gray beneath it, with a large circular or oblong blotch on each side, on a line with the middle of the pectorals, and just above them, which at its upper portion generally extends above the lateral line, its larger part being beneath that line. The gill-covers are much lighter-colored than the top of the head and snout, with a purplish tinge after death. The dorsal, pectoral, and caudal fins are bluish; the anal fins are of the color of the abdomen; the ventrals are rather lighter than the anal. The lateral line of a jet-black color. Pupils black, irides bluish.

Description. Stout in front of the first anal fin, gradually diminishing in size posterior to this. Length of the head less than one fourth the length of the body; depth of the body across from the anus less than the length of the head. Neck convex; top of the head between the eyes flattened; snout prominent. The upper jaw projects beyond the lower, and has several rows of sharp, pointed teeth; a single row of teeth are observed in the lower. A very minute barbule is suspended from the chin. The posterior nostril is much larger than the anterior. The eyes are circular; the diameter of the eye is rather more than one sixth the length of the head; the distance between the eyes is equal to about one fourth the length of the head.

The lateral line commences just above the posterior angle of the operculum, and assumes the curve of the body until on a line with about the middle of the second dorsal fin, when it takes a straight course, and terminates at the base of the caudal rays.

All the fin rays are enveloped by a thick fleshy membrane.

The first dorsal fin is high and triangular, and three fifths the length of the second dorsal; it commences on a line above the base of the pectorals.

The second dorsal arises just back of the first, on a line above the posterior extremity of the pectoral fin, and is equal in length to the head; its first rays are equal in height to nearly the length of the fin; its last ray is very minute; this fin terminates just anterior to the third dorsal.

The third dorsal is of the same form as the second, and a little longer than the first.

The pectorals are triangular; in height they are equal to the length of the third dorsal; their rays are multifold.

The ventrals are situated in front of the pectorals; the extremities of their first two rays are free; the second ray is the longest.

The first anal fin commences on a line back of the second dorsal, and is formed like that fin.

The second anal arises just back of the third dorsal, and terminates nearly on a line with it.

The caudal fin is emarginated.

The fin rays are as follows: — D. 16, 24, 20. P. 21. V. 6. A. 26, 21. C. 35.

Length, one to two feet.

Remarks. Immense numbers of this species are found on our coast in the spring, and continue through the season until autumn. The best haddock are caught on rocky bottoms, where in summer they are most plenty; but in the colder portions of the year they are most abundant on clayey bottoms. It is not an uncommon circumstance for haddock to remain on the fishing-ground with a large school of cod. About thirty years since, this species was comparatively rare at Cape Cod; in 1839, when my "Report on the Fishes of Massachusetts" was published, it was almost as common there as in any part of the bay. It is estimated that in the warm season about twelve hundred-weight of haddock are taken to one hundred-weight of codfish in Massachusetts Bay, and in the winter about twelve hundred-weight of cod to one hundred-weight of haddock; but as the haddock-fishery is of longer duration, the quantities through the year will average about the proportion of three haddock to one cod. Large numbers are sold in the market; during the entire summer it is eaten by the poorer classes, who are often able to obtain from the fishing-smacks a fine fish weighing several pounds for one or two cents. When boiled or made into a chowder, it is an excellent table-fish.

In the winter, this fish is worth about a dollar and a quarter a hundred-weight, while the cod is worth a dollar and three quarters a hundred-weight. This species is sometimes taken weighing seventeen pounds, although the average weight is between two and six pounds.

Maine, Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

MORRHUA PRUINOSA, DeKay.

The Tom-Cod.

(PLATE XXVII. FIG. 5.)

- Frost-Cod, and Frost-fish*, PENNANT, Arctic Zool, Supplement, p 114.
Gadus prunosus, Tom-Cod, or Frost-fish, MITCH, Report in part, p. 4
Gadus tomcodus, Tom-Cod, MITCH, Trans Lit. and Phil. Soc. of N. Y., 1. p 368
Morrhua tomcodus, Tom-Cod, STORER, Report, p 126.
Morrhua prunosa, Tom Cod, DEKAY, Report, p 278, pl. 44, fig 142
 " " " AYRES, Bost Journ. Nat Hist, iv. p 276
 " " " STORER, Mem Amer Acad, New Series, II p 468
 " " " " Synopsis, p 216.

Color. This species varies exceedingly in its color. Generally it is brown, greenish, or yellowish-brown, with deeper patches, spots, and blotches; beneath lighter. The whole upper portion of the sides is sprinkled with irregular black points or dots, which are continued upon the ventral, pectoral, and anal fins. The abdomen in front of the vent is almost free from dots in some specimens. Pupils black, irides golden.

Description. Body oblong, abdomen somewhat prominent. The length of the head is rather less than one fifth the length of the body. The depth of the fish over the anus, exclusive of the dorsal fin, is about one sixth the length of the body. The upper jaw projects beyond the lower; the snout is blunt; beneath the chin is situated a small barbel. Compact, small, and sharp teeth in the intermaxillary bone, lower jaw, and upper palatine bones. The eyes are circular; their diameter is equal to less than one half the distance between them. The nostrils are double, situated just anterior to the eyes; the posterior and inferior is much the larger.

The lateral line, arising above the operculum, curves upward to a line opposite the termination of the pectorals, and just beyond these fins commences a straight course, which is continued to the base of the caudal rays.

The first dorsal fin, which is of a triangular form, commences opposite the middle of the pectorals.

The second dorsal is subquadrangular.

The third dorsal is one fourth shorter than the second, and longer than the first.

The pectorals are one fourth shorter than high.

The ventrals are situated in front of the pectorals ; the first two rays are free at their extremities ; the second ray is considerably the longer.

The first anal fin is more than as long again as high.

The second anal is shorter than the first anal, and is of the same form as the third dorsal. The anals are separated from each other by a space equal to one fourth the length of the second anal.

The caudal fin is rounded at its posterior extremity.

The fin rays are as follows: — D. 13, 18, 19. P. 17. V. 6. A. 22, 18. C. 39.

Length, twelve to fourteen inches.

Remarks. This common species is taken by the hook from our wharves and bridges in the summer ; and through the winter, Boston market is supplied with this fish from the mouths of the rivers in the vicinity, where it is taken in dip-nets. The amount of tom-cod taken at Watertown alone is estimated at two thousand bushels annually ; about half of these are sent to Boston market, and the remainder to the neighboring towns.

Maine, Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHELL, DEKAY.

GENUS II. MERLANGUS, CUV.

Three dorsal and two anal fins. No barbels to the chin.

MERLANGUS PURPUREUS, *Storer.*

The Pollack.

(PLATE XXVIII. FIG. 3.)

Gadus purpureus, *New York Pollack*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 370.

Merlangus Purpureus, *Pollack*, STORER, Report, p. 130.

“ “ *New York Pollack*, DEKAY, Report, p. 286, pl. 45, fig. 147.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 472.

“ “ “ Synopsis, p. 220.

Color. The upper part of the head and body is of a greenish-brown color ; the sides are lighter ; the abdomen is white. In very small specimens, the color above is deeper, and the abdomen is reddish. The pupils are black ; the irides silvery, with greenish reflections. The dorsal, pectoral, and caudal fins are of the color of the back. The ventrals are white. The first anal fin is white at its base, and bluish above ; the second

anal has a longitudinal white line at its base, and, as well as the first dorsal, is whitish at its top. The lateral line is grayish.

Description. Body oblong, subcompressed. Slightly arched above to the origin of the first dorsal fin. Its greatest depth about equal to the length of the head. The head is more than one fourth as long as the body, flattened above, somewhat pointed at the snout when the jaws are closed. The eyes are large; their diameter is less than half the distance between them. The gape of the mouth is quite large; the tongue is large, fleshy, fuliginous. The lower jaw is longer than the upper; minute teeth in both jaws; a single row only in the lower. The posterior nostril the larger. A line of mucous pores is situated on both maxillary bones, and upon the lower portion of the opercula. The division between the gill-covers is scarcely distinguishable when first examined; the posterior angle of the operculum is obtuse.

The lateral line, commencing above the posterior angle of the operculum and slightly curving over the pectorals to their extremity, pursues a straight course to the middle of the caudal rays.

The first dorsal fin is triangular, and arises opposite the middle of the pectorals.

The second dorsal is more than as long again as the first; the rays gradually diminish in height to the last, which is very short.

The third dorsal is three times as long as high, and terminates opposite the second anal.

The pectorals arise just beneath the posterior angle of the operculum; their depth at their base is equal to one third their height.

The ventrals are just in front of the origin of the pectorals; their second and third rays are longest.

The first anal fin arises opposite the commencement of the second dorsal, and terminates on a line opposite the termination of that fin.

The second anal is about half the height of the first; the first two rays are short and simple.

The caudal fin is large, strong, forked; the length of the outer rays is equal to the distance between the extremities of the fin when expanded.

The fin rays are as follows:—D. 14, 22, 21. P. 20. V. 6. A. 22, 21. C. 24 $\frac{8}{8}$.

Length, one to three feet.

Remarks. Immense numbers of this species are found in our waters in spring and autumn. A fleet of twenty or thirty boats frequently go off to Jeffries' Ledge, east of Cape Ann, in the fall of the year, and, having fastened their craft together, and thrown overboard a quantity of bait to entice the fish, capture in a single night from thirty to

forty quintals of pollack to a boat. When prepared in the same manner as the cod when intended for dun-fish, with proper care and good salt, this is really an excellent fish, and its value is increased from nine shillings to three or four dollars per quintal.

Maine, Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

GENUS III. LOTA, CUV.

Body elongated. Two dorsal fins. A single anal fin. One or more barbels on the chin.

LOTA COMPRESSA, *Lesueur*.

The Eel-pout.

(PLATE XXVIII. FIG. 4.)

Gadus compressus, LESUEUR, Journ. Acad. Nat. Sciences, I. p. 84.

Le Molve Hunt (Molva Huntia), LESUEUR, Mémoires du Muséum, v. p. 161.

Lota compressa, Eel-pout, STORER, Report, p. 134.

“ “ “ THOMPSON, Hist. of Vermont, p. 147.

“ “ *Compressed Burbot*, DEKAY, Report, p. 285, pl. 78, figs. 244, 245.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 471.

“ “ “ Synopsis, p. 219.

Color. The back and sides of this species are of a yellowish-brown, variegated with darker spots, which are more distinct anterior to the dorsal fin; abdomen yellowish. The first dorsal fin is lighter than the body, and variegated with black. Upon the lower portion of the second dorsal is a row of dark-colored spots, and its edge is margined with black.

Description. The body in front of the first dorsal is cylindrical, beginning to be compressed at the sides at the extremity of the pectorals, gradually becoming more so towards the tail, so that the caudal rays appear as a membranous prolongation of the body. The entire surface is covered with minute scales, appearing like cup-shaped depressions. The head is very much compressed above; its length is equal to one sixth the length of the body. The eyes are circular; the distance between them equal to one fourth the length of the head. The nostrils are double; from the back of the anterior nostril a very minute cirrus is suspended. The upper jaw is the longer; to the chin is attached a cirrus of a length nearly equal to the distance between the eyes. The jaws and palatines are armed with numerous minute, sharp teeth.

The lateral line arises above the operculum, and extends in a straight course to the middle of the fleshy portion of the tail.

The first dorsal fin is small, subquadrangular when expanded; it is situated one sixth the length of the fish back of the head.

The second dorsal, arising just back of the first, is continued to the tail; it is rounded at its posterior extremity.

The fan-shaped pectorals are three quarters the length of the head.

The ventrals are small, and terminate in a point.

The anal fin arises on a line just back of the origin of the second dorsal; it is of the same length as that fin, and, like it, is joined to the caudal fin.

The caudal is rounded at its extremity.

The fin rays cannot be accurately made out, owing to the fleshy membrane of which they are formed.

Length, six inches.

Remarks. This species was first described by Lesueur from a specimen taken at Northampton. The individual which has enabled me to furnish the above description was also brought from the Connecticut River, by Thomas M. Brewer, M. D., of this city.

GENUS IV. MOTELLA, Cuv.

Body elongated, cylindrical, compressed posteriorly; the first dorsal fin very slightly elevated, delicate in structure, scarcely perceptible; second dorsal and anal fins long, continued nearly to the base of the tail.

MOTELLA CAUDACUTA, *Storer.*

(PLATE XXIX. FIG. 1.)

Motella caudacuta, STORER, Proc. Bost. Soc. Nat. Hist., III. p. 5.

Color. The general color of the body is a yellowish-brown; the posterior margin of the second dorsal and anal fins, as well as the edges of the caudal fin, of a dark-slate color; the whole of the pectorals also of this color; the ventrals are lighter. The body beneath is lighter; the throat and lower jaw are externally much lighter than the rest of the body; the inside of the mouth and tongue are purple. The barbels on the snout of the color of the head; that on the chin colorless.

Description. The body of this species is elongated; cylindrical anteriorly, much compressed posteriorly. The head above is flattened posteriorly, and rounded anterior to the eyes. The snout is blunted. The length of the head is equal to one sixth the length of the entire fish; the depth of the body is equal to about three fourths the

length of the head. The gape of the mouth is large. The upper jaw is the longer; a single row of sharp teeth in each jaw. The nostrils, situated just anterior to the eye, are large. The eyes are horizontally oblong; their longest diameter is equal to one fourth the length of the head. On each side of the snout, just anterior to the nostril, is a barbule half the length of the head; between these two, at the anterior inferior angle of the snout, is a third, much smaller; from the chin hangs another barbule, of about the same length as the third.

The uninterrupted lateral line arises at the posterior superior angle of the operculum, and passes obliquely downwards to near the centre of the fish, when it pursues a straight course to the tail.

The first dorsal fin has one free ray, which is three fourths the length of the head; the remainder of the fin consists of minute hair-like rays situated in a groove of the length of the first ray, in which, when unexpanded, they are all concealed. Directly back of this groove the second dorsal commences, which is continued to the fleshy portion of the tail, terminating just anterior to the caudal rays; it is of about the same height throughout.

The vent is upon the anterior half of the body.

The anal fin commences directly back of this, and terminates on a line opposite the second dorsal; this fin is not as high as the dorsal.

The ventral fin has the first two rays free; the second ray is the longest.

The pectoral fins are three fourths as high as the length of the head, and are rounded posteriorly.

The caudal fin is about as long as the height of the pectorals, and tapers to a point.

The fin rays are as follows: — D. 53. P. 16. A. 48. C. 24.

Length, six inches.

Remarks. The specimen here described was one of two taken at Long Point, Provincetown, by Mr. Heman M. Smith, of that place. They had apparently been thrown ashore but a short time previously, being perfectly fresh. Since these were found, Captain Atwood has noticed several specimens in the stomachs and mouths of codfish caught in Massachusetts Bay during the winter.

GENUS V. MERLUCIUS, CUV.

The head flattened; the body elongated; the back furnished with two dorsal fins, the first short, the second long; but one anal fin, also very long; no barbels at the chin.

MERLUCIUS ALBIDUS, *Dekay*.*The Whiting.*

(PLATE XXVIII. FIG. 2.)

Gadus albidus, *New York Whiting*, MITCH, Journ. Acad. Nat. Sciences, I. p. 409.*Gadus merluccius*, *The Hake*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 371.*Merluccius vulgaris*, *Hale*, STORER, Report, p. 132.

" " " AYRES, Bost. Journ. Nat. Hist., IV. p. 276.

Merluccius albidus, *American Hake*, DEKAY, Report, p. 280, pl. 46, fig. 148.

" " STORER, Mem. Amer. Acad., New Series, II. p. 470.

" " " Synopsis, p. 218.

Color. When alive, this species is of a rusty-brown color upon the upper portion of the sides, golden in the sun; silvery beneath. Pupils black, irides with golden reflections. Dorsal and caudal fins rusty; pectorals and ventrals fuliginous; anal colorless. The whole interior of the mouth, jaws, throat, and tongue of a beautiful purple. Pupils black, irides silvery. The lateral line is lighter-colored than the upper part of the body.

Description. Body elongated, somewhat compressed in front of the anus, rounded posteriorly. The length of the head is equal to one fourth the length of the body. The top of the head is flattened, exhibiting depressions. The lower jaw is slightly the longer. The jaws as well as the palatine bones are armed with a row of prominent, sharp, incurved teeth, exterior to which is a row much smaller. Numerous teeth in the pharynx. The tip or middle of the upper jaw is edentate. A deep furrow exists in the suborbital bones, extending from the side of the snout in the upper jaw to the posterior portion of the preoperculum; and beneath the lower, from the chin to the outer angle of the jaw. The eyes are large and circular; their diameter is equal to more than half the distance between them. The inferior portion of the gill-covers is naked, the upper portion is scaly. The scales upon the top of the head are smaller than those on any other part of the body. Those on the opercles are smaller than those of the body. At the anterior angle of the eye, a bony process is observed; just in front of this process are situated the nostrils; the anterior is circular, the posterior, which is much the larger, is vertical.

The lateral line, appearing like a smooth raised ridge, arises at the superior posterior angle of the operculum, and pursues a slightly oblique course to the anterior half of the second dorsal, and thence passes in a straight line to the tail.

The first dorsal fin, which is short and triangular, arises on a line a short distance behind the origin of the pectorals. The second, third, and fourth rays of this fin are the highest, and equal in their height to the length of the fin. The last rays are very short. The distance between this fin and the second dorsal is equal to about one third the length of the first dorsal.

The second dorsal is more than three times as long as the first. A deep emargination is observed between the nineteenth and twentieth rays, causing this fin to appear like two fins. The highest rays of the posterior portion of this fin are much higher than those of the anterior portion, but not as high as the rays of the first dorsal. The extremities of the rays in both fins are bifid.

The pectorals are broad when expanded, slightly rounded; their middle rays the longest. The length of the pectorals is to their height as one to five.

The ventrals arise just in front of the pectorals.

The anal fin arises on a line just back of the origin of the second dorsal, and terminates on the same plane as that fin. This fin is slightly higher than the dorsal; between the twentieth and twenty-first rays is an emargination similar to that in the dorsal fin, making this also to appear as two.

The caudal fin is but very slightly concave at its posterior extremity.

The fin rays are as follows: — D. 13, 41. P. 13. V. 7. A. 40. C. 23.

Length, one and a half to two feet.

Remarks. When my "Report" was published, in 1839, I stated that the whiting was taken, not however in large quantities, in our Bay in the summer, upon the cod-fishery ground. Since that period, this species has increased very perceptibly in our waters. It is frequently caught in considerable numbers with the hook upon Crab Ledge, a few miles from Boston Light-house, and has become at Provincetown a serious inconvenience to the fishermen. Captain Atwood informs me, that, when the fishermen at the latter place commence the mackerel fishery with nets, which usually takes place about the 20th of May, the whiting are scarce, and few are caught; by the 1st of June they become more plenty; and from the middle of June to the last of the fishery, which closes about the 20th of July, they are exceedingly numerous, in all parts of the bay, in all depths of water. In such quantities are they taken in the nets, that frequently eight or ten hours are required for a man to clear his nets of them. At this season of the year, so many of them are thrown from the boats upon the shore, that the Board of Health are sometimes called upon to interfere, and to compel the fishermen to bury them, from the fear of sickness being produced by their decomposition. While visiting Race Point, the easterly extremity of Cape Cod, in June, 1847, I saw quite a number of

this species strewed along the shore, where they had been left by the tide, while in pursuit of sand-eels and other small fishes. Since that period, the blue-fish having been more common, this species does not exist in as great abundance.

Occasionally this species is brought to market, and when perfectly fresh is a very sweet fish, boiled, broiled, or fried. It soon becomes soft, and is preserved with difficulty. As it does not appear to be known abroad, and the fishermen consequently have no call for it, it is not cured, but is considered worthless. In the months of September and October the whiting is used somewhat for bait for the dog-fish, and answers a good purpose. This species remains upon our coast until late in the autumn, when, the water becoming colder, they disappear.

Dr. Dekay's figure of this species is bad. The second dorsal and anal fins do not show the emargination at all, and the caudal is too deeply concave.

Dr. Dekay thinks that Mitchill was induced to attribute three dorsal fins to this species on account of "the accidental rupture of the membrane." I think this is not the case; but that, owing to this deep emargination, the membrane connecting the nineteenth and twentieth rays was so low as almost to seem like the extremity of a fin.

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY.

GENUS VI. PHYCIS, ARTEDI.

Body elongated. Two dorsal fins, first short, second long; ventral fins with a single ray only at the base, afterwards divided. Chin with one barbule.

PHYCIS AMERICANUS, Storer.

The White Hake.

(PLATE XXIX. FIG. 3.)

Enchelyopus Americanus, SCHNEIDER, GRIFFITH'S CUV, x. p. 489.

Gadus longipes, *Codling*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., i. p. 372, pl. 1, fig. 4.

Phycis fuscatus, STORER, Bost. Journ. Nat. Hist, i. p. 418.

Phycis Americanus, *American Hake*, STORER, Report, p. 138.

" " *Codling*, DEKAY, Report, p. 291, pl. 46, fig. 150.

" " STORER, Mem. Amer. Acad., New Series, II. p. 473.

" " " Synopsis, p. 221.

Color. This fish, when first taken, is of a reddish-brown color above, bronzed upon the sides. The throat, and abdomen in front of the anus, are white, thickly sprinkled with minute black dots, causing them to appear almost fuliginous; less of this appear-

ance exists upon the belly and posterior portions of the fish. The snout is tinged with orange. The top of the head in front of the eyes, the checks and intermaxillaries, are also dotted. The upper edge of the dorsal fin is black. The pectorals are transparent, and dotted throughout their greater portion. The anal fin is of the color of the abdomen, and is also dotted, and black upon its edge. The caudal fin is reddish, with exceedingly minute black dots; its posterior extremity is black.

These colors fade in death, and the upper portion becomes of a grayish-brown, and the abdomen a dirty white.

Description. Body cylindrical, compressed posteriorly. Length of the head equal to nearly one fourth the entire fish; depth of the body in front of the pectorals one fifth its entire length; depth across from the anus, exclusive of the dorsal fin, about one sixth its length; depth of the body beyond the termination of the dorsal and anal fins equal to about one quarter the last measurement. Head much flattened above, broad, and strongly convex back of the eyes; sides somewhat compressed; snout projecting, rounded; eyes circular, large, prominent; the upper jaw projecting beyond the lower; both jaws are armed with several rows of sharp incurved teeth; five or six of these in the upper jaw, a less number in the lower; teeth also on the vomer; a small portion at the tip of each jaw is without teeth; that in the lower jaw is much the smaller. Tongue large and fleshy. A minute barbule at the chin.

The lateral line commences above and anterior to the posterior angle of the operculum, and curves with the body until it reaches a line opposite the eighteenth ray of the second dorsal, whence it pursues a straight course to the tail.

The first dorsal fin is triangular, and commences just back of the pectorals; its third ray is filamentous, and about twice the length of the fin.

The second dorsal commences just back of the first; its rays gradually diminish in height posteriorly. The membrane connecting the fin rays is much firmer than that of the first dorsal, although, like it, it is transparent; all the rays are slightly free at their tips. This fin terminates just anterior to the commencement of the fleshy portion of the caudal fin.

The pectorals commence just beneath the posterior angle of the operculum; their length is equal to about one fourth their height. They are rounded when expanded.

The ventrals commence at a point just half-way between the base of the pectorals and the angle of the lower jaw; they are composed apparently of a single ray, which bifurcates about its middle; but dissection shows they are formed of two rays, the inferior of which is much the longer.

The anal fin arises some distance back of the second dorsal, and terminates opposite

the termination of that fin; the first ten or eleven rays of this fin are the longest; they diminish in size towards the tail; this fin is not as high as the opposite dorsal.

The caudal fin is long; its rays are nearly even at its extremity; it is but very slightly convex.

The fin rays are as follows: — D. 10, 54. P. 17. V. 2. A. 48. C. 20.

Length, one to three feet.

Remarks. This species is taken in large numbers, between the first of June and the first of September, on muddy bottoms, between Cape Ann and Boston Light-house. In some seasons they are brought to market in October also. They are generally taken in the night with the hook, although they will sometimes take the bait in a cloudy day. Occasionally two thousand pounds' weight, varying in size from three to ten pounds or more, are taken in a single night by one man, where scarcely an individual was captured during the previous day. It sells for about half the price of cod, when fresh. It is a good fish fried and boiled, and is also used for chowder; for the latter purpose, it has perhaps no superior. It is also a valuable fish when salted.

Maine, Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

PHYCIS FILAMENTOSUS, *Storer.*

The Squirrel-Hake.

(PLATE XXIX. FIG. 4.)

Color. The upper part of the body is of a reddish-brown color. The sides are lighter and tinged with orange. The abdomen is of a pure white; the throat is also white. The anal fin is margined with white. Pupil black, irides silvery.

Description. Length of head one fifth that of the body, and rather more than the greatest depth of the fish. Depth at the base of the pectorals one seventh, at anus exclusive of dorsal fin one fifth, at posterior extremities of dorsal fin one twenty-first of the entire length. Top of head much depressed throughout its whole extent. Snout rounded and not very prominent. Eyes moderate; their diameter equal to three quarters the distance between them. Upper jaw projecting far beyond the lower. Teeth numerous, minute, incurved. The lateral line commences just above the operculum, and curves with the body to the tail. Scales very large, smaller upon the head.

The first dorsal fin is triangular; the third ray is filamentous, and from three to five times the length of the fin.

The second dorsal arises directly back of the first; its first few rays are shortest, the

remainder are of a uniform height, to the fleshy portion of the tail. It is stout and rounded, ending abruptly.

The pectorals arise just beneath the posterior angle of the operculum; they are rounded posteriorly.

The ventrals are composed of a single ray, bifurcated at their lower third; the outer portion being the shorter.

The anal fin arises at the posterior extremity of the longer portion of the ventral ray, and about opposite the tenth dorsal ray, on a line with which fin it terminates. The first four or five rays of this fin are the shortest.

The caudal fin is slightly expanded and nearly straight at its extremity.

The fin rays are as follows: — D. 10, 60. P. 16. V. 1. A: 55. C. 18.

Length, seventeen inches.

Remarks. This species is known by the fishermen of Massachusetts Bay as the "Squirrel-Hake." It seldom exceeds two pounds in weight, while the *P. Americanus*, when full grown, often weighs more than thirty pounds.

GENUS VII. BROSMIUS, CUV.

Body elongated; a single dorsal fin extending the whole length of the back. One barbel at the chin. Ventral fins fleshy.

BROSMIUS FLAVESCENS, *Lesueur.*

The Cusk.

(PLATE XXIX. FIG. 2.)

Le Brosme jaune, Brosmius flavescens, LESUEUR, Mémoires du Muséum, v. p. 158, pl. 16.

Gadus (Brosmius) flavescens, LESUEUR, *Yellow Tusk*, RICH, Fauna Boreal. Americ, III. p. 252

Brosmius vulgaris, CUV., *Cusk*, STORER, Report, p. 136.

" " (2), *Cusk*, DEKAY, Report, p. 289.

Brosmius flavescens, LESUEUR, STORER, Mem. Amer. Acad, New Series, II p. 473.

" " STOREE, Synopsis, p. 221

Color. The back is of a brownish color in the larger specimens; the sides yellowish, and sometimes of a decided yellow; frequently, in very large specimens, the fish is whitish, with brownish patches, appearing as if abraded; beneath, white. In the smaller specimens, the body is of a uniform dark-slate color in some specimens; while in others six or eight transverse yellow bands are seen. The dorsal, anal, and caudal

fins are bordered with black or blue-black, and edged throughout with a white margin. The pectorals are of the color of the sides. The ventrals are fuliginous.

Description. Body cylindrical, compressed posterior to the anus, tapering to a point at the fleshy extremity of the caudal fin. The top of the head is flattened. A slight furrow between the nape of the neck and the dorsal fin. The upper jaw is slightly longer than the lower; several rows of prominent, sharp, incurved teeth upon the jaws; the innermost row of those upon the lower jaw the longest; similar teeth upon the palatine bones. The mouth is large, its vertical gape being nearly equal to three fifths the length of the head. A single barbel, about one fifth the length of the head, is suspended from the chin. The eyes are horizontally oval; the distance between them is rather greater than their longest diameter. The posterior nostril is situated directly in front of the anterior angle of the eye; a tubular cirrus projects from the anterior, which is much the smaller.

The lateral line commences just back of the eye, and curves backwards and downwards to a line above the origin of the anal fin, whence it pursues a straight course to the caudal rays.

The dorsal fin arises on a line above the anterior half of the pectorals; its height at its origin is equal to about one fifth the length of the head; it continues of this height until near its posterior termination. It is rounded at its extremity, and is continued to the caudal rays, with which it unites.

The pectorals are rounded posteriorly, and are equal in their height to two fifths the length of the head.

The fleshy ventrals are situated anterior to the pectorals, and are about the same height as those fins; the extremities of their rays are free.

The anal fin arises at a distance back of the termination of the pectorals equal to about one fifth the length of the fish; this fin terminates opposite the termination of the dorsal, and, like that fin, is united to the caudal rays.

The caudal fin is rounded when expanded.

The anus is small, and situated just in front of the anal fin.

The fin rays are as follows: — D. 98. P. 24. V. 5. A. 71. C. 34.

Length, two to three feet.

Remarks. This fine species is commonly taken on ledges in deep water; it is frequently caught upon the Middle Bank, between Cape Cod and Cape Ann, with the hook, while fishing for cod. In the spring of the year it is occasionally met with in Boston market, but does not sell as readily as the cod; in the winter season it is more rare, and not unfrequently sells for double the price of that species. It is an excellent

fish, and is considered by those best acquainted with it, when fresh, quite a delicacy, and, when salted, preferable to the cod. A large quantity of oil is procured from its liver, which is sometimes preserved by the fishermen for external application to burns. This species grows to the weight of thirty pounds. Captain Atwood informs me that he has never known an individual to be taken on the Cape Cod shore of Massachusetts Bay.

Massachusetts, LESUEUR, STORER.

FAMILY XIX. PLANIDÆ.

Body flat, compressed vertically. Upper surface dusky, and of various colors; beneath white. Dorsal single, extending the whole length of the back. Both eyes placed on the same side of the head. No air-bladder. Branchial rays six.

GENUS I. HIPPOGLOSSUS, CUV.

Eyes and colored surface on the right side. The fins are similar to those of the species of the genus *Platessa*; the jaws and the pharynx are armed with teeth that are sharper and stronger, and the form of the body is more elongated.

HIPPOGLOSSUS VULGARIS, Cuv.

The Halibut.

(PLATE XXX. FIG. 1.)

- Pleuronectes hippoglossus*, LIN., Syst. Nat., p. 456.
 “ “ *Holybut*, BLOCH, II. p. 44, pl. 47.
 “ “ FABRICIUS, Fauna Groenlandica, p. 161.
 “ “ *Holibut*, SHAW, Gen. Zool., IV. p. 295.
 “ “ “ PENNANT, Brit. Zool., III. p. 302.
 “ “ *Halibut*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 386.
Hippoglossus vulgaris, *Holibut*, JENYNS, Brit. Vert., p. 460.
 “ “ GRIFFITH'S CUV., X. p. 494.
 “ “ YARRELL, Brit. Fish., 1st edit., II. p. 230; 2d edit., II. p. 321.
 “ “ STORER, Report, p. 145.
 “ “ DEKAY, Report, p. 294, pl. 49, fig. 157.
 “ “ STORER, Mem. Amer. Acad., New Series, II. p. 475.
 “ “ “ Synopsis, p. 223.

Color. The entire right side of this species of an almost uniform dark-brown; the left side of a pure white. Very rarely, an individual is caught having the left side also brown.

Description. Body elongated. The length of the head is equal to one fourth the length of the entire fish. The eyes are large, oblong; their longest diameter equal to the distance between them. The lips are large and fleshy. The lower jaw the longer. The jaws are furnished with two rows of strong, sharp teeth, the inner of which is larger and incurved. The nostrils are double; the anterior is tubular, the posterior the larger.

The lateral line commences at the posterior superior angle of the operculum, and, making a high curve above the pectorals, assumes just back of their posterior extremity a straight line, which is continued to the rays of the caudal fin.

The dorsal fin arises over the anterior third of the eye, and terminates at the fleshy portion of the caudal fin. The highest rays of this fin are six times the height of those above the base of the pectorals.

The pectorals arise just back of the posterior angle of the operculum.

The ventrals are small, and situated beneath the base of the pectorals. The third ray is the longest.

The anal fin arises beneath the posterior half of the pectorals, and terminates opposite the dorsal fin.

Two apertures anterior to the anal fin; the anterior, the anus; the posterior, the smaller, the urinary outlet.

The fin rays are as follows, in two specimens examined:—

D. 99. P. 17. V. 6. A. 73. C. 18.

D. 100. P. 16. V. 6. A. 74. C. 17.

Length, three to six feet.

Remarks. In some rare instances, the eyes of this species are reversed, being situated on the left side of the fish.

By far the greatest quantity of halibut brought to Boston market is taken at George's Banks, twenty thousand pounds' weight being frequently captured at that place in a day or two, by the crew of a single smack, constituting what is called a "trip." Considerable numbers, however, are taken along our coast. Nantucket Shoals have for many years been a favorite resort for the halibut fishers, and formerly many were taken there. Captain Atwood informs me that, with a crew of eight men, he has captured there in a single day 7,300 pounds' weight of this species. They have of late years become more scarce. In the spring of 1845, four men, from the 20th of April to the 15th of May, landed 13,000 pounds, which they took on the south side of Cape Cod, and which sold in Boston market for \$390. About eight or nine miles directly north of Race Point is a bank, which is called the Middle Bank; between this bank and Race Point the water is from about twenty-five to twenty-eight fathoms deep, with a

hard clayey bottom. This is called the "Gully." In the summer, this species strays up Massachusetts Bay, and scatters all along the shoal water, upon the hard bottoms; but in winter it goes back to this "Gully," and there remains during the cold weather. The reasons appear to be obvious. The shoal water would be too cold a situation for them during the winter; and the middle of the bay has a muddy bottom, which it avoids. Halibut were first taken in this "Gully" about twenty years since, and for several successive seasons the fishery was quite a lucrative business, but at present the fish are very scarce there. In the most successful year's fishery at this place, about 75,000 pounds of halibut were taken by the Provincetown fishermen. When the halibut were first caught at the "Gully," they averaged nearly one hundred pounds each; thirteen fish captured at one time weighed 2,043 pounds; those taken afterwards were smaller, and during the second and third years' fishery, they weighed sixty pounds or less upon an average.

An unusual number of halibut were brought to Boston market in the early part of 1837. Eighty large schooners, of from sixty to eighty tons' burden, belonging to Cape Ann, were thus employed. Captain Nathaniel Blanchard, of Lynn, one of our oldest fishermen, and to whom I am indebted for many valuable facts in the preparation of this report, informs me that the largest individual of this species he ever saw weighed 386 pounds. The late Mr. Lemuel Newcomb, then the oldest fishmonger in Boston market, stated to me in 1847, that, forty years before, a halibut was taken upon the South Shore, and brought to Boston, which, after the head and bowels were removed, weighed 420 pounds. This specimen when perfect must have weighed nearly 500 pounds.

For a knowledge of the largest specimen of which I have heard, I am indebted to Mr. Anthony Holbrook, a fishmonger in Boston market, — for many years a practical fisherman, and possessing an unusually extensive knowledge of our fishes, and a man of unimpeachable veracity. He assures me that a halibut weighing upwards of 600 pounds was taken at New Ledge, sixty miles southeast of Portland, Maine, in 1807.

This species feeds upon other fishes. In its stomach are frequently found portions of haddock, rays, menhaden, mackerel, herring, the eel-shaped blenny, &c. Its flesh is rather coarse and dry, but by many is much esteemed; when fresh, the fins are a great delicacy, as also when pickled and packed. When fresh, this species sells for a higher price than the cod. Large quantities are also smoked, and occasionally the dried flesh is eaten.

Greenland, FABRICIUS. Maine and Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

XV.

A History of the Fishes of Massachusetts.

BY DAVID HUMPHREYS STORER, M. D., A. A. S.

(Continued from Vol. VI. p. 372.)

GENUS II. PLATESSA, CUV.

Body rhomboidal, depressed; both eyes generally on the right side of the head, one above the other; a row of teeth in each jaw, with others on the pharyngeal bones; dorsal fin commencing over the upper eye, that fin and the anal extending nearly the whole length of the body; but neither of them joined to the tail; branchiostegous rays six.

Eyes on the Right Side of the Head.

PLATESSA PLANA, Storer.

The Flounder.

(PLATE XXX. FIG. 2.)

Pleuronectes planus, *New York Flat-fish*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 387.

Platessa plana, *Flounder of Massachusetts*, STORER, Report, p. 143.

“ “ *New York Flat-fish*, DEKAY, Report, p. 295, pl. 48, fig. 154, and pl. 49, fig. 158.

“ “ AYRES, Bost. Journ. Nat. Hist., IV. p. 276.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 476.

“ “ “ Synopsis, p. 224.

Color. The smaller and middling-sized specimens, when first taken from the water, are of a greenish-brown tinge, more or less spotted and blotched with rusty brown. The larger individuals are of a general rusty-brown color; or a dark, blackish brown, or a dull slate-color scarcely exhibiting any spots. The left side is colorless. Pupils black, irides golden. The dorsal, anal, and caudal fins are yellowish-brown; the two former are generally blotched with darker brown. The pectorals and ventrals are of the color of the right side of the fish.

Description. The greatest depth of this species is less than half of its length exclusive of the tail. The head is about two fifths the length of the fish includ-

ing the tail. The mouth is small, the lips are fleshy. A single row of compact, prominent, incurved, trenchant teeth, slightly notched on the cutting edge, form a continuous line from the angle to the centre of each jaw. On the upper jaw is one tooth, on the lower jaw are two teeth, on the side of the jaw next the colored side. The right half of the jaws, or the half next the colored side of the fish, edentate. The eyes are large, oblong; their longest diameter less than one fifth the length of the head. The space between the eyes, which is covered with scales, at its middle portion is equal in width to about one third the long diameter of the eye.

The lateral line, commencing at the anterior inferior angle of the inferior eye, curves backwards and upwards just behind the eyes to the posterior angle of the upper eye, then passes backwards along the edge of the gill-covers to the superior angle of the operculum, from whence, after making a slight curve over the pectorals, it pursues a straight course to the tail.

The dorsal fin commences anterior to the middle of the upper eye, and gradually increases in the length of its rays towards its posterior half, when it beautifully curves to its termination, at the origin of the fleshy portion of the tail.

The pectorals are situated just beneath the posterior angle of the operculum: their height is nearly equal to half the length of the head; the central rays are bifid at their posterior extremities.

The ventrals, which are of moderate size, arise on a line just anterior to the pectorals, and their extremities project beyond the commencement of the anal fin.

At the origin of the anal fin is situated a strong spine, which is nearly concealed by the flesh.

The anal fin arises on a line with the anterior third of the pectorals, and terminates opposite the termination of the dorsal fin.

The caudal fin is rounded when expanded.

The rays of the fins are scaled,—and the extremities of those of the dorsal and anal are free.

The fin rays are as follows:—D. 61. P. 10. V. 6. A. 46–48. C. 17.

Length, from twelve to twenty-one inches.

Remarks. This is the most common flat-fish taken in the waters of Massachusetts. It is captured in considerable quantities throughout all the warm season of the year near the shore, from the wharves and bridges; and in the winter is speared through the ice. The finest brought to Boston market are taken from around Deer Island,—and those from that locality frequently measure from twelve

to eighteen inches. The largest specimen of this species I have ever seen measured twenty-one inches in length, and seventeen in width.

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY.

PLATESSA DENTATA, *Storer*.

The Flounder of New York.

(PLATE XXX. FIG. 3.)

Pleuronectes dentatus, *Flounder of New York*, MITCH, Trans. Lit. and Phil. Soc. of N. Y., I. p. 390.

Platessa dentatus, *Flounder of New York*, STORER, Report, p. 143.

“ “ “ “ DEKAY, Report, p. 298.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 476.

“ “ “ Synopsis, p. 207.

Color. All the right side of the body and the fins of a uniform reddish-brown. Pupils black, irides golden.

Description. Body elongated. The length of the head to the whole length of the body, exclusive of the caudal fin, about as one to four. The eyes are situated upon the right side of the body, and placed over each other,—the upper slightly posterior,—separated by a bony ridge, covered with scales similar to those over the whole head. The longest diameter of the eye nearly equal to one sixth the length of the head. The mouth is very large, the perpendicular gape being nearly equal to two thirds the length of the head; the upper jaw projects slightly beyond the lower; both jaws are furnished with a single row of prominent, sharp teeth, separated from each other, so that when the mouth is closed the teeth of one jaw shut into the space between those of the opposite jaw; the lower jaw has a blunt, bony tubercle at the chin. The lips are small.

The lateral line is nearly straight, making only a scarcely perceptible curve over the pectoral fins.

The dorsal fin commences just over the middle of the eye, and terminates at the base of the fleshy portion of the tail; the first rays are quite short, and gradually lengthen towards the middle of the fin, whence they again diminish posteriorly.

The pectorals are subtriangular, and nearly half the length of the head.

The third and fourth rays of the ventrals are the longest; the posterior ray is very minute.

The anal fin commences on a line beneath the middle of the pectorals, and terminates opposite the dorsal fin. The edges of the dorsal and anal fins on the right side are fringed by the continuation of the whiteness of the left side upon them.

The fin rays are as follows:— D. 98. P. 11. V. 6. A. 70–75. C. 18.
Length, twelve to twenty-one inches.

Remarks. This species is frequently taken in the winter season at Provincetown; and is occasionally brought to Boston market. It is a sweet fish, but is not generally relished as well as the *P. plana*. It is known as the *Sand-dab*. The largest specimen I have seen, measured twenty-one inches in length, and weighed three and a half pounds.

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY.

PLATESSA FERRUGINEA, *Storer.*

The Rusty Flounder.

(PLATE XXX. FIG. 4.)

Platessa ferruginea, Rusty Dab, STORER, Report, p. 141, Plate II.

“ “ *Rusty Flat-fish*, DEKAY, Report, p. 297.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 476.

“ “ “ Synopsis, p. 224.

Color. All the right side of the body is of a reddish slate color, with a tinge of green, covered with numerous large, irregularly formed ferruginous spots. The fins have the color of the body. Beneath, of a clear white, except the posterior portion in front of the caudal fin, the caudal fin, and the margins of the dorsal and anal, which are a lemon yellow. The pupils are black, the irides golden.

Description. Body elliptical. The depth of the body is rather more than one third the entire length of the fish. Its surface is roughened by the scales. The length of the head is less than one fourth the length of the fish. The mouth is small; the lips are tumid. The jaws are equal, with a row of numerous small teeth in each jaw; those upon the colored side of the upper jaw are very minute. The anterior nostril is tubular. The eyes are large, and separated by a bony ridge, which arises in front of the centre of the upper eye, (the fish being placed upon its belly with the tail towards the describer,) and, passing in front of and around that eye, goes backwards and downwards to the posterior superior angle of the operculum, where the lateral line commences. The lateral line at its origin curves upward to a height equal to about one fourth the length of the head; and at the distance of about one half the length of the head from its commencement assumes a straight course, which it pursues to the extremity of the caudal fin.

The dorsal fin arises over the anterior third of the upper orbit, and its rays gradually increase in their length towards its middle, where they are longest. This

fin terminates in front of the caudal rays at a distance equal to about one third of their height: the extremities of the rays, which are white, are free, and resemble small filaments or tentaculæ.

The pectorals are situated at the posterior angle of the operculum; the extremity of the first ray reaches the arch of the lateral line at its centre.

The ventrals are opposite the pectorals, and extend to the origin of the anal fin.

Just anterior to the anal fin is a strong horizontal spine, almost concealed by the flesh.

The anal fin commences under the posterior third of the ventral fins, and terminates on a plane with the dorsal fin: this fin is of the same form as the dorsal; like it, its longest rays are towards the centre of the fin; and the tips of the rays are free.

The caudal fin is rounded; its central rays are three fourths as long as the head.

The fin rays are as follows:— D. 84. P. 10. V. 6. A. 65. C. 16.

Length, eighteen to twenty inches.

Remarks. This species is occasionally brought to Boston market, in the winter and early spring, from the northwestern coast of Massachusetts Bay, and principally from the vicinity of Cape Ann, where it is taken in about thirty fathoms of water.

Massachusetts, STORER. New York, DEKAY.

PLATESSA GLABRA, *Storer.*

The Plaice of Massachusetts.

(PLATE XXXI. FIG. 1.)

Platessa glabra, Plaice, STORER, Proceed. Bost. Soc. Nat. Hist., I. p. 130.
 “ “ “ “ Mem. Amer. Acad., New Series, II. p. 477.
 “ “ “ “ Synopsis, p. 225.

Color. Above grayish, mottled with dark brown: dorsal, anal, and caudal fins reddish-yellow, with well-marked, nearly black spots, more or less oval, differing in their size. Ventrals of a light brown.

Description. Body elongated, perfectly smooth. The length of the head is rather less than one fifth of the whole length of the fish, including the tail. The eyes are prominent, not so much so, however, as in the *plana*; the inferior eye hardly in advance of the upper. The lips are fleshy. The mouth is very protractile. Numerous sharp, cylindrical, somewhat conical teeth exist in both jaws; those on

that portion of the jaw next to the colored side are the smaller. The nostrils are directly in front of the eyes; the anterior is tubular. Between the eyes is a smooth ridge, covered by the common cuticle of the head as far back as the posterior angle of the orbit of the upper eye; from this point it becomes naked and rough, and is continued back to the superior angle of the operculum, where it is much larger than at any other point, terminating obtusely; between the extremity of this and the commencement of the lateral line is a smaller bony tubercle, apparently separated from the former.

The lateral line commences just back of the outer edge of the tubercle just referred to, and continues nearly in a straight course to the posterior extremities of the caudal rays.

The dorsal fin commences above the superior anterior angle of the upper eye, and gradually increases in the height of its rays towards its posterior half, the height of the longest rays being five times that of the first rays; this fin terminates at the base of the fleshy portion of the caudal fin, its last ray being of about the same height as the first ray.

The central rays of the pectorals are bifid.

The ventral rays do not extend to the anal.

The anal fin is formed like the dorsal, and terminates on a line with it. The rays of this fin, as well as of the dorsal, are somewhat scaled.

The caudal fin is slightly rounded when expanded.

The fin rays are as follows:— D. 62. P. 9. V. 6. A. 41. C. 16.

Length, eight inches.

Remarks. This species differs from the *plana* in the smoothness of its body; in the situation of the eyes; in its less distorted mouth; in the bony ridge upon its head; in the much greater thickness of its body; in its ventral fins not reaching the anal fin; in its caudal rays being almost destitute of scales; in there being scarcely any curve at the origin of the lateral line; in the number of the dorsal and anal fin-rays; and in the rays of the fins being stouter.

Besides these external differences between this species and the *plana*, the different form of the teeth in the jaws of the two species, the absence of teeth on the hyoid bone of the *plana*, the comparative lengths of their intestinal tubes, and the difference in form of the cœcal appendices, are very striking.

This is not a common species. It is taken in company with the *plana*, and is generally known as the Plaice.

Massachusetts, STORER.

*Eyes on the Left Side.*PLATESSA OBLONGA, *Dekay.**The American Turbot.*

(PLATE XXXI. FIG. 2.)

Pleuronectes oblongus, *Spotted Flounder*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., 1. p. 391.*Rhombus aquosus*, *Watery Flounder*, STORER, Bost. Journ. Nat. Hist., 1. p. 351.

" " " " " Report, p. 146.

Platessa oblonga, *Oblong Flounder*, DEKAY, Report, p. 299, pl. 48, fig. 156.*Platessa ocellaris*, *Long-toothed Flounder*, DEKAY, Report, p. 300, pl. 47, fig. 152.*Platessa oblonga*, STORER, Mem. Amer. Acad., New Series, p. 477.

" " " Synopsis, p. 225.

Color. Of a reddish-gray color, with more or less numerous circular, oval, or oblong blotches of a darker color, surrounded with a lighter margin, and also numerous white spots, which are distributed more especially at the bases of, and upon, the fins. The dorsal fin is of a lighter color than the body of the fish; its lower portion is reddish; the upper part of a leaden color; and frequently the entire fin is sprinkled with minute white spots; the extremities of the rays are tipped with white. The pectorals are transversely barred with black and white bands, and have a white blotch at their inferior base. The ventrals are light, with darker spots. The anal is similar in its color to the dorsal. The orbits, space in front of the eyes, and the jaws, are spotted with dull blue. Pupils black, irides golden. Right side of fish colorless.

Description. Body elongated, with very small, perfectly smooth scales. The depth of the body across the middle, exclusive of the fins, less than one third the length of the fish. The length of the head is rather less than one fourth the entire length of the fish. The top of the head in front of the eyes, the lower jaw, and the intermaxillaries, are perfectly smooth. The eyes are oblong, moderate in size: the upper eye is slightly back of the inferior, in a vertical line; distance between the eyes equal to the longest diameter of the eye. The mouth is situated obliquely; its gape is very large; when closed, the upper jaw projects very slightly in front of the lower; the jaws are armed with a single row of separated, quite large, sharp teeth, the front ones much the largest. A protuberance at the chin. The nostrils are double; the anterior has at its posterior edge a tubular membrane.

The lateral line, commencing in front of the posterior angle of the operculum, makes a high arch over the pectorals, and terminates in a straight line which begins at the posterior extremity of these fins; the top of this arch is a distance nearly equal to one third the length of the head above this straight line.

The dorsal fin arises on a line with the origin of the orbit of the upper eye, and extends to the fleshy portion of the tail. The extremities of the rays are free. The first rays are quite short; those at the middle and towards the posterior portion the longest; the most posterior are the shortest rays of the fin.

The pectorals are rounded when expanded.

The ventrals are very small, half the height of the pectorals; their extremities are free.

The anal fin arises just back of the origin of the ventrals, and terminates on a line with the dorsal, to which it is similar in form.

The caudal fin is large and fleshy, equal in height to the pectorals. The depth of the fleshy portion of the tail at the termination of the dorsal fin is equal in length to the caudal rays. The rays are deeply bifid. When this fin is expanded, it is rounded at its posterior extremity; when not expanded, it is convex, sometimes almost acutely pointed at its posterior centre.

The fin rays are as follows:— D. 89. P. 12. V. 6. A. 74. C. 16.

Length, fifteen to thirty inches.

Remarks. The species above described must, I think, be considered the *Platessa oblonga*, and also the *Platessa ocellaris* of Dekay. This conclusion, I conceive, is inevitable upon an examination of Dekay's descriptions and figures. A few observations upon this point may serve to settle the matter. The specimen before me has ocellated spots upon its surface, an angulated caudal fin, a prominence at the chin, and less than ninety dorsal rays.

The ocellated spots would show it to be the *P. ocellaris*. But that species, according to Dekay, has a rounded caudal fin, more than ninety dorsal rays, and a prominent chin.

The angulated caudal fin, and number of dorsal rays (less than ninety), would point it out as the *P. oblonga*. But Dr. Dekay would lead us to infer that there were never ocelli. He says, this species "is nearly uniform brown; occasionally with spots." As I have seen numbers of this species in the market at a time, they present the following characters. Some have distinct ocelli distributed over the greater portion of the body; while in others they are so dim as scarcely to be observed at all. They all have the chin prominent. They all have an angular tail when unexpanded, which is rounded when fully expanded. I have counted eighty-eight, eighty-nine, ninety, ninety-one rays in the first dorsal fin. The two species of Dekay would thus appear identical.

In a specimen I received from Provincetown, in August, 1844, both sides of the fish were equally dark-colored; the upper eye was situated directly upon the top of

the head; back of this eye was a deep notch, upon the upper edge of which, at its anterior angle, commenced the dorsal fin, as shown in the figure. (Fig. 2. b.)

This species is quite common during the summer and early part of autumn at Provincetown, and as far up the Cape as Wellfleet. It is taken along shore in very shallow water, and frequently weighs from fifteen to twenty pounds. At Provincetown it is known as the *Plaice*, in Boston market it is called the Turbot. It is an excellent fish, and is considered by judges to be fully equal to the *Rhombus maximus*, English turbot. For quite a number of years a few specimens had occasionally been yearly brought to our market, when Captain Atwood, about the year 1841, conceived the project of bringing them alive, by the cargo, in the well of his smack. For three years he succeeded quite well in disposing of several loads in this manner,—some being bought, by those who knew their value, as turbot, and others as young halibut. When, however, in the year 1844, the fishermen commenced packing in ice halibut taken upon George's Banks, and were thus enabled to keep the market supplied with that species in a state of perfect preservation, the species we are considering could not be sold. In the latter part of 1847, Captain Atwood brought to Boston a smack load of most excellent turbot, alive, and sold but two hundred-weight,—the remainder died upon his hands,—while species of infinitely inferior quality met with a ready sale in the market.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

PLATESSA QUADROCELLATA, *Storer*.

The Four-spotted Flounder.

(PLATE XXXI. FIG. 3.)

Platessa quadrocellata, STORER, Proceed. of Bost. Soc. Nat. Hist., II. p. 242, 1847.

Color. When just taken, the left side of this species is of a gray color, thickly spotted with brown, so as to appear almost confluent, including all of the fins. Upon the posterior half of the body, just beneath the dorsal fin, and directly opposite this, above the anal fin, are situated two large, nearly black ocelli, surrounded by a pinkish halo; at the base of the caudal fin are two similar, smaller ocelli.

Description. Body elongated. The greatest depth of the body, exclusive of the dorsal and anal fins, is just back of the posterior extremities of the pectorals. The length of the head is not quite equal to one fourth the length of the entire fish. The eyes are prominent, oblong, situated over each other, separated by a prominent, smooth, bony ridge; their longest diameter is about equal to one sixth the

length of the head. The upper jaw projects beyond the lower when the jaws are closed. The upper jaw has four or five prominent teeth in its front, and numerous card-like teeth towards its angles; in the lower jaw there are from seven to ten teeth on each side. The chin is prominent. The posterior nostril is the larger.

The lateral line curves over the pectorals to their posterior extremity, then pursues a straight course to the tail, and is lost on the central caudal ray.

The dorsal fin commences over the anterior superior angle of the eye, and its rays gradually become higher, until, having reached their highest point just back of the centre of the fin, they gradually diminish in height, and terminate rather abruptly at the fleshy portion of the caudal fin.

The moderate-sized pectorals are situated just beneath the posterior angle of the operculum.

The ventrals are small, broad, and stout.

The anal fin commences just back of the base of the pectorals, and terminates on a line with the termination of the dorsal fin.

The caudal fin is large and angulated, with stout rays.

The fin rays are as follows:— D. 86. P. 10. V. 6. A. 76. C. 17.

Length, twelve to sixteen inches.

Remarks. Captain Atwood informed me that he never noticed this species previous to the year 1846. During a visit to Long Point, Provincetown, in the latter part of June, 1847, I observed numerous specimens there. I have seen a single specimen having both sides dark-colored,—and both bearing the peculiarly marked ocelli,—with the exception of the head, which was, as usual, colorless beneath.

Massachusetts, STORER.

GENUS III. PLEURONECTES, DEKAY. (RHOMBUS OF CUVIER.)

Eyes and colored surface on the left. Teeth in the jaws and pharynx. Dorsal fin commences anterior to the eye.

PLEURONECTES MACULATUS, *Mitchill*.

(PLATE XXXI. FIG. 4.)

Pleuronectes maculatus, *New York Plaice*, MITCH., Report in part, p. 9.

Pleuronectes aquosus, *Plaice of New York*, MITCH., Trans. Lit. and Phil. Soc. of New York, I. p. 389, pl. 2, fig. 3.

Rhombus aquosus, CUVIER, Règne Animal.

Pleuronectes maculatus, *Spotted Turbot*, DEKAY, Report, p. 301, pl. 47, fig. 151.

“ “ STORER, Mem. Amer. Acad., New Series, II. p. 479.

“ “ “ Synopsis, p. 227.

Color. The living fish is of a greenish-brown color above, with small darker

green irregularly formed blotches, and dotted with a great number of minute white spots resembling snow-flakes, the spots near the back being the largest. The fins are of the color of the body. The rays of the pectoral fins are regularly spotted, and present the appearance of bands; their connecting membrane is perfectly colorless and transparent. The pupils are black, the irides golden.

Description. Body nearly orbicular, translucent. The scales are very small and round. The greatest depth of the body, exclusive of the fins, is rather less than half of its length. The length of the head is less than one fifth its entire length. The eyes are moderate in size: the inferior is anterior. The mouth is protractile; both of the jaws are furnished with a row of minute, sharp teeth; a patch of similar teeth are situated on the vomer. The nostrils are large, the anterior tubular: on the left, or colored side of the fish, the posterior nostril is just above the anterior angle of the inferior eye, and the anterior nostril is on a line before this. On the right, or colorless side, the nostrils are just below the origin of the dorsal fin.

The lateral line makes a high arch over the pectorals, whence it pursues a straight course to the caudal rays.

The dorsal fin commences on a line with the anterior nostril, above it, and is continued to the fleshy portion of the tail. The ten or twelve first rays of the dorsal fin are fleshy at their bases, and bifurcated just above their bases, and are again subdivided into delicate slips or filaments, which make them appear at first sight as if torn. The rays gradually become higher towards the centre of this fin, and again diminish as they approach the tail. This fin is rounded when expanded; the tips of the rays project just beyond the connecting membrane.

The pectorals are situated just beneath the posterior angle of the operculum; they are fan-shaped and transparent; their rays are bifid.

The ventrals arise at the angle of the lower jaw; the first ray is bifid, and its bifurcations are branched as in the first rays of the dorsal. The remaining rays are merely bifid at their tips.

The anus is situated at the posterior extremity of the ventrals.

The anal fin commences directly back of the anus. It is similar in its form to that of the dorsal, and is coterminous with that fin.

The caudal fin, which is rounded when expanded, is composed of strong, broad, bifid rays.

The fin rays are scaled, with the exception of the ventrals and the anterior rays of the dorsal and anal fins.

The fin rays are as follows:—D. 67. P. 10. V. 10. A. 51. C. $16\frac{2}{2}$.

Length, twelve to eighteen inches.

Remarks. When my "Report on the Fishes of Massachusetts" was published, I had never seen a specimen of this species. In August, 1845, Captain Atwood sent me a specimen from Provincetown; and in the following November I received one from the late Dr. Yale, from Holmes's Hole. While visiting Provincetown, in the summer of 1847, I saw this fish swimming about in considerable numbers, in shallow water, with the *Platessa oblonga* and *plana*. It is not used there as an article of food, although Dekay informs us that in New York it is considered a delicate fish.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

GENUS IV. ACHIRUS, LACEPEDE.

Destitute of pectoral fins. Both eyes and color on the right side. Mouth distorted to the side opposite the eyes. Dorsal and anal extend to the tail, but are not united with it.

ACHIRUS MOLLIS, *Cuv.*

The New York Sole.

(PLATE XXXII. FIG. 1. *b.* Left Side of Head.)

Pleuronectes mollis, *New York Sole*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I p. 388, pl. 2, fig. 4.

Achirus mollis, GRIFFITH'S *CUV.*, x. p. 499.

" " STORER, Report, p. 149.

" " DEKAY, Report, p. 303, pl. 49, fig. 159.

" " STORER, Mem. Amer. Acad., New Series, II. p. 480.

" " " Synopsis, p. 228.

Color. Upon the right side of a dark brown, marked transversely with rather indistinct, irregular, interrupted black bands; the left side is of a dirty white, with nearly circular dark brown blotches scattered over its entire surface, and also in a less marked manner upon the fins.

Description. Body oval. Length of the body, exclusive of the tail, four inches six lines; entire length, six inches; depth of the body two inches back of the snout, three inches, exclusive of the dorsal and anal fins. The length of the head is equal to nearly one fifth the length of the body. The eyes are small, circular, protuberant, and placed directly over each other. Directly in front of the upper eye, and in a line with it, just back of the commencement of the dorsal fin, almost entirely concealed, is a strong, compressed spine, two thirds of a line in length. The mouth is small, with minute teeth in both jaws on the under side; on the left side the aperture is partially concealed by the upper lip. The nostrils are large. The scales on

the body are quite small; on the lower anterior portion of the operculum, on the back just above the eyes, and on the fin-rays, they are larger. The left side is also scaly. The left side of the head is covered with soft filaments, which are continued along the base of the dorsal fin for an inch or more.

The lateral line commences just above the operculum, and is continued in a straight course to the base of the caudal rays.

The dorsal fin commences at the very anterior extremity of the back, which projects slightly beyond the upper jaw, and is continued to the tail, but not united to it.

The ventrals are situated just in front of the anal fin.

The anal fin commences in front of the posterior angle of the operculum, and terminates opposite the dorsal fin.

The caudal fin is nearly one third longer than its width at the base.

The rays of each fin are covered by scales on both sides.

The fin rays are as follows:— D. 55. V. 4. A. 38. C. 13. In a second specimen they were as follows:— D. 52. V. 4. A. 40. C. 16.

Length, six inches.

Remarks. Although Dr. Dekay speaks of this species as being common in the waters of New York, it must rarely be found in Massachusetts. In December, 1837, Dr. Yale, of Holmes's Hole, sent me a specimen which had been just taken in Tashmou Pond, about a mile from the village of Holmes's Hole. This pond is separated from the sea by a narrow beach, which is dry a portion of the year. Although Dr. Yale had resided many years at Holmes's Hole, and had a great fondness for natural history, he had never seen another specimen of this fish. In April, 1840, I received a specimen taken at Nahant. In January, 1847, Professor Agassiz procured two specimens in Boston market, which had been taken near Boston, in Charles River. Both Mitchill and Dekay consider this a very delicate fish for the table.

Massachusetts, north of Cape Cod, STORER. Nantucket to Carolina, DEKAY.

FAMILY XX. CYCLOPTERIDÆ.

Ventrals suspended all around the pelvis, and united by a single membrane, forming an oval and concave disk, which the fish employs as a sucker to fix itself to the rocks. Mouth broad, furnished at the jaws and pharyngeals with small pointed teeth; opercula small. Branchial rays six. Pectorals very ample, and almost uniting under the throat, as it were to embrace the disk of the ventrals.

GENUS LUMPUS, Cuv.

Two dorsal fins; the first dorsal fin so enveloped by a thick and tubercular skin, that, externally, it might be taken for a simple hump of the back; second dorsal with branched rays, opposite the anal. Body deep and rough, with conical horny tubercles.

LUMPUS ANGLORUM, *Willoughby*.*The Lump-Fish.*

(PLATE XXXII. FIG. 2.)

- Cyclopterus lumpus*, LIN, Syst. Nat., I p. 414.
 " " *Lump*, BLOCH, III. p. 92. pl. 90.
Lumpus Anglorum, WILLOUGHBY, p. 208, No. II.
Cyclopterus lumpus, *Lump-Sucker*, PENN., Brit. Zoöl., III. p. 176, pl. 24.
 " " SHAW, Gen. Zoöl., v. p. 388, pl. 166.
 " " *Common Lump-fish*, JENYNS, Brit. Vert., p. 471.
 " " *Lump*, RICH., Faun. Boreal. Americ., III. p. 260.
 " " FABRICIUS, Faun. Groenlandica, p. 131.
 " " *Lump-Sucker*, YARRELL, Brit. Fishes, 2d edit., II. p. 365, fig.
Cyclopterus cæruleus, *Blue Lump-fish*, MITCH., Trans. Lit and Phil. Soc of N. Y., I. p. 480, pl. 2, fig. 7.
Lumpus vulgaris, CUV., Règne Animal, II.
 " " *Lump-Sucker*, STORER, Report, p. 151.
Lumpus Anglorum, *Lump-Sucker*, DEKAY, Report, p. 305, pl. 54, fig. 175.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 481.
 " " " Synopsis, p. 229.

Color. All the upper part of the body is of a bluish-slate color; the sides and abdomen are of a yellowish-green. The immature fish is blue above, and almost entirely white beneath. Lips yellow.

Description. The body is suborbicular, compressed at its upper part. The entire surface of the fish is covered with an immense number of small stellated tubercles, studding, in the adults, even the rays of all the fins. Three rows of tubercles, much larger than those which are universally distributed over the fish, and terminating at their apices in naked spines, are observed projecting from either side. One row, commencing at the upper anterior angle of the eye, curves slightly over the humeral bones, and then passes in nearly a straight line to the tail; a second row, composed of much larger, wider, and more prominent tubercles, commences just beneath the posterior angle of the operculum, and terminates on the same plane with the extremity of the first row, the tubercles having diminished in size as they approached the tail, as in the first row; a third row, composed of a small number of still larger tubercles, commences on a line with the posterior portion of the ventral disk, and terminates just in front of the anal fin, forming the outer boundary of the abdomen. The two upper rows of tubercles are of the color of the back; the lower row is colored like

the abdomen. The tubercles of all these rows are granulated upon their sides, and have a naked spine at their summit. The greatest depth of the fish is equal to more than one half its length. The length of the head is less than one quarter the length of the fish. The head is covered with tubercles similar to those of the body; those on the posterior inferior angle of the operculum are larger than those on the other parts of the head. The eyes are circular; their diameter is equal to less than one third the distance between the eyes. The nostrils are large, tubular. The teeth are sharp and compact. A greater number of rows are in the upper than in the lower jaw; two small patches of minute teeth above and below in the pharynx. Just back of the top of the head, a compressed ridge rises abruptly and curves upward and backward to the posterior half of the body; its depth in the middle being equal to one third of its length; and its length equal to one third the length of the body of the fish. This ridge is formed of eight rays, which are perfectly distinct when the fish is dissected, and readily distinguished also in the dried specimen. The top of this ridge is covered with tubercles precisely similar to those which compose the middle row on the body; directly back of this dorsal ridge is a small flat surface composing the space between it and the dorsal fin, whose sides are armed with strong, prominent tubercles.

The dorsal fin, which is rounded, and one sixth longer than high, with rays multifid, is situated directly behind the flat surface just referred to.

The pectorals are longer at their base than the height of their highest rays; the height of the inferior rays is equal to about one fifth the height of the longest; these fins are rounded when expanded.

The ventrals, together with the anterior portion of the pectorals, form an oblong disk, of a bright yellow color, with six well-marked lines on each side of its centre, by which it is enabled to attach itself very powerfully to foreign substances.

The anal fin, commencing about on a line opposite the beginning of the dorsal, terminates on the same plane with that fin.

The caudal fin, when not expanded, is a little higher than wide; when expanded, it is one quarter wider than high. The depth of this fin at its base to its extremities when expanded is as two to five.

The fin rays are as follows:— D. 10. P. 20. A. 10. C. 12.

Length, eight to twenty inches.

Remarks. The whole appearance of this fish is very forbidding, being in young specimens a soft, gelatinous, tremulous mass; in older specimens it is of a much firmer consistence; but in both it is covered entirely with firm, horny spines.

This not uncommon species in Massachusetts Bay is frequently seen after severe storms thrown upon our beaches. Occasionally it is taken while fishing for cod, with the hook; and it is also caught in nets set for menhaden; generally, however, it is found attached to sea-weed and other substances floating near the shore.

Richardson tells us that "the Greenlanders eat its flesh, either cooked or dried, and its skin raw, throwing away only the tubercles"; and Dr. Neal observes, "that it is purchased at Edinburgh for the table." With us, however, it is not used as an article of food. The common weights of this fish are from three to four pounds, and from six to twelve pounds. The largest specimen I have met with was taken in January, 1843, and weighed eighteen pounds and three quarters.

Greenland, FABRICIUS. Maine, Massachusetts, STORER. New York, MITCHILL, DEKAY.

FAMILY XXI. ECHENEIDÆ.

With a flattened disk upon the top of the head, composed of numerous cartilaginous transverse plates, directed obliquely backwards, dentated or spinous at their posterior edge, and movable, by means of which they are enabled to attach themselves to other substances.

GENUS ECHENEIS, LIN.

Body elongated, covered with very small scales. A single dorsal fin, placed opposite the anal. Head very flat, covered with a disk; mouth wide, with numerous small, recurved teeth on both jaws, tongue, and vomer.

ECHENEIS ALBICAUDA, *Mitchill*.

The White-tailed Remora.

(PLATE XXXII. FIG. 3.)

Echeneis albicauda, *White-tailed Remora*, MITCHILL, Amer. Monthly Magazine, II. p. 244.

Echeneis naucrates, *The Indian Remora*, STORER, Report, p. 153.

Echeneis albicauda, *White-tailed Remora*, DEKAY, Report, p. 307, pl. 54, fig. 177.

" " " " STORER, Bost. Journ. Nat. Hist., IV. p. 183.

" " " " " Mem. Amer. Acad., New Series, II. p. 483.

" " " " " Synopsis, p. 231.

Color. Above, of a grayish-slate color; lighter upon the sides, with a dark band, which, commencing at the tip of the lower jaw as a small black point, runs along its margin to the angle of the jaw, where it expands to a band which passes to the tail, interrupted only by the eyes; in front of the pectorals this band is only two

lines in width, at the pectorals it grows wider, is widest beneath them, and becomes gradually smaller as it approaches the posterior extremity of the fish. The first ray of the dorsal fin is margined with white. The pectorals are the color of the body. The anal fin is dark-colored, edged with white. The upper and lower extremities of the caudal fin are white.

Description. Body cylindrical, elongated. The greatest depth of the body, exclusive of the fins, is equal to one tenth its length. The length of the head, from the tip of the lower jaw to the posterior angle of the operculum, is equal to about one seventh the entire length of the fish; the depth of the head at the posterior portion is equal to half of its length; its width over the same portion is equal to one third of its length. The top of the head is flattened; the body between the disk and the dorsal fin is nearly circular; back of the dorsal fin it is somewhat compressed. Upon the top of the head is an adhesive disk, about one fifth the length of the body, at its anterior extremity equal in width to about one third the length of the head; the widest part of the posterior extremity is slightly greater. This disk extends from the tip of the upper jaw to the middle of the pectorals; it has twenty-one light-colored transverse plates, divided by a longitudinal median fleshy line; the entire disk is margined by a fleshy border from one to four lines wide. The eyes are situated half-way between the tip of the lower jaw and the extremity of the operculum; they are circular, and between three and four lines in diameter. The nostrils are double, with fleshy appendages. The jaws are crowded with numerous small, card-like teeth. Teeth also are observed in the throat and upon the palatine bones. The lower jaw terminates in a point in advance of the upper.

The dorsal fin arises just anterior to the middle of the body. It is rather more than one third the length of the fish. It is of a dark slate color; the tips of the anterior rays are edged with white.

The pectorals commence on a line with the posterior fifth of the disk; their depth to their length is as one to three.

The ventrals are situated just posterior to the pectorals; their depth is equal to one sixth their length.

The anal fin arises directly opposite, and terminates upon the same plane as the dorsal. Its anterior rays are higher than those of that fin. The anus is half an inch in front of this fin.

The caudal fin is nearly even at its extremity.

The fin rays are as follows:—D. 29. P. 18. V. 5. A. 30. C. 18.

Length, twenty inches.

Remarks. This species is exceedingly rare in our waters; the specimen from which my description was drawn up, in my "Report on the Fishes of Massachusetts," was taken from the bottom of a fishing-smack, to which it was attached, in Boston Bay.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

ECHENEIS QUATUORDECIMLAMINATUS, *Storer.*

The Fourteen-plated Remora.

(PLATE XXXII. FIG. 4.)

<i>Echeneis quatuordecimlaminatus</i> , <i>Fourteen-plated Remora</i> , STORER, Report, p 155.
" " " " an juv ? DEKAY, Report, p 309.
" " STORER, Mem Amer Acad, New Series, II. p 484.
" " " Synopsis, p. 232.

Color. Of a light reddish-brown color, rather darker beneath. The pectoral and ventral fins are a little lighter than the body. The dorsal and anal fins are clouded with a lighter tint.

Description. Body fusiform, elongated. The length of the head is less than one fifth the length of the entire fish: above, it is entirely covered by an adhesive disk, which commences at the tip of the upper jaw, and, extending on each side to the eyes, terminates on a plane with the posterior half of the pectorals: this disk is surrounded by a fleshy margin, which is tipped with a darker brown than the color of the body, and is divided in its centre by a longitudinal fleshy septum, on each side of which are fourteen or fifteen distinct, strongly serrated laminae. The gill-covers are large; the lower jaw projects beyond the upper; the jaws are armed with several rows of strong, sharp, recurved teeth; teeth also are observed upon the pharynx, the palatine bones, and the root of the tongue. The gape of the mouth is moderate in size. The eyes are horizontally oval. The nostrils, which are near the edge of the upper jaw, are double.

The lateral line commences at the origin of the pectorals above, and, making a slight curve from their extremities, is continued in a straight course to the tail.

The dorsal fin commences about the middle of the length of the fish: it is rounded anteriorly, gradually diminishes in height as it approaches the tail, and terminates posteriorly above in a point.

The pectorals are somewhat rounded at their extremities.

The ventrals are narrow and triangular; and are attached to the belly by a membrane extending from the inner ray; the rays are multifold.

The anal fin commences a short distance back of the dorsal, is of a form somewhat similar to that fin, and terminates upon the same plane with it.

The caudal fin, composed of stout fleshy rays, is nearly straight at its posterior extremity. The distance between the extremities of the outer rays is equal to the height of those rays.

The fin rays are as follows:—D. 32. P. 22–24. V. 5. A. 28–30. C. 18. Length, seven and a half inches.

Remarks. This may be an immature fish which I have described; but I think it must be a new species. According to Dekay, three species of Remora are observed upon the coast of New York, the Albicauda, Naucrates, and Remora. I think it cannot be one of these species. It has not the broad longitudinal band, nor the white tips at the extremities of the caudal fin, noticed in the Albicauda, nor has it the twenty or twenty-three plates observed in the disk of that species. From the Naucrates it differs in its color, and the number of plates in the disk.

In the Remora the disk extends to the end of the pectorals; in this species it terminates at the commencement of the posterior half of these fins. In this species the dorsal and anal fins are not coequal; the dorsal fin of the Remora has twenty-one rays, while in this species it has thirty-two; the anal fin in the Remora contains twenty rays, the same fin in this species has twenty-eight rays. The caudal fin of the Remora is crescent-shaped.

I have seen but two specimens of this species. One of these was received from the late Dr. Yale, of Holmes's Hole, and served for the description contained in my "Report." The other was taken at Wellfleet, in August, 1844. One of these measured five inches and a half, and the other seven inches and a half.

APODES.

No ventral fins.

FAMILY XXII. ANGUILLIDÆ.

Body very much elongated and cylindrical, for the most part of a serpentine figure. Scales scarcely apparent, being imbedded in a soft and thick skin. Air-bladder of various singular forms. No cœcal appendages.

GENUS I. ANGUILLA, Cuv.

The dorsal commencing considerably behind the pectorals, and uniting with the anal to form the caudal. Lower jaw the longer. Mouth with a row of teeth in each jaw, and a few on the anterior part of the vomer.

ANGUILLA BOSTONIENSIS, *Dekay*.*The Common Eel of Massachusetts.*

(PLATE XXXIII. FIG. 1.)

- Anguilla vulgaris*, *Common Eel*, MITCH, Trans. Lit. and Phil. Soc. of N. Y., I p. 360.
 " " *Fresh-water Eel*, MITCH., Amer Month. Mag., II. p. 242.
Muraena Bostoniensis, LESUEUR, Journ Acad. Nat. Scien., I. p. 81.
 " " *Common Eel of Massachusetts*, STORER, Report, p. 158
Anguilla tenuirostris, *Common Eel of New York*, DEKAY, Report, p. 310, pl 53, fig. 173.
Anguilla Bostoniensis (LESUEUR), DEKAY, Report, p 313.
 " " AYRES, Bost. Journ. Nat Hist, IV. p. 279.
 " " STORER, Mem. Amer. Acad., New Series, II. p. 485.
 " " " Synopsis, p. 233

Color. This species is of a greenish or olive-brown above, and yellowish or yellowish-white beneath; frequently a reddish tinge is noticed along the margin of the anal fin. In the smaller specimens, the opercula, throat, and abdomen anterior to the vent, are of a bluish slate color, with scarcely a tint of yellow. The dorsal fin is of the same color as the back.

Description. Body cylindrical, compressed posteriorly, terminating in a point. The head is equal to about one tenth the length of the body, compressed above, tapering to a blunt point at the snout; the distance across the occiput is equal to about half the length of the head. The lower jaw slightly projects; both jaws are furnished with several rows of small, incurved, card-like teeth. The lips are fleshy. The vertical gape of the mouth is equal to half the length of the head. The eyes, situated just above and anterior to the angle of the jaw, are equal to one eighth the length of the head. The posterior nostrils, which are oval, are situated directly in advance of the superior anterior angle of the eye. A small tubular cirrhus projects forwards from the anterior nostrils situated on each side of the snout. A line of mucous pores are observed between the anterior and posterior nostrils, and another series pass backwards to the posterior inferior angle of the eye.

The lateral line commences above and in front of the pectoral fin, and pursues a straight course to the very extremity of the fleshy portion of the tail.

The dorsal fin arises on the anterior half of the body, and is continued to the

caudal fin, which is again connected with the anal; the three forming one continuous fin. The widest portions of these fins are at a short distance in front of their posterior termination. The number of rays in these united fins is about four hundred and fifty-five.

The anus is small, and situated just anterior to the anal fin.

The pectorals are directly back of the branchial aperture; they are somewhat rounded at their extremities, and are composed of sixteen rays.

Length, twenty-four to thirty-four inches.

Remarks. Dr. Mitchill, in his paper on the "Fishes of New York," published in 1815, briefly refers to this species, which he incorrectly considered the *Anguilla vulgaris*, Bloch. Lesueur, in the first volume of the "Journal of the Academy of Natural Sciences of Philadelphia," published in 1817, describes it as a new species, with sufficient accuracy to be readily distinguished, under the name of *Muræna Bostoniensis*. Subsequently, in February, 1818, Dr. Mitchill minutely and clearly described it as the *Anguilla vulgaris*. In my "Report on the Fishes of Massachusetts," I included it under the name given it by him who first knew it to be, and described it as, a new species. Dr. Dekay has since called it *Anguilla tenuirostris*.

In my "Report," &c., I included a species which I supposed to be the *argentea* of Lesueur. This was also contained in my "Synopsis of the Fishes of North America." In October, 1845, my friend, the late Dr. Yale, sent me a living specimen of this fish from Holmes's Hole, where it is called the Neshaw eel. I carefully compared this specimen with the *A. Bostoniensis*, and could not perceive characteristics sufficiently well marked to make them distinct species. The color of the Neshaw eel is rather more of a brown than greenish, and the abdomen is destitute of the yellowish tinge possessed in the common specimens in the market; but these differences may be dependent upon its locality. Dr. Yale writes: "The Neshaw eel is taken in all the ponds and lagoons connected with the sea on the Vineyard; and are taken in October and November in pots while making their way from the ponds to the sea. It is said, that, when the openings from the ponds are closed, they pass over the sand in the night."

The common eel of Massachusetts is taken along our entire coast, as well as in the rivers and ponds of the State. At some seasons, spring and winter, for instance, great numbers are brought to market from the mouths of the neighboring rivers, upon the muddy bottoms of which they live. They meet with a ready sale. So great is the demand sometimes that it cannot be answered. During the winter this species is speared, holes being cut through the ice for this purpose. In spring the

markets are usually supplied from the rivers, where they are taken in nets. At Medford nets are stretched across the river, having in their middle a large bag capable of containing from fifteen to twenty bushels; as the eels are going up or down the river they are caught, and are kept alive for the supply of the market in large ditches, excavated near the river, which are supplied by the tide-water. About three thousand pounds are yearly taken at Watertown. Those taken in summer, when they are able to procure the blitt, and other fishes upon which they feed, are much the larger and richer, weighing from one to nine pounds. In October, 1844, I saw an individual measuring two feet and ten inches in length, and weighing three pounds and a half, which was taken in Medford River, which agreed in its measurements with the one I have above described, and was, I suppose, a mere variety, although it was of a dark olive-brown above, and of a slate color beneath, without the slightest tint of yellow, and a very slight tinge of red along the anal fin. The fishermen suppose this peculiarity of color, which it appears they occasionally see, is owing to their being confined entirely to fresh water, and never having visited the sea.

Massachusetts, LESUEUR, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

GENUS II. AMMODYTES, LINN.

Head and body elongated; gill-openings large; dorsal fin extending nearly the whole length of the back; anal fin of considerable length; dorsal and anal fins separated from the caudal fin. Lower jaw longest. Their stomach is pointed and fleshy; they have neither coeca nor natatory bladder.

AMMODYTES AMERICANUS, *Dekay*.

Sand-Eel.

(PLATE XXXIII. FIG. 2.)

Ammodytes tobianus, *Sand-Launce*, BLOCH, MITCH, Trans. Lit and Phil Soc of N. Y., 1 p 363.

“ “ *Sand-Eel*, STORER, Report, p 159.

Ammodytes Americanus, *American Sand-Launce*, DEKAY, Report, p 317, pl. 52, fig 167.

Ammodytes lancea, AYRES, Bost. Journ. Nat. Hist., IV. p 280.

Ammodytes tobianus, *Little Sand-Eel*, LINSLEY, Cat. of Fishes of Connecticut.

Ammodytes lancea, *Banded Sand-Launce*, “ “ “

Ammodytes Americanus, STORER, Mem. Amer. Acad., New Series, II. p. 489.

“ “ “ Synopsis, p 237.

Color. Of a dirty greenish-brown color upon the back; the sides and abdomen are silvery; the top of the head is flesh-colored; the preopercles are silvery; the opercula are cupreous and silvery. The pupils are black, the irides silvery.

Description. Body elongated, slightly compressed. Head pointed at snout. The length of the head, from the extremity of the snout to the end of the gill-covers, is more than one fifth the length of the entire fish. The lower jaw projects beyond the upper, and terminates in a conical tip. From the anterior inferior portion of the operculum, a few slight striæ pass obliquely upwards, backwards, and downwards to its posterior margin. The nostrils are double, and are situated half-way between the eyes and the snout. The eyes are circular; the diameter of the eye is equal to one ninth the length of the head.

The lateral line is straight and indented.

The very delicate dorsal fin commences on a line with the end of the pectorals, and terminates at the fleshy base of the caudal fin. This fin is rather highest just posterior to its centre. When unexpanded, it is received into a groove at its base.

The pectorals are one third the length of the head. From their base a slight membrane extends posteriorly on each side of the abdomen.

The anal fin, which is about as high as the dorsal fin and terminates posteriorly on a line with it, is just one third the length of the entire body.

The caudal fin is forked.

The fin rays are as follows:— D. 61. P. 13. A. 28. C. 14.

Length, six to twelve inches.

Remarks. This species, which is generally known among fishermen as the "Sand-Eel," is found plentifully at Holmes's Hole, and it oftentimes collects at Provincetown in myriads. In June, 1847, while on a visit at this latter place, I observed the shores were lined with these fishes, which were left by the reflux tide. Captain Atwood assured me that the waters around Longpoint were at times so densely crowded with them, as to seem literally alive. In a letter to me, dated June 18th, 1847, he says, while speaking of this species: "Last Friday night they ran ashore in such quantities, that they covered the ground from one to two inches deep, and when the water covered the flats the whole bottom looked like an immense sheet of silver."

When thus situated they are readily devoured by their enemies, among whom are the cuttle-fish.

Banks of Newfoundland, H. R. STORER. Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHILL, DEKAY.

LOPHOBRANCHII.

Gills, instead of being, as usual, pectiniform, are divided into little round tufts, dispersed in pairs along the branchial arches.

FAMILY XXIII. SYNGNATHIDÆ.

Body mailed with transverse angular plates. Opercle large; branchial opening very small, and formed by a membrane which only exhibits vestiges of rays. Dorsal single. No cœca; with an air-bladder.

GENUS I. SYNGNATHUS, LINN.

Body elongated, slender, covered with a series of indurated plates, arranged in parallel lines; head long; both jaws produced, united, tubular; no ventral fins. Males with a pouch for the reception of the female roe.

SYNGNATHUS PECKIANUS, *Storer*.*Peck's Pipe-fish.*

(PLATE XXXIII. FIG. 3.)

- Syngnathus typhle*, *Smaller Pipe fish*, MITCHILL, Trans Lit and Phil Soc of N Y, I p 475
Syngnathus Peckianus, *Peck's Pipe fish*, STORER, Report, p 163.
Syngnathus fuscus, *Brown Pipe fish*, STORER, Report, p 162.
Syngnathus fasciatus, *Banded Pipe fish*, DEKAY, Report, p 319, pl 54, fig 174
Syngnathus viridescens, *Green Pipe fish*, DEKAY, Report, p 321, pl 54, fig 176
Syngnathus fuscus, DEKAY, Report, p 321
Syngnathus Peckianus (STORER), DEKAY, Report, p 321
 " " AYRES, Bost Journ Nat Hist, IV p 282
 " " STORER, Mem Amer Acad, New Series, II p 490.
 " " " Synopsis, p 238.

Color. A living male specimen presents the following appearances. Of a greenish-brown color above, with several irregular transverse broad dark bands; numerous narrower bands upon the sides of the same color. The upper portion of the operculum is olive-colored; the lower portion is of a golden yellow. The abdomen in front of the anus is golden; the portion just back of the anus is very broad, and contains a flesh-colored membrane, which separates in its centre, forming two flaps; the lower portion of the sides, exterior to this dilated part, is sprinkled with minute white dots; and along this outer edge is a beautiful deep-brown band,

extending its whole length. The inferior portion of the body posterior to the membranous flap is of a pinkish hue. The throat is of a bright yellow color. The pupils of the eyes are black; the irides are coppery. A yellowish-brown band passes downwards and backwards from the posterior angle of the eye to the centre of the operculum. Along the outer edge of the rostrum, from the eye almost to the snout, passes a dark-brown band. The dorsal fin is transparent, and indistinctly longitudinally banded with brown. The pectorals and anal fin are colorless. The caudal fin is wholly brown.

When the fish is preserved in spirits, the colors almost entirely disappear; the band on the outer edge of the abdominal flaps, the transverse bands on the back and sides, and the bands on the rostrum, are scarcely, if at all, perceptible; and the flesh-colored membrane of the pouches becomes of a dull white color.

Description. Body elongated, compressed upon the sides, flattened above, and gradually tapering from the head to the tail; its whole surface being covered with horny, striated plates. The depth of the body just back of the pectorals, and also at the anus across, equal to one thirty-sixth its entire length; the width of the body at the anus is equal to half the depth back of the pectorals; the width at the centre of the pouches is equal to the depth back of the pectorals; the length of the pouches is less than one third the length of the fish.

The length of the head, from the extremity of the snout to the posterior angle of the operculum, is equal to one ninth the entire length of the fish. Rostrum tubular, compressed. The lower jaw is rather the longer, and passes obliquely upwards to form the mouth. The eyes are prominent, and very movable in their orbits. The orbitar edges being elevated, a depression is seen between the eyes; in the centre of this depression arises a slight ridge, which is continued upon the top of the rostrum to the tip of the snout; upon the top of the head is situated another ridge which is continued on the neck posterior to the origin of the pectorals. The opercula are pectinated; or of the form of a Pinna, broad posteriorly, rounded beneath and behind, and covered with striæ radiating from their circumference.

The anterior portion of the body is heptangular: on each side of this portion are three ridges, and one upon the abdomen. One of these ridges commences at the posterior superior angle of the operculum, and is continued in a straight line nearly to the termination of the dorsal fin; this ridge forms the lateral boundary of the dorsum.

The second ridge arises beneath the pectorals at their base, and, passing along

the middle of the side of the fish, terminates beneath the centre of the dorsal fin, above the anus.

The third ridge commences below and anterior to the pectoral fins, and, bounding the sides of the abdomen, is continued to the tail. Besides these three ridges on each side, a seventh ridge, commencing at the throat, passes through the centre of the abdomen to the vent. Just above the termination of the second ridge, or that upon the centre of the sides, another ridge commences, which passes backwards to the termination of the first ridge, or that upon the side of the back, then, curving upwards to the sides of the back, takes the place of the first ridge, and is continued to the tail. Back of the vent the abdominal ridge disappears, so that the space between the vent and the termination of the first ridge is hexangular. Back of the dorsal fin, the ridge upon the centre of the sides having disappeared, the body is quadrangular.

In front of the anus are nineteen transverse plates, and in front of the dorsal fin are fourteen of these plates; between the anus and the caudal fin are forty-two of these plates. The portion of the abdomen just back of the vent is much wider than the rest of the body, and presents the membranous flaps, which approach each other at the median line, thus forming pouches or a false belly in which are contained the ova of the female.

The dorsal fin is situated at the commencement of the second third of the body, or at a distance back of the tip of the snout equal to one third the entire length. It is slightly rounded above, and is longer than the head; the height of its rays is equal to about one fifth the length of the head.

The anus is situated directly beneath the middle of the dorsal fin.

The pectorals are rather small, and are rounded when expanded.

The anal fin is exceedingly delicate, scarcely discernible without the aid of a glass.

The caudal fin is fan-shaped when expanded; the extremities of the rays project slightly beyond the connecting membrane.

The fin rays are as follows:— D. 45. P. 14. A. 3. C. 12.

Length, six to twelve inches.

Remarks. This species is frequently taken in nets, in the waters of Boston Harbor, by boys, while catching minnows for bait. Its motions are exceedingly rapid, resembling the gyrations of the Colubridæ. In one of the specimens described in my Report, numerous ova contained in its false pouches were hatched soon after it was taken, and when I received it, two days subsequent to its capture, it was

surrounded by one hundred and fifty young, about half an inch long, which, with the exception of several narrow transverse black bands, were nearly colorless. In several others, examined at the same time, their pouches were crowded with ova, or in the act of protruding the young.

The following remarks accompanying my original description of this species may not be considered inappropriate here.

Among the earliest cultivators of Ichthyology in our country no name is more prominent than that of William Dandridge Peck. So early as the year 1794, while residing at the town of Kittery, in Maine, he wrote a clear and accurate "description of four remarkable fishes, taken near the Piscataqua, in New Hampshire." This paper was published in 1804, in the second part of the second volume of the "Memoirs of the American Academy of Arts and Sciences," accompanied with very good figures, when the early period of our country is considered. The manuscript of his Ichthyological Lectures also, afterward delivered by him at Harvard University as Professor of Natural History, and kindly loaned me to examine by my friend Thaddeus William Harris, M. D., Librarian to the University, exhibit no inconsiderable degree of research. As the species described and first published by him as new have, *three of them at least*, been described by other naturalists under other specific names, I feel that I am performing an appropriate duty in connecting the name of our deceased countryman, whose merits have been unjustifiably overlooked, with one of a class of animals whose history he so successfully endeavored to elucidate.

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

GENUS II. HIPPOCAMPUS, CUV.

The jaws united and tubular, like those of the Syngnathi; mouth placed at the end; body compressed, short, and deep; the whole length of the body and tail divided by longitudinal and transverse ridges, with tubercular points at the angles of intersection; pectoral and dorsal fins; no ventral nor caudal fins; the females only have an anal.

HIPPOCAMPUS HUDSONIUS, *Dekay*.*Short-nosed Sea-Horse.*

(PLATE XXXIII. FIG. 4.)

Syngnathus hippocampus *Sea Horse Pipe fish*, MITCH, Trans Lit and Phil Soc of N Y, I p 475.*Hippocampus brevirostris*, *Short nosed Sea Horse*, STORER, Report, p 167.*Hippocampus Hudsonius*, *Hudson River Sea Horse*, DEKAY, Report, p 322, pl 53, fig 171*Hippocampus brevirostris*, LINSLEY, Cat of Fishes of Connecticut*Hippocampus Hudsonius*, STORER, Mem Amer Acad, New Series, II p 491

" " " Synopsis, p 239.

Color. Yellowish-brown throughout.

Description. Body heptagonal, composed of twelve segments, which are armed on each side with three rows of prominent spines, and a single row of similar spines are noticed beneath. The greatest depth of the body is across from the dorsal fin. The length of the head is more than one fifth the entire length of the fish. The head is compressed upon the opercula and surmounted above by a bony prominence which expands into five points, four lateral and one posterior. Behind this are situated the branchial orifices. A short spine is seen at the base of the snout, in front of the eyes; on each side of this is a minute spine; directly above each eye is a larger spine; and at the posterior angle of the eye is a very short one: beneath the eye, on the throat, are two small ones on each side. The snout is straight and tubular, and measures ten lines to the anterior base of the opercula. The eyes are large. The tail is quadrangular, about half of its entire length; it is divided into thirty-four segments, and gradually terminates in a point.

The dorsal fin is situated upon a slight projection of the dorsum, composed of three segments, at the origin of the tail.

The fin rays, as well as can be determined with the specimen much contracted and otherwise injured by drying, are as follows:— D. 18 or 20. P. 14 or 15. A. 3 or 4. Length, five inches.

Remarks. In my "Report" I described this species from the only specimen I had seen. It was found by Dr. Yale upon the shore at Holmes's Hole, and was sent by him to the cabinet of the Boston Society of Natural History. He observed, in a letter to me, "he never knew one to be taken alive, yet they are frequently found on the shore." The specimen described was a female. As I have seen no specimen since that was noticed, I can only redescribe it, and accompany the description with a figure, which, considering the dried condition of the fish, is quite accurate.

I was undoubtedly in error in considering this species as the *brevirostris*, and with pleasure adopt the specific name of my lamented friend, Dr. Dekay.

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

PLECTOGNATHI.

The maxillary bone soldered or fixedly attached on the side of the intermaxillary, which alone forms the jaw, and to which the palatine arch is dovetailed by a suture within the cranium, and consequently has no power of motion. Opercula and the rays concealed under a thick skin, which only permits a small branchial cleft to be visible externally.

FAMILY XXIV. GYMNODONTIDÆ.

Instead of apparent teeth, the jaws are furnished with an ivory substance, divided internally into laminæ, the general appearance of which somewhat resembles the bill of a parrot, and which is essentially composed of true teeth united together, and succeeding one another in proportion as there are any worn out by trituration. Opercula small; their rays five in number.

GENUS I. TETRODON, LINN.

Jaws divided in the middle by a suture, presenting the appearance of four teeth in front, two above and two below. The skin over a portion of its whole extent covered with prickles.

TETRODON TURGIDUS, *Mitchill*.*The Swell-fish. Puffer.*

(PLATE XXXIII. FIG. 5. *b.* Jaws.)

- Tetraodon turgidus*, *Puffer*, MITCH, Trans Lit and Phil Soc. of N Y, I p. 473, pl 6, fig 5.
 " " *Swell fish*, *Puffer*, STORER, Report, p. 169.
 " " *Common Puffer*, DEKAY, Report, p 327, pl 55, fig 178
 " " " AYERS, Bost Soc Nat Hist, IV p 285
 " " " STORER, Mem Amei Acad, New Series, II. p 493.
 " " " " Synopsis, p 241.

Color. Upper part of the body ash-colored, interspersed with light pea-green, with large irregular patches of greenish-brown. Sides orange, with a shade of brown, barred transversely by seven or eight blackish irregularly defined bands. Abdomen yellowish-white. Head greenish-brown. Pupils green, irides orange. Fins color of abdomen.

Description. Body oblong, cylindrical, globular when inflated. The whole surface

of the body, save the chin and the space between the dorsal and the caudal fins, and the anal and caudal, roughened by innumerable small spines. The greatest depth of the body when collapsed is one fourth the length of the body; when inflated, its greatest depth is one third the length of the body; the greatest width of the fish is equal to one third its length. The length of the head is nearly one third the length of the body. The eyes are large, and horizontally oval. The distance between the eyes is equal to their longest diameter. The nostrils are situated just in front of the eyes, and are furnished with a fleshy filament. The jaws are stout and equal.

No lateral line is observable.

The fan-shaped dorsal fin arises just in advance of the anal fin. The first ray is the shortest, the third ray the longest of the fin.

The pectorals are subquadrangular.

The anal fin is rather smaller than the dorsal.

The caudal fin is nearly even at its extremity.

The fin rays are as follows: — D. 6 – 8. P. 15. A. 6, 7, 8. C. 6, 7.

Length, six to fourteen inches.

Remarks. This species is known by the names of Swell-fish, Bellows-fish, and Puffer, from its power of inflating itself with air. It is found along our entire coast. It is common at Nahant, and is sometimes taken from the bridges leading from Boston. At Manimsha Creek, in Chilmark, it exists in great numbers. When taken with the hook it is collapsed, but almost immediately inflates itself: this inflation is readily induced by scratching its abdomen.

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY.

TETRODON LÆVIGATUS, *Linn.*

The Smooth Puffer.

(PLATE XXXIV. FIG. 1.)

Tetraodon lævigatus, LIN, Syst. Nat., p. 411.

“ “ SHAW, Gen. Zool., v. p. 446.

Tamboril, PARRA, p. 37, pl. 19.

Tetraodon lævigatus, *Brown Globe-Fish*, MITCH., Report on the Fishes of New York, p. 28.

Tetraodon mathematicus, *Mathematical Tetraodon*, MITCH., Trans. Lit. and Phil. Soc. of New York, I. p. 474, pl. 6, fig. 6.

“ “ “ “ STORER, Supplement to Rep. Bost. Journ. Nat. Hist., IV. p. 183.

Tetraodon lævigatus, *Lineated Puffer*, DEKAY, Report, p. 329, pl. 56, fig. 182.

“ “ “ “ STORER, Mem. Amer. Acad., New Series, II. p. 493.

“ “ “ “ “ Synopsis, p. 241.

Color. Of a deep olive-green color above; the sides are silvery; the inferior portion of the body is white. Pupils black, irides golden.

Description. Body elongated; anterior portion of the body much the more prominent; abdomen pendulous. The entire surface of the body is perfectly smooth, except the portion below the pectoral fins, posterior to the throat, and anterior to the anus, which is armed with an immense number of small stellated spines.

Several well-marked series of mucous pores are distributed over the surface, which have caused it to receive its common names, in the works of ichthyologists, of *lineated* and *mathematical*. One of these commences about half an inch back of the angle of the jaws; this passes backwards to the posterior extremity of the eye, being a short distance beneath the eye, then ascends obliquely to a point upon the back two inches above the middle of the pectoral fin, then curves downwards to the middle of the side of the fish, to a point about an inch back of the dorsal fin, whence it proceeds in a straight course to the caudal rays. This line from its origin also passes upward and backwards, just exterior to the nostrils, and, curving high up over the eyes, passes back of them and downward to meet the former line about half an inch back of the eyes, thus forming a ring around them. Directly above the base of the pectoral fins, a transverse line crosses from the lateral line on one side to that on the other. From this transverse line, an undulating line passes to the ring around the eyes.

Its greatest depth is less than one sixth its length. Its greatest width is across the base of the pectorals.

The length of the head is equal to about one quarter its entire length. The eyes are oblong. The nostrils are situated a short distance in front of, and rather above, the anterior angle of the eyes. The jaws are very strong. The lips are fleshy and lax.

The trapezoidal dorsal fin is situated upon the posterior half of the body.

The pectoral fins are short and subquadrangular.

The anal fin, of the same form and size of the dorsal, is directly opposite that fin.

The caudal fin is deeply forked.

The fin rays are as follows:— D. 13. P. 16. A. 12. C. 11.

Length, one to two feet.

Remarks. The only individual of this species I have seen was taken several years since at Nantucket, and was described by me, from the preserved specimen, in the Boston Journal of Natural History, 1843–4.

Massachusetts, STORER. New York, MITCHILL, DEKAY. South Carolina, LINN. Gulf of Mexico, PARRA.

GENUS II. ORTHAGORISCUS, SCHN.

Jaws undivided, forming a cutting edge. Body compressed, without spines, not susceptible of inflation, and with the tail so short, and so high, vertically, that they have the appearance of fishes from which the posterior part has been cut away. Dorsal and anal, each high and pointed, united to the caudal. No natatory bladder; stomach small, and immediately receiving the biliary canal.

ORTHAGORISCUS MOLA, *Schn.**The Sun-fish.*

(PLATE XXXIV. FIG. 2.)

- Tetraodon mola*, LIN, Syst Nat p 412
 " " *Short Tetraodon*, PENN, Brit Zool, III p 172, pl 22
Diodon mola, BLOCH, pl 128
Cephalus brevis, *Short Sun fish*, SHAW, Gen Zool, v. p 437, pl 175
 " " " MITCH, Trans Lit and Phil Soc of N Y, I p 471
Orthagoriscus mola, *Short Sun fish* (SCHNEIDER), JENYNS, Brit Vert, p 490
 " " GRIFFITH'S CUV, v p 569
 " " *Short Sun fish*, YARRELL, Brit Fishes, 2d edit, II p 462, fig
 " " STORER, Report, p 170, pl 3, fig 1
 " " *Short Head fish*, DEKAY, Report, p 331, pl 59, fig 193
 " " STORER, Mem Amer Acad, New Series, II p 494
 " " " Synopsis, p 242

Color. The back is of a dark gray color; the sides of a grayish-brown, with silvery reflections; the abdomen is of a dull, dirty white. A broad, nearly black, band commences at the origin of the dorsal fin, and, running along its base, is continued, in front of the caudal and anal fins, to the anus; this band is lighter-colored along the base of the anal fin, and here it is also narrower, being about the same depth as at the dorsal; but along the base of the caudal it is considerably deeper. Pupils black, irides of a dark brown, encircled within by a silvery ring. The general color of the caudal fin is similar to that of the inferior portion of the sides; its outer edge is flesh-colored.

Description. Body oblong, compressed. Its entire surface presents a fine, unyielding granulated surface. The depth of the body across, from the middle of the pectorals, is equal to rather more than half its length; from the tip of the dorsal to the extremity of the anal, measured across the body, the distance is equal to about the length of the fish. The length of the head, from the tip of the snout to the base of the pectoral fin, is equal to one fifth the entire length; the head is flattened over the snout, which is obtuse and projecting. Upon the top of the

head an arched ridge commences on a line with the anterior angle of the eye, and is continued to a line above the origin of the pectorals; thence a straight line is pursued to the dorsal fin. The sides of the head project out from the body, — quite prominently over the eyes to the branchial aperture. The eyes are oblong, small, convex, very movable in their orbits; their larger diameter is one fourth greater than their smaller. The nostrils are double, very small, situated just in front of the eyes. The mouth is small. The jaws are armed with a broad bony plate, much worn in front, sharp at its edges. The temporal orifice is oval, and situated just in front of the pectoral fin.

The dorsal and anal fins are triangular, and situated at the upper and lower posterior extremities of the fish; the former slightly the posterior. These fins are almost precisely equal in their length and height.

The caudal fin borders the posterior extremity of the body, and reaches nearly to the base of the dorsal and anal fins, although it is not really connected with them. This fin is scalloped, or divided into digitations, about eight in number, the fourth of which is the longest. The digitations in the specimen here described are much more unequal than in that mentioned in my "Report."

The pectorals are one third the height of the dorsal fin; their length is equal to more than one third their height.

The anus is large and corrugated, and situated a short distance in front of the anal fin. Directly in front of the anus commences a very obvious carina, which is continued to a line opposite the origin of the pectorals. The very dense texture of these fins renders it about impossible to determine with accuracy the number of their rays. As nearly as I have been able to distinguish, they are as follows:—
D. 13. P. 12. A. 13. C. 8–9.

Length, five to six feet.

Remarks. Three specimens of this fish, carefully examined, present the following proportions.

One, described in my "Report," measured fifty-four inches in length; depth across from the middle of the pectorals, two and a half feet; from the top of the dorsal to the extremity of the anal fin, six and a half feet. Weight, two hundred pounds.

A second, seen by Dr. Jeffries Wyman, also noticed in my "Report," measured fifty-four inches in length; diameter of the operculum, three inches; of the eye, two inches; greatest breadth of the fish, thirty inches; pectoral fins, eight inches high, six long, composed of ten rays; anal fin, eighteen inches high, ten long, composed of eighteen rays; nine scallops to the tail, six in the broadest part.

The individual now described measured fifty-four inches in length, and was judged to weigh nearly five hundred pounds.

This species is occasionally met with during the summer season in Massachusetts Bay, sluggishly swimming near the surface. On account of the great elasticity of its exterior, it is captured with difficulty, by being gaffed at or near the branchial aperture. Dr. Yale, writing of this species to me, observes: "It has an entire cartilaginous case of an inch and a half to two inches thick, covering the whole body, perfectly white and milky in its appearance, and very elastic. A small ball of it, cut out and thrown with moderate force upon the ground, will rebound from fifteen to twenty feet." Its liver, which weighs eight or ten pounds, is very oily, furnishing two or more quarts of oil, which is used by the fishermen to grease their masts; it is also sometimes used by painters, although Captain Atwood tells me he does not think it preferable in this respect to other fish-oil. It is considered by many fishermen a valuable application for sprains and bruises, and by such it is preserved for these purposes.

Upon the exterior of the specimens described in my "Report" were attached several parasites; at the base of, or near to the fins, a large number of the *Pen-nella sagitta* were found imbedded, with their pinnated extremities projecting like tentaculæ, and to them were firmly fixed specimens of the *Cineras vittata*. One beautiful specimen of the *Tristoma coccineum*, figured by Yarrell as being taken from this species, was found firmly attached to the posterior extremity of the fish. Closely attached to the branchiæ were a dozen or more specimens of the *Cecrops Latreillii*. The thickness of the exterior varies from two to three inches. A large number of *Tenia* were found in the intestines. Several *Cysticerci* were imbedded in the substance of the liver.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

FAMILY XXV. BALISTIDÆ.

Body compressed. Snout prolonged from the eyes. Mouth small, with a few distinct teeth in each jaw. Skin roughened with prickles or scales. Dorsals, two; the anterior sometimes represented by a single spine. Ventrals often wanting or indistinct. Pelvic bone prominent.

GENUS I. MONACANTHUS, CUV.

Body covered with very small scales, bristling with stiff excrescences, and extremely crowded. The extremity of the pelvis projecting and spiny, as in the *Balistes*, but they have only one large dentated spine to their first dorsal, or at least the second is almost imperceptible.

MONACANTHUS AURANTIACUS, *Dekay*.*The Orange File-fish.*

(PLATE XXXIV. FIG. 3.)

- Balistes aurantiacus*, *Orange File-fish*, MITCH, Trans Lit and Phil. Soc. of N Y, I. p. 468, pl 6, fig. 1.
Monacanthus aurantiacus, *Orange File-fish*, DEKAY, Report, p 333, pl 57, fig. 186.
 " " STOREY, Proceed Bost Soc Nat Hist, II p 72.
 " " " Mem. Amer Acad, New Series, II p 496
 " " " Synopsis, p 244

Color. The greater portion of the fish is of an orange-yellow; the lower portion of the sides and beneath of a bluish-white.

Description. Body oval, compressed. Its entire surface covered by minute prickles, which are very obvious when the hand is drawn towards the head. Abdomen tumid. A slight concavity is noticed upon the forehead; the dorsal outline is horizontal. The greatest depth of the fish is just back of the pectorals. The length of the head is equal to about one quarter its entire length. The mouth is small, prominent, protruding. The lower jaw the longer, with eight flattened teeth; the front teeth large, flattened, emarginated above; the teeth in the lower jaw smaller and lanceolate. The eyes are large and circular, situated just beneath the dorsal spine. The branchial aperture, which is linear and nearly as long as the dorsal spine, is situated just beneath the eye. The nearly straight dorsal spine is equal to one half the length of the head; it is slightly rounded on its anterior edge, grooved at its posterior base, and exhibits numerous very minute serrations upon its posterior superior edge. A small membrane is attached to its base, posteriorly.

Just before the second dorsal fin, which commences on a line slightly anterior to the anal, is a prominent projection. This fin is rounded above. The middle rays are the longest; all the rays are more or less flattened.

The pectorals are broad and rounded, and situated on a line directly beneath the eyes.

The anal fin, resembling the dorsal in its appearance, terminates just posteriorly to that fin.

The caudal fin is composed of stout, bifurcated rays.

The fin rays are as follows:— D. 1, 35. P. 12. A. 39. C. 12.

Length, seventeen inches.

Remarks. The only individual of this species I have known to have been taken in our waters was captured at Salem, August, 1845. It belongs to the Natural History Society of that city, and was kindly loaned me by Dr. Wheatland, one of the Curators of the Society, to determine the species. The fish, when discovered, was swimming about two feet from the bottom, near the wharf, and from post to post, biting off the barnacles attached to them. When taken, and lying upon the wharf, it made a chirping noise like a bird, and endeavored to wound his captor with his spine. While dying, the color of the abdomen changed as in the dolphin.

The specimen referred to had been injured in its capture, being speared; and had lost its proportions by the process of drying, preventing me at the time from preparing an accurate description. My excellent friend, James Carson Brevoort, Esq., the distinguished ichthyologist of Brooklyn, New York, has kindly loaned me a specimen which has enabled me to present the above account. Dr. Dekay observes that this is a rare species in the waters of New York, he having seen but two specimens.

In August, 1842, the late lamented Charles D. Bates, M. D., formerly of the U. S. Navy, sent me a figure and description of this fish which was taken in the harbor of Portland, Maine, when he was attached to that station. He observes in his letter to me: "This fish appeared, about a fathom under water, like a bit of kelp, and was rising toward the surface, when a fisherman, observing its motion, put his hand into the water, and the fish came directly into it and was caught." He adds: "It is called Hog-fish vulgarly, either from its snout resembling that of this animal, or from a sort of short grunting noise it makes on being taken out of the water."

Maine, Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

MONACANTHUS MASSACHUSETTENSIS, *Storer*.*The Massachusetts File-fish.*

(PLATE XXXIV. FIG. 4.)

- Monacanthus Massachusettensis*, *Massachusetts File fish*, STORER, Report, p. 174.
 " " " " DEKAY, Report, p. 336, pl. 57, fig. 187.
 " " STORER, Mem Amer Acad, New Series, II p. 496
 " " " Synopsis, p. 244.

Color. Of a yellowish-brown, variegated over its entire extent with brownish markings and blotches; more obvious upon upper portion of sides. Numerous minute white cilia are suspended from its sides.

Description. Body oblong, very much compressed. Surface granulated. Its depth from the base of the dorsal spine is equal to half the entire length of the fish. Length of head equal to one fourth the entire length. Jaws of equal length; teeth stout. Eyes circular, equal to one fourth the length of the head. A strong, granulated, curved spine, half the length of the head, with small sharp spines upon its posterior lateral edges pointing downwards and backwards, is situated just back of the centre of the eye.

The second dorsal fin commences some distance back of the spine; it is composed of colorless rays, which are roughened at their bases.

The pectorals also are colorless, and rounded when expanded.

The pelvic bone projects, is quite movable, and is connected by a dewlap to the abdomen.

The anal fin, of the same form as the dorsal, commences just posterior to that fin: the rays of this fin are granulated at their base like those of the dorsal.

The caudal fin is of a darker color than the other fins.

Length, four inches.

The fin rays are as follows:—D. 34. P. 12. A. 34. C. 12.

Remarks. I have seen but one specimen of this species. This was sent to me in 1838, by the late Dr. Yale of Holmes's Hole, as having been found in Massachusetts Bay.

Massachusetts, STORER. Connecticut, LINSLEY. New York, DEKAY.

MONACANTHUS SIGNIFER, *Storer*.

(PLATE XXXV. FIG. 1.)

Monacanthus setifer, DEKAY, Report, p 337, pl 59, fig 194.*Monacanthus signifera*, STORER, Mem. Amer. Acad., New Series, II. p. 497.

" " " Synopsis, p 245.

Color. Of a reddish-brown color, with greenish reflections.

Description. Body elongated, compressed. The entire surface is very minutely granulated, by which a sensation of roughness is perceived, by the finger, over its whole extent, with the exception of the fleshy portion of the tail, and a small portion of the body just anterior to it; which parts are thickly studded with stiff setæ, looking and feeling like the teeth of a card, the points of which incline forwards, producing consequently this roughness only when the finger is drawn towards the tail.

The depth of the fish across the body from the base of the dorsal fin is less than half its length; the depth at the fleshy portion, to its greatest depth, is as one to four. The length of the head is equal to one fourth the entire length of the fish. The mouth is small. The teeth are sharp, and are four in number on each side. The eyes are circular. On the top of the head, back of the centre of the eyes, is situated a movable spine, terminating in a naked point, and armed posteriorly upon its sides with a number of small spines pointing downwards; these spines are more developed towards its upper portion.

The dorsal fin arises just back of the centre of the fish, and is nearly as long as the greatest depth of the fish; its second ray is the longest.

The pectorals commence on a line beneath the dorsal spine.

The pelvic bone is prominent, and terminates in a small stellated point; the dewlap to which it is attached is marked by large granulations, similar to those upon the rest of the surface.

The anal fin commences back of the dorsal; it is of a rounded form, and terminates opposite that fin.

The caudal fin is composed of very firm rays.

The fin rays are as follows:— D. 32. P. 16. A. 32. C. 10.

Length, five inches.

Remarks. Until the summer of 1842 I had not known of an individual of this species having been taken in the waters of this State. During that season, however, I saw specimens which had been caught at Hingham, Lynn, Nahant, and even in our harbor by means of seines. For the fine specimen from which my

drawing is made, I am indebted to John L. Tucker, Esq., formerly of the Tremont House of this city.

Previous to the appearance of Dekay's Report, I supposed this species to be Dr. Mitchill's *M. broccus*, and thus called it in the Proceedings of the Boston Society of Natural History, p. 84 (Sept. 1842).

Dekay described it as a new species, under the specific name of *setifer*. As, however, this name had been previously applied to another species of this genus by Bennett, in the Proceedings of the Zoölogical Society of London, Part I. p. 112, 1830, I have felt compelled to substitute another.

Massachusetts, STORER. New York, DEKAY.

GENUS II. ALUTERES, Cuv.

An elongated body, covered with small and scarcely visible granules; a single spine in the first dorsal; the chief character is the pelvis, which is completely hidden under the skin, and is without that spinous projection observed in the other Balistes.

ALUTERES CUSPICAUDA, *Dekay*.

The Sharp-tailed File-fish.

(PLATE XXXV. FIG. 2.)

Balistes cuspicauda, *Sharp-tailed File-fish*, MITCH., Amer. Month Mag., II p. 326.

Aluterus monoceros, *Unicorn File fish*, (BLOCH,) STORER, Report, p. 175.

Aluterus cuspicauda, *Long-tailed Unicorn-fish*, DEKAY, Report, p. 338, pl. 59, fig. 192.

" " " " STORER, Mem. Amer. Acad., New Series, II. p. 497.

" " " " " Synopsis, p. 245.

Color. Coppery brown, with spots of pale bluish slate and of brassy yellow from the eyes to the tail and back half-way down the sides, arranged in rather regular series. Head, back, and throat of a dark olive-brown; lower part of sides and abdomen lighter. A pale greenish-blue tint on the cheeks and opercles. Irides brassy yellow. Dorsal spine dark. The last two thirds of the membrane of the caudal fin of a dusky brown, with the tips of the rays yellowish. The dorsal, pectorals, and anal almost colorless.

Description. Body elongated, compressed laterally. Its greatest height, which is just back of the dorsal spine, is equal to one third its entire length; its height at the base of the caudal rays is equal to about one fourteenth its length. Between the spine and the dorsal fin the back is nearly straight. The length of the head

is equal to one third the length of the fish. The facial angle is oblique, gradually sloping from the dorsal spine to the tip of the snout. The mouth is turned upwards. The teeth are sharp, pointed. The eyes are large and circular. The nostril is situated just in front of the anterior superior margin of the orbit. The branchial aperture is oblique.

The dorsal spine is short and serrated, having at its posterior base, connected by a membrane, a minute rudimentary spine.

The dorsal fin commences on the anterior half of the body; its central rays are the highest.

The pectoral fins are situated on a line beneath the eyes.

The anal fin commences opposite the dorsal, and terminates posterior to it.

The middle caudal rays are the highest; and all the rays, except the two outer, are filamentous.

Length, eight inches.

The fin rays are as follows, in four specimens:—

D. 2, 32.	P. 10.	A. 34.	C. 12.
D. 2, 36.	P. 12 or 13.	A. 36.	C. 12.
D. 2, 37.	P. 13.	A. 40.	C. 12.
D. 2, 38.	P. 13.	A. 42.	C. 12.

Remarks. I have seen a single specimen only of this species which has been taken in our waters. This was an immature fish sent me by Dr. Yale, from Holmes's Hole. As I had not met with Dr. Mitchill's paper on the "Fishes of New York," contained in the American Monthly Magazine, I described it in my "Report" as the *A. monoceros*, Bloch. Dekay, with recent specimens of the mature fish before him, was enabled to correct my error; and, through the kindness of J. Carson Brevoort, of Brooklyn, New York, to whom I have already expressed my indebtedness, I have been furnished with recent specimens, and notes, by which I am enabled to present the present description and remarks.

The color of this species varies exceedingly. Some specimens are almost as yellow as the *Monacanthus aurantiacus*; but most of them are of a dusky olive-brown, with cloudings of darker hue, and the series of spots of metallic brassy-yellow; while Dekay observes that he has seen them of a uniform brown, without any spots or clouds whatsoever. Brevoort tells me the species is very common in the month of September, and up to October 15th, in the narrow channels of the marshy Jamaica Bay. They are taken in nets altogether.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

FAMILY XXVI. OSTRACIONIDÆ.

Body triangular or four-sided, enveloped in a hard bony case, composed of numerous plates, soldered together in such a manner that only the mouths and fins are movable. No ventral fins; a single dorsal.

GENUS LACTOPHRYS, DEKAY.

Body triangular; with strong spines directed backwards before the anal fin. Orbits usually spinous.

LACTOPHRYS YALEI, *Dekay*.*Yale's Trunk-fish.*

(PLATE XXXV. FIG. 3.)

- Ostracion Yalei*, STORER, Bost Journ. Nat. Hist., I p. 353, pl 8.
 " " *Yale's Trunk-fish*, STORER, Report, p 176.
Lactophrys Yalei, *Yale's Trunk-fish*, DEKAY, Report, p 362.
 " " STORER, Mem. Amer Acad., New Series, II. p. 498
 " " " Synopsis, p 246.

Color. Above, of a light leaden color; beneath, nearly colorless.

Description. Body triangular. Its entire surface is granulated and covered with hexagonal plates, each containing six raised lines, which diverge from the centre of the plate to the angles; these plates are much the larger posterior to the pectoral fins. From the posterior angle of the eye to the ligamentary substance at the base of the tail are included ten plates in a direct line; from the highest point of the back to the abdomen are nine similar rows of plates. Behind the dorsal fin is a surface of ligamentary substance, of a darker color than the rest of the exterior, extending to the caudal fin, and containing, just back of the dorsal fin, one isolated plate, apparently composed of portions of several plates. Upon the posterior portion of the abdomen are situated, laterally, two stout, naked, recurved spines. The mouth is large and prominent; the jaws are armed with elongated, strong teeth; the eyes are large, and elongated horizontally; the nostrils are directly anterior to the anterior inferior angle of the eye.

The fin rays are as follows:— D. 10. P. 12. A. 10. C. 10.

Remarks. The only specimen of this species which has been seen was discovered alive by Dr. Yale, in 1833, among the sea-weed on the beach at Martha's Vineyard, and was by him presented to the Boston Society of Natural History. In the

year 1836 I read a description of it to said Society, which was published in the first volume of their Journal, and afterwards in my "Report upon the Fishes of Massachusetts." This description I am again here compelled to present. The length of the specimen, in its dried state, is fourteen inches. From the contracted and wrinkled appearance of the ligamentary portion at the base of the tail, it must vary considerably from the size of the living fish.

Massachusetts, STORER.

CLASS II. CARTILAGINOUS FISHES.

Skeleton cartilaginous. Cranium divided by indistinct sutures. Gills generally fixed; the membrane without rays. Maxillary and intermaxillary bones either wanting or rudimentary; the palatines or vomer alone supplying their place.

ORDER I. ELEUTHEROPOMI.

Gills pectinated, free, as in ordinary fishes, with one large external aperture on each side, furnished with a strong opercle; without rays. Upper jaw formed by the palatine bone, firmly united to the maxillary; intermaxillary rudimentary.

FAMILY XXVII. STURIONIDÆ.

The genera of this family approach to ordinary fishes, by their gills being attached only at one extremity. They have but one branchial aperture, which is very open; they have but one operculum, and are without rays to the membrane of the gills.

GENUS ACIPENSER, LINN.

Body elongated and angular, defended by indurated plates and spines, arranged in longitudinal rows; snout pointed, conical; mouth placed on the under side of the head, tubular, and without teeth.

ACIPENSER OXYRINCHUS, *Mitchill*.*The Sharp-nosed Sturgeon.*

(PLATE XXXV. FIG. 4.)

- Acipenser Oxyrinchus, Sharp-nosed Sturgeon*, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 462.
 “ “ LESUEUR, Trans. Amer. Phil. Soc., New Series, I. p. 394.
 “ “ *Sharp-nosed Sturgeon*, STORER, Report, p. 178.
 “ “ “ “ DEKAY, Report, p. 346, pl. 58, fig. 189.
 “ “ AYRES, Fishes of Brookhaven, L. I., Bost. Journ. Nat. Hist., IV. p. 287.
 “ “ LINSLEY, Cat. of Fishes of Connecticut, Amer. Journ. Science.
 “ “ STORER, Mem. Amer. Acad., New Series, II. p. 499.
 “ “ “ “ Synopsis, p. 247.

Color. Of a grayish-brown color above; silvery upon the inferior portion of the sides; white beneath. Pupils black, irides yellow.

Description. Body elongated, pentagonal. Entire surface granulated, excepting that occupied by five longitudinal rows of flattened plates, of the same structure as the covering of the head, but of a lighter color. The largest plates form the dorsal ridge; in younger specimens these plates are compressed at their sides, and terminate above in strong, sharp, recurved spines; while in this the spines on the dorsal ridge in some plates are obsolete, and the whole crest a mere sharp edge, and are obvious only on a few of the plates; radiating lines are distinctly seen running from the centre of these scales to their circumference; this row is composed of ten plates. In the specimen formerly described by me, measuring two feet and three inches in length, this row contained twelve plates. The first are the largest; that at the commencement of the dorsal fin by far the smallest; between the dorsal and caudal fins are situated four plates. In the specimen described in my “Report” two quite small plates were seen just back of the dorsal, forming a pair; next to these a much larger one, and, lastly, an elongated one at the commencement of the caudal fin.

A second row of bony plates, twenty-eight in number, placed obliquely, commences just back of the operculum, situated where the lateral line is usually observed in fishes, and is continued to the base of the tail; these plates are narrowed to a point at their upper extremities, obtuse at their lower extremities, widened in their centres, and, like the former, are crowned by spines, more or less prominent, from the bases of which radii diverge. The posterior plates are much the smaller.

Beneath this row, just back of the pectorals, commences a third row of plates, eight in number, placed vertically, larger than those of the last row.

The head is flattened above, slightly depressed between the eyes, and terminates

at the occiput in a rounded plate, which in the immature fish is pointed. The whole upper portion of the head is bony, and irregularly marked upon its surface.

The snout is blunted. The eyes are small, and their diameter is less than one fifth the distance between them. The nostrils are double, situated directly in front of the eyes; the posterior is much the larger. The mouth, without teeth, capable of great protrusion, with fleshy, lobed lips, is situated on the under surface of the head; half-way between the mouth and the snout are situated four cirrhi placed transversely with respect to each other, nearly as long as the mouth.

The dorsal fin is situated far back, at the posterior extremity of the body; it is deeply emarginated; its first rays are higher than its length.

The pectorals arise from a strong, triangular plate; their first ray is very large and strong; the seventh and eighth are the highest; the length of the fins at their base are less than one half their height.

The ventrals, which are placed far back, are subquadrangular.

The anal fin is opposite the dorsal; its length is equal to one half its height; its posterior rays are equal in height to one third the height of the longest rays.

The upper lobe of the caudal fin is nearly double the length of the lower; the membranous structure of this fin renders it difficult accurately to determine the number of its rays.

The fin rays are as follows: — D. 38. P. 28. V. 24. A. 23. C. 125.

Length, six to ten feet.

Remarks. The largest specimen I have seen, nearly six feet in length, was found at Deer Island. It is sometimes taken measuring even ten feet. The specimen above described was captured in the harbor of Provincetown, and measured four feet and six inches in length.

But little attention has as yet been paid in this country to the value of the sturgeon fishery in an economical point of view. The several species we possess might unquestionably be made useful. The following observations of Professor B. Jaeger, contained in the nineteenth volume of Hunt's Merchants' Magazine, for 1848, are worthy of perusal.

“The principal sturgeon fisheries are, without doubt, those on the Volga, near Astracan, and those on the Don, which are carried on chiefly by the Cossacks of that country, who find this occupation much more lucrative than agriculture, which they neglect entirely, in spite of the very fertile soil of their lands.

“The fish forms an important object of fishery and commerce to many nations, as well for its flesh, as for the caviare prepared from its roe, and the isinglass from

its swimming-bladder. The city of Astracan exports every year several thousand tons of pickled sturgeon and caviare for consumption in the Russian empire; and Odessa much larger quantities for Greece, Italy, France, and other parts of Europe.

“When the catching of the sturgeons on the Oby, the Volga, Jaik, and Don begins, there arrive at these places, from the remotest parts of the Russian empire, a considerable number of merchants, who purchase the fish and prepare them for transportation. The average price of one fish, without the roe and swimming-bladder, is generally \$4. A large one, which weighs over two hundred pounds, is sold at from \$4 to \$6, and contains forty pounds of caviare, or prepared roe, which is sold for \$1.50.

“The flesh is fat, very palatable, and much better in the summer, after the fish has been some time in fresh water. That which is not eaten fresh is cut into large slices, salted, peppered, broiled, and put in barrels, where it is preserved in vinegar, and fit for transport. A considerable quantity of their flesh is smoked. The wholesale price of pickled sturgeon is from \$6 to \$12 a hundred-weight. The caviare is prepared in three different manners, namely:—

“1. Two pounds of salt are added to forty pounds of roe, and dried upon mats in the sun. The price of forty pounds is \$1.

“2. Eight tenths of a pound of salt are mixed with forty pounds of roe, then dried upon nets or sieves, and pressed into barrels. This is sold for a little more.

“3. The best caviare is that when the roe is put into sacks made of tow-cloth, and left for some time in a strong pickle. These sacks are then suspended, in order to let the salt, watery substance run off, and finally squeezed, after which the roe is dried during twelve hours and pressed into barrels. This roe, of which forty pounds are sold for \$1.50 at the place, is that which is sent all over Asia and Europe as a considerable article of commerce, and known by the name of caviare, and is eaten with bread like cheese.

“Another very profitable part of the sturgeon is the swimming-bladder, of which isinglass is made. For this purpose it is cut open, washed, and the silvery glutinous skin exposed to the air for some hours, by which process it can be easily separated from the external skin, which is of no use. This glutinous skin is placed between wet cloths, and shortly after each piece is rolled up and fastened in a serpentine form on a board; after they are partly dry they are hung up on strings in a shady place.

“This valuable and extensive article of commerce is the isinglass of our shops, and is sold there for about \$50 a hundred-weight.

“There is made isinglass also from the swimming-bladder of the cat-fish, and of some others; but as this is very inferior to that from the sturgeon, it brings scarcely \$10 a hundred-weight.

“The sturgeon is found in immense quantities in the United States and North America, from Virginia up to the highest habitable northern latitudes, where they ascend the rivers from three hundred to five hundred miles up. The Potomac, Delaware, Hudson, and principally the Kennebec, as well as many other rivers, contain such a quantity of sturgeons, that from those rivers alone, without counting those farther north of Maine, according to my calculation, the annual export of pickled sturgeon, caviare, and isinglass alone would be worth nearly half a million of dollars. Pickled sturgeon and caviare is a favorite food of the descendants of Spain and Portugal in South America, as well as of the inhabitants of the West India Islands, principally during Lent; and isinglass would be an article of home consumption, as well as for the European market.

“But the sturgeon is not a very favorite dish in our country; it brings scarcely five cents a pound in the market, and the roe and swimming-bladder are always thrown away. Our fishermen, therefore, are not much encouraged in catching these fishes, though, according to careful observations, from thirty thousand to forty thousand sturgeons could be annually caught in the rivers of the United States.

“The sturgeon was highly appreciated by the ancient Romans and Greeks. It was the principal dish at all great dinner-parties, and Cicero reproached epicures on account of their spending so much money for this fish. Pliny says that this fish was served at the most sumptuous tables, and always carried by servants, crowned with garlands of flowers, and accompanied by a band of musicians. And even at this time one pound of fresh sturgeon costs \$4 in Rome, where this fish is very rare.”

Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHILL, DEKAY.

X.

A History of the Fishes of Massachusetts.

By DAVID HUMPHREYS STORER, M. D., A. A. S.

Continued from Vol. viii. p. 434.

ORDER II. PLAGIOSTOMI.

Gills fixed by their external edges, with five small external openings on each side. No opercle. Jaws represented by the palatine and postmandibular bones, which alone are armed with teeth. Pectorals and ventrals always present, — the latter, in the male, furnished on their internal margins with long appendages.

FAMILY XXVIII. SQUALIDÆ.

Body elongated, cylindrical. Tail thick and muscular. Eyes lateral. Branchial openings on each side, never underneath.

GENUS I. CARCHARIAS. Cuv.

One anal and two dorsal fins; the first dorsal placed over the space between the pectoral and abdominal fins. Jaws and head depressed. Teeth flat, pointed, and cutting; serrated in the upper jaw, sometimes in both jaws. No temporal orifices in adults, but rudiments may be observed in the foetus of some of the species.

CARCHARIAS GRISEUS, *Ayres.*

The Gray Shark.

(PLATE XXXVI. FIG. 1.)

Carcharias griseus, AYRES, Bost Journ. Nat. Hist, iv. p. 293, pl. 12, fig. 4.
“ “ STORER, Synopsis

Color. The anterior and upper parts of the body are of a dark ash color; sides lighter; beneath white.

Description. Body much more elongated than that of the *Lamna punctata*; its greatest depth, across from the origin of the dorsal fin, is equal to about one fifth the entire length of the fish. The length of the head is equal to about one seventh the entire length. The eyes are horizontally oblong, — their longest diameter one inch and a half; the distance between the eyes is three and a half inches. The nostrils are large, situated half way between the eyes and the tip of the snout; similar in form to those of the *Lamna punctata*. Numerous minute black points, the orifices of mucous pores, are distributed along the under surface of the snout. Mouth of moderate size, situated beneath. Three rows of elongated, sharp, smooth teeth, with a minute denticulation on each side, at their base, in each jaw; about twelve teeth on each side of the median line, — those toward the angle of the mouth the smallest. The tongue is large, fleshy, smooth. The posterior of the branchial orifices is situated just anterior to the base of the pectoral fins.

The lateral line is scarcely discernible.

The first dorsal fin arises upon the anterior half of the body, nineteen inches posterior to the tip of the snout. It is slightly convex upon its anterior edge, rounded above, emarginated posteriorly. A portion of its base is free.

The second dorsal is situated about six inches back of the first, of the same form, and but a very little smaller than that fin.

The pectorals are broad and stout, and as high again as long.

The ventrals are semiquadrate; they are just back of the termination of the first dorsal fin; the distance between the ventrals and anal is less than the length of the ventrals.

The anal fin is of the form and size of the second dorsal, and arises on a line opposite the termination of that fin.

About three inches back of the second dorsal, the body terminates in a slight protuberance, directly back of which is a depression from which commences the caudal fin. This fin is thirteen inches in length; at its anterior inferior margin, it is similar in form to the dorsal and anal fins; this portion is rounded at its inferior posterior margin, emarginated upon its posterior edge, and is continued gradually elongating, its inferior edge being a mere fringe, and terminates within three inches of the extremity of the tail, which dilates into a triangular portion.

The specimen above described measured three feet and eleven inches.

Length, four feet.

Remarks. This species was first described and figured by Mr. William O. Ayres from

a specimen taken in Long Island Sound, on the north shore of Brookhaven. It is uncommon in our waters.

Massachusetts, STORER. Connecticut, AYRES.

CARCHARIAS OBSCURUS, *Storer.*

The Dusky Shark.

(PLATE XXXVI. FIG. 2.)

<i>Squalus obscurus, Dusky Shark,</i>	LESUEUR, Acad. Nat. Science 1, p. 223, pl. 9.
<i>Carcharias obscurus,</i> “ “	STORER, Report, p. 184.
“ “	“ Bost. Journ. Nat. Hist., II. p. 558.
“ “	DEKAY, Report, p. 350, pl. 61, fig. 201.
“ “	STORER, Synopsis.

Color. Above, a dark yet vivid blue, somewhat banded by lateral lines, yet gradually passing into the pure white of the abdomen; this tinge of the back extends low upon the sides. Upper part and sides of head, as well as caudal and most of dorsal fins, of a delicate steel color with coppery reflections. Pectorals above, very dark green; beneath, a dull white. Posterior border of dorsals covered with a black mucous slime. Pupils dark brown, irides golden.

Description. Body tapering gently posteriorly; its greatest depth, midway between the pectorals and the first dorsal fin, equal to a little more than one seventh the entire length. Head elongated, sharp, flattened above and below. Snout throughout studded with mucous pores arranged in lines or at random, some of which are very large. The length of the head is equal to little more than one sixth the length of the body; its greatest depth is about one third its length, and nearly equal to its greatest width. Eyes large; their longest diameter, the longitudinal, equals about one quarter the distance between them. Nostrils situated on the outer edge of the lower surface of the head, not quite midway between the eyes and end of the snout, nearer the eye, double; the anterior and outer, a narrow slit, entering downwards and inwards; the posterior, nearly circular. Mouth not very large; the outer edge of the upper jaw just beneath the centre of the eye; its outer angle about one third the distance between the eye and pectorals. Both jaws armed with short, triangular, and serrated teeth; those in the upper jaw curved backwards; in each jaw a single row behind, a double row in front. Branchial apertures, five, comparatively small; the posterior two just above the anterior margin of the pectorals.

The lateral line is indistinct, — high up on the back ; mucous pores somewhat similar in appearance, scattered throughout upper back.

The first dorsal fin is small and subquadrangular ; its height equalling its length ; and each about one third the length of the head.

The second dorsal is very small, about one third as large as the first, from which it also differs in another respect, its posterior margin being the longer ; whereas in the first it is the anterior. It is situated posterior to the middle point between the first dorsal and caudal fin.

The pectorals are very large ; their length is nearly four times their height, reaching beyond the middle of the first dorsal, — triangular, slightly falciform ; the apex and posterior angle being rounded. These fins are situated just posterior to the middle point, between the end of the snout and the first dorsal.

The ventrals are moderate sized ; height and length about equal ; placed on a line about midway between the first and second dorsals.

The anal fin is small, of the size of the second dorsal, and of same form as that fin, save that its anterior border is slightly more rounded, and its margin more deeply cleft directly beneath that fin.

The caudal fin is slender, elongated, about two ninths the entire length. The upper lobe is little more than twice as long as the lower, and less stout ; the preceding carinæ but little marked ; a well marked notch above and below, before the caudal.

Length, nine to ten feet.

Remarks. The specimen described by me in the Boston Journal of Natural History was captured at Nahant, July 10th, 1839, and measured nine and a half feet. The one above described was sent to me from Provincetown, by Captain Atwood, October 30th, 1851. This is not a common species in the waters of Massachusetts. It sometimes floats ashore in the night, like the Goose-fish, — *Lophius Americanus*, — or becomes entangled in mackerel-nets, like the mackerel shark — *Lamna punctata*.

Massachusetts, STORER.

CARCHARIAS VULPES, *Cuv.**The Thresher. Fox Shark.*

(PLATE XXXVI. FIG. 3.)

- Squalus vulpes*, GMEL., LIN., Syst. Nat. I. pt. 3, p. 1496.
Long-tailed Shark, PENN., Brit. Zoöl., III. p. 110, pl. 14.
Squalus vulpes, Fox Shark, SHAW., Gen. Zoöl., v. p. 333.
Carcharias " " " or *Thresher*, GRIFFITH'S, CUV., x. p. 599.
Thresher, MITCH., Medical Repository, VIII. p. 77.
Squalus vulpes, Thresher or Long-tailed Shark, MITCH., Trans. Lit. and Phil. Soc. of N. Y., I. p. 482.
" " *Sea Fox or Thresher*, JENYNS, Brit. Vert., p. 498.
Carcharias vulpes, Fox Shark, STORER, Report, p. 182.
Alopias vulpes, Sea Fox, Thresher, Sea Ape, YARRELL, Brit. Fishes, 2d edit., II. p. 523, fig.
Carcharias " *Thresher or Fox Shark*, LINSLEY, Cat. of Fishes of Connecticut.
Carcharias vulpes, Thresher Shark, DEKAY, Report, p. 348, pl. 61, fig. 199.
Alopias vulpes, STORER, Synopsis.

Color. All the upper part of the body, together with the fins, a dark bluish lead; beneath white. Pupils blue-black, edged with golden.

Description. Surface of the skin rough when hand is passed toward the head. The depth of the body, at the origin of the dorsal fin, is equal to a little more than one eighth of the length of the fish; the length of the tail, from its origin to its extremity, is rather more than one half the entire length of the fish; the distance from the tip of the snout to the origin of the dorsal fin nearly one fifth the length of the fish. Length of the head, from the tip of the snout to the first branchial aperture, nearly equal to the greatest depth of the body.

Occiput slightly convex. Eyes situated vertically, very movable in their sockets. In the specimen now before me, a female, their longest diameter is one seventh the length of the head; whereas in a male specimen I formerly described, it was about one tenth the length of the head. Snout blunted; distance from its tip to the mouth two thirds of the length of the head. Gape of mouth moderate; three rows of very small teeth in each jaw, smooth on their edges; the two first rows nearly perpendicular, the back row recurved; teeth in the upper jaw rather the longer. Nostrils beneath, nearer the mouth than the snout. Five branchial apertures placed vertically, the posterior the smallest.

The body of this fish is terminated on the back by a slight ridge; just back of this, is a depression between it and the tail, at the origin of which is quite a concavity.

The first dorsal fin is triangular, as long as high; convex anteriorly, rounded above.

The second dorsal is a mere finlet, quadrangular, with its posterior superior angle projecting backwards.

The pectorals are large, stout, falciform; their posterior bases are free.

The ventrals are shaped like the first dorsal, and are of the same length.

The anal fin is of the same size and form as the second dorsal, and is situated just posterior to it.

The caudal fin is very strong and powerful; its inferior base is triangular; back of this portion it gradually diminishes in thickness and terminates obtusely; just anterior to the extremity of the tail, upon its inferior edge, is a small triangular portion. A fleshy membrane margins the entire inferior edge of this fin.

Length, twelve to fifteen feet.

Remarks. This species, which sometimes weighs from one hundred and fifty to two hundred pounds, is known by our fishermen as the *Thresher* or *Swingle-tail*, from the motions of its tail, which is often used with great force. It is met with in our waters in summer, not often however, pursuing mackerel and manhaden, upon which it feeds. Small numbers are yearly captured in the fall of the year in nets set for mackerel, and occasionally a specimen is taken with the hook while fishing for dog-fish. When thus caught, it is secured with much difficulty on account of the constant and powerful thrashing of its tail.

This fish is considered almost valueless. Its liver, however, contains a small quantity of oil, and when an individual is accidentally taken, this is preserved and sold with the oil from the livers of other species.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

CARCHARIAS ATWOODI, Storer.

The Man-eater Shark.

(PLATE XXXVI. FIG. 4.)

Carcharias Atwoodi, STORER, Proceed. Bost. Soc. Nat. Hist., III. p 72.

Color. A leaden gray upon back and sides, and white beneath. The lower portion of the tips and edges of the pectorals are black.

Description. Depth across from the origin of the dorsals, twenty-three inches; across from the origin of the pectorals, twenty-six inches; across from the first branchial orifice, twenty-five inches; across from the extremities of the ventrals, fourteen inches; from the tip of the snout to the first branchial orifice the distance is equal to the greatest depth of the fish. The cheeks are very prominent. The eyes are perpendicularly oblong, their greatest diameter being two inches, their shorter diameter an inch and a half;

the distance between the eyes is eleven inches ; the distance from the eyes to the tip of the snout is ten inches. The nostrils are situated three and a half inches in front of the eyes, and six inches from the tip of the snout. The gape of the mouth is very large. Both jaws are armed with five rows of large, triangular, serrated teeth, — the front teeth of the upper jaw about an inch and a quarter long ; toward the angles of the jaw they are smaller. The teeth in the lower jaw are less wide than those of the upper. About twenty-five teeth can be counted in each row.

The branchial apertures vary from twelve to fifteen inches in length.

The first dorsal fin is just back of the pectorals ; it is eighteen inches high, measured over its outer edge, and thirteen inches long, four inches of its base being unattached ; it is slightly emarginated posteriorly.

The second dorsal fin arises thirty-one inches back of the posterior edge of the first dorsal. This fin is four inches high and five inches long, three and a half inches being unattached.

The pectorals are thirty-two inches high, and rounded over their outer edge ; they are fourteen inches long at their base, six inches of which are unattached.

The ventrals are eight inches high at their outer edge, three at their middle, and five at their posterior portion. They are nine inches long at their base, four inches of which are unattached.

The anal fin arises eleven inches posterior to the extent of the ventrals, on a line opposite the posterior portion of the second dorsal ; it is three and a half inches high, and five inches long at its base, three inches of which are unattached ; its posterior edge is highly emarginated.

Just anterior to the caudal fin, upon the dorsum, is a groove two inches across, and half an inch deep ; beneath this, upon each side, a prominent carina passes to the base of the caudal fin.

The caudal fin is large and strong ; it measures thirty-three inches over its upper lobe, and twenty-six over its inferior lobe ; eight and a half inches anterior to the tip of the larger lobe is a small triangular posterior. This fin measures thirty-three inches across from the tip of its lobes.

The specimen here described measured twelve feet eleven inches in length, and weighed about fifteen hundred pounds.

Length, thirteen feet.

Remarks. That this is an exceeding rare species along our coast, is obvious from the fact that I can learn of but three individuals having been seen by our fishermen during

the last fifty years. One of these measured six feet; a second, nine feet; the third, thirteen feet. My specimen was captured at Provincetown, June 16th, and was brought to this city for exhibition. When first seen, it was swimming in about ten feet of water on the Long-Point side of Provincetown harbor. A boat's crew having given chase, a harpoon was thrown into it, when it instantly turned toward the boat, and seized it with great ferocity near the bows, in which act several of its teeth were broken off. It was eventually killed by being frequently lanced.

I know of no species which resembles this, unless it be the great white shark, — *Carcharias vulgaris*, — and it certainly cannot be identical with that. When I presented the generic characters of this species to the Boston Natural History Society, October 18th, 1848, I made the following remarks: "The absurd notion of indiscriminately annexing the names of individuals to objects of Natural History has been almost discarded, unless in cases where the persons so specified have in some way advanced the boundaries of science. In the instance before us, I feel you will all agree with me in acknowledging that the compliment here offered is deserved, when I remind you that the hardy fisherman referred to, while constantly engaged in the fatigues of his exceedingly laborious profession, has transmitted me within the last two seasons, besides the species here described, a species of *Blennius* and *Motella*, both of which genera were new to our waters; besides a specimen of the *Somniosus brevipinna*, previously only known by a description of a stuffed specimen met with by Lesueur, at Marblehead, thirty years ago; and a specimen of *Aspidophorus monopterygius*, never but once previously met with south of Greenland; without referring to numerous specimens of our most common species. I would at the same time reiterate, what you have repeatedly heard me state, that he is more conversant with the history and habits of the fishes north of Cape Cod, than any individual with whom I am acquainted, or in other words that he is our best practical ichthyologist." Eighteen years have elapsed since the above words were spoken, and my debt to the individual referred to has immensely increased, and can never be repaid. Whatever other genus this species may be hereafter arranged in, whether it be *Carcharodon* or some one yet unformed, unless it be ascertained to have been previously described, I implore succeeding ichthyologists to hesitate before they expunge it. Let his name, who has done so much to enable me to present this final report on the fishes of Massachusetts, be indelibly associated with the science to which he is an honor.

Massachusetts, STORER.

GENUS II. LAMNA, CUV.

Muzzle pyramidal, under the base of which are the nostrils. Branchial apertures all in front of the pectorals.

LAMNA PUNCTATA, *Storer*.

The Mackerel Shark.

(PLATE XXXVII. FIG. I.)

Squalus punctatus, *Green-backed Shark*, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 483.

Lamna punctata, *Mackerel Shark*, STOREY, Report, 185, pl. 3, fig. 2.

“ “ “ “ “ Bost. Journ. Nat. Hist., II. p. 534.

“ “ *Mackerel Porbeagle*, DEKAY, Report, p. 352, pl. 63, fig. 206, 207.

Lamna punctata, *Mackerel Shark*, STOREY, Synopsis, p. 252.

Color. All the upper part of the body is greenish, which becomes of a slate color after death; lighter upon the sides; white beneath. Pupils black, irides dusky.

Description. Head small, its length is nearly equal to one seventh the length of the entire fish. Eyes nearly circular, very movable in their orbits; distance between the eyes equal to three times their diameters. Nostrils large, in front of eyes and inferior to them; the posterior opens forward, and is the larger; a semicircular groove passes forward and downward to the inferior which opens posteriorly. On a line above the eyes, are seen a series of mucous pores, resembling black orifices, running toward the snout; another series between the eyes and the snout. These are also distributed upon the under portion of the snout. Each jaw is furnished with three rows of small, sharp, triangular teeth, smooth at their edges; the two first rows straight, the back row recurved; the three teeth on each side of the middle of the lower jaw, the largest. Tongue large, rough, fleshy. Five large branchial apertures situated vertically; the distance between the anterior greater than that between the posterior. The depth of the fish, in front of the dorsal fin, is less than one quarter the length of the fish; the distance from the extremity of the snout to the dorsal fin is less than one third the length of the fish.

The first dorsal fin is somewhat triangular, with a fleshy horizontal process pointing backward from its base posteriorly, higher than long, emarginated posteriorly, rounded above.

The second dorsal fin is adipose, rhomboidal; its height is equal to one fourth the length of the first dorsal.

The pectorals are quite strong, falciform, higher than the length of the head, and connected posteriorly by a membrane to the body.

The semiquadrate ventrals are situated far back on the body; anus large, situated between the ventrals.

The anal fin is formed like the second dorsal, and is opposite it.

A double series of mucous pores point out the lateral line. On a line with the origin of the second dorsal fin, continuous with the lateral line, a wide carina runs on each side to the centre of the tail. The space between the second dorsal and the tail is equal to the length of the pectorals; at the posterior portion of this space is a crescent-shaped ridge with a groove behind.

The lobes of the caudal fin are unequal; the upper is much the larger, with a slight emargination at the superior posterior portion. This emargination is not referred to by DeKay in his description; and it is omitted in his figure. The specimen which I described in my "Report," measured eight feet, and near its anus, embedded in the flesh, was a specimen of the "*Anthosoma Smithii*" — Leach.

Length, three to ten feet. Weight, between two and four hundred pounds.

Remarks. This is the most common species of shark found in Massachusetts. It is met with during the summer and autumn. The fishermen are much annoyed by having their hooks and lines bitten off by this species while fishing for cod and mackerel, and their nets seriously injured, and not unfrequently ruined by them, while fishing for the latter species. It is more plenty upon some portions of the coast of Maine than in our bay. Captain Atwood informs me that while he was fishing for mackerel with nets at Monhegan, Maine, in September, 1845, his boat's crew of four men took twelve individuals; and another boat's crew of six men captured nineteen in a single night; and he adds, he should judge that one hundred and fifty at least, were taken during three weeks he continued to fish there. Except for the oil furnished by this species it is worthless to the fisherman. Seven gallons of oil are frequently extracted from the liver of a single fish, and eleven and a half gallons have been taken from one. Of late years this fish has yielded less oil than formerly, so that they are now scarcely thought worth saving. Formerly, a barrel of oil was frequently made from the livers of eleven fish, and Captain Atwood tells me that, many years since, his father even procured a barrel of oil from eight livers; not selecting the largest but employing large and small indiscriminately; but now, at least one hundred livers would be required to furnish this amount of oil. So that the procuring oil from this fish, which was once a regular business, has been almost entirely abandoned. When this oil is carefully prepared by boiling the fresh liver,

it is less valuable than whale oil to burn. It is a usual practice, however, among the fishermen to mix all the common fish oils together, when they are sold in Boston market under the name of shore oil. The carriers use the greater portion of this oil. This species feeds upon many different kinds of fish; but as it is generally met with while following shoals of mackerel, it is generally known as the mackerel shark. At Provincetown, it is called blue shark.

Maine, Massachusetts, STORER. New York, MITCHILL, DEKAY.

GENUS III. MUSTELUS, CUV.

Teeth blunt, forming a closely compacted pavement in each jaw; with temporal orifices. First dorsal in front of the ventrals. Lower lobe of the caudal short. No spines.

MUSTELUS CANIS, *Dekay*.

The Smooth Hound.

(PLATE XXXVII. FIG. 2. 2 a. Head beneath.)

Squalus canis, *Dog-fish*, MITCHILL, Trans. Lib and Phil. Soc. N. Y., I. p. 486, pl. 64, fig. 209.

Mustelus canis, *American Hound-fish*, DEKAY, Report, p. 355, pl. 64, fig. 209.

“ “ STORER, Synopsis, p. 253.

Color. All the upper part of the body is of a uniform slate color; the sides are lighter; the abdomen of a dirty white.

Description. Of an elongated form, gradually sloping upward from just back of the eyes, to the origin of the dorsal fin, beyond which it tapers to the tail. Skin smooth. The individual before me, which is a male, is three feet and three inches in length; the width of the body at the ventrals, is five inches; the greatest height is at the origin of the first dorsal fin, about three inches. The length of the head is eight and a half inches; the distance between the eyes is two and a half inches. The head is flattened between the eyes, which are longitudinally oblong; their greatest length is one inch. The temporal orifices are just back of the posterior angle of the eyes, on a line with them. The mouth is large, triangular when closed. The teeth like those of the rays. At the posterior angle of the upper jaw, a fleshy prolongation, half an inch in length, projects backward. The snout is obtuse; the nostrils are large, situated just in front of the mouth, on the edge of the base of the snout, and are covered by a valve.

The lateral line is quite prominent throughout the greater portion of its extent, and is continued in a straight course to the tail.

The first dorsal fin is subquadrangular, rather longer than high, deeply emarginated posteriorly, and terminating in an acute point.

The second dorsal fin is formed like the first, and is situated far behind it.

The pectorals are large and subtriangular.

The ventrals are subquadrangular; the claspers on each side of the ventrals are as long again as the fins themselves.

The anal fin is of the same form as the second dorsal, but smaller; it arises beneath the middle of that fin, and extends beyond it.

The caudal fin commences by a small elevation or crest, the prolongation, as it were, upwards of the cuticle, gradually becomes higher and is rounded at its posterior extremity; beneath, at its posterior extremity, is a triangular portion, which is partially separated at its base by a small fissure from the anterior portion, which is of a more elongated form.

Length, two to four feet.

Remarks. This species, which is called by the fishermen of Massachusetts Bay the smooth hound from its smooth skin, and dog-fish from its general resemblance to the dog-fish shark, I had not seen when my report on the fishes of Massachusetts was published. Since then I have examined several specimens taken in our bay and at Holmes Hole. This species sometimes runs ashore in great numbers. It is more numerous south of the Cape. Its liver yields about as much oil as that of the *Acanthias Americanus*. The largest I have met with measured forty-six inches.

Massachusetts, STOREY. New York, MITCHILL, DEKAY.

GENUS IV. SELACHUS, CUV.

Two dorsal fins, — the first placed but little behind the line of the pectorals, the second over the interval between the ventral and anal fins. The skin rough. Snout short and blunt. Temporal orifices very small. Teeth very small, numerous, conical, edges smooth, no lateral denticles. Branchial openings large, nearly encircling the neck.

SELACHUS MAXIMUS, *Cuv.**The Basking or Elephant Shark.*

(PLATE XXXVII. FIG. 3.)

- Squalus maximus*, LIN., Sys. Nat. i. p. 400.
 “ “ *Basking Shark*, PENN., Brit. Zool p 134, pl. 16.
 “ “ SHAW, Gen. Zool. v. p. 327, pl. 149.
 “ “ FABRICIUS, Fauna Greenlandica, p. 130.
 “ “ *Basking Shark*, JENYNS, Brit. Vert. p 503, sp. 193.
Squalus peregrinus, BLAINVILLE, Ann. du Museum, xviii. pl. 6, fig. 1.
Squalus maximus, *Basking Shark*, MITCH, Trans. Lit. and Phil. Soc. of N. Y. i. p. 486.
Squalus elephas, LESUEUR, Journ. Acad. Nat. Soc. ii p. 343, pl.
Squalus (*Selachus*) *maximus*, CUV., *Basking Shark*, RICH, Faun. Boreal, Americ. iii. p. 291.
Selachus maximus, *Basking Shark*, *Sun-fish*, *Sail-fish*, YARRELL, Brit. Fishes (2d edit.) ii. pl. 518, fig.
Selachus maximus, GRIFFITH, CUV. x. p. 603.
Squalus elephas, LES., STORER, Report, p. 407.
Selachus maximus, *Basking Shark*, DEKAY, Rep. p. 357, pl. 63, fig. 208.
 “ “ STORER, Synopsis.

Color. The whole upper part of the body of a dark slate color; lighter beneath. Mouth white, mottled with fuliginous.

Description. The surface of the body throughout, divided into innumerable rugæ which are covered with minute sharp points, often collected into groups, resembling the discs of many of the echini, upon which are situated the spines by which they are ornamented; or, still more, the tubercles along the lateral line of some of our cotti, causing the skin to be exceedingly rough.

From the tip of the snout to the first branchiæ, four feet nine inches. Five very large branchiæ nearly surrounding the head, as the animal is lying; the first pair of branchiæ are separated on the neck, from each other, six inches; the second pair are separated, at the same situation, nine inches; the third pair, one foot three inches; the fourth pair, one foot nine inches; the fifth pair, two feet three inches; showing the first interval to be much the largest. The head is small; perfectly smooth for the most part in front of the eyes, and covered with circular and oblong mucous pores, which keep this portion constantly lubricated. Snout blunt. Nostrils five inches in front of the eyes, the lower portion upon the edge of the upper lips. Eyes very small; their diameter three inches; largest circumference of sclerotic coat when removed from the socket, eight and a half inches. Eyes very movable in their orbits; distance between the eyes two feet; distance between the tip of the jaws, as artificially raised, two feet; this vertical gap is undoubtedly as much again at least, in the living fish, which gives an opening of four feet.

Jaws furnished with a great number of small, incurved, pointed teeth. Six rows of these in the upper jaw, and seven rows in the lower jaw; the inner row in this jaw are hardly formed; each of the rows in this jaw, as I counted them in the mouth, contained one hundred teeth from the tip to the angle of the jaw, or two hundred, as counted from one angle to the opposite one; or, in a word, fourteen hundred teeth in this jaw. The teeth are conical, sharp, polished, with a sensible ridge upon each side, often roughened, almost serrated; the lower portion of the tooth striated; the teeth at the angles of the jaws, short and more compressed. The teeth in the centre of the jaw are three lines high above the jaw, and their base or root about the same length within the socket. Temporal orifices small; just back of the angle of the jaws.

The first dorsal fin is triangular; two feet ten inches long, four feet four inches high anteriorly, three feet posteriorly; distance between the first and second dorsal fins, six feet.

The second dorsal fin is ten inches long, sixteen high anteriorly, thirteen posteriorly.

The pectorals are falciform; one foot nine inches long, five and a half feet high; distance between pectorals and ventrals, eight feet.

Length of the ventrals, one foot eleven inches; height, two feet nine inches; length of the claspers, three feet three inches; width at their base, eight inches, from which they gradually pass to a point; they enclose a strong bony spine.

The anal fin commences opposite the second dorsal; its length is eleven inches, its height fourteen inches; across the top, ten inches; distance between the anus and the anal fin, three and a half feet.

Anterior to the caudal fin is a lunated depression; above and beneath the posterior extremity of the fish, at the base of the tail, is a carina upon each side, one foot eight inches long. The caudal lobes are unequal; the upper lobe, six feet six inches in length, measured over its curve, having at its extremity a small triangular lobe; the lower lobe, four feet two inches, measured in the same way; width of the extremity of the lower lobe, six inches; width at the base, two feet two inches; width of the extremity of the upper fluke or lobe, one inch; width of the base, two feet three and a half inches; from the lunated depression to the middle of the fin, two feet eleven inches.

Length, thirty-six feet.

Remarks. The specimen above described, measured thirty feet and three inches. It was harpooned in the harbor of Provincetown, in 1839, and being towed to Chelsea, was there exhibited. I visited it with my friend, Jefferson Wyman, M.D., who made a figure, while I prepared the description which accompanied my "Report," which I

have here transcribed, not having been able to see a second specimen. When I saw the fish, it was lying upon the beach, where it was entirely exposed at low tide, and nearly, if not altogether, covered by water when the tide was high. The tide was flowing in when I examined it, which compelled me to make a more rapid survey than could have been wished. It had been opened, and its viscera were removed. The liver filled eight barrels, and furnished six barrels of oil.

Among our fishermen this species is known as the Bone Shark. It is rarely observed on our coast, and when taken is generally harpooned. For my knowledge of it in our waters, I am almost entirely indebted to my old and tried friend, Capt. Atwood. Within his remembrance he has known but three to be captured in nets. In 1835, an individual became entangled in a mackerel-net, and was then harpooned. In 1836 or 1837, a second was caught in a net; and after being drowned, its carcass was freed by the fishermen from the net, and it afterward drifted ashore in a state of decomposition. After lying upon the beach several days, a fisherman visited it for the purpose of procuring a slice for his hens, as is the custom at Provincetown, he supposing it to be a dead whale. Ascertaining what the animal was, he removed the liver and sold the oil in Boston for *one hundred and three dollars*, it having produced five or six barrels of oil. In 1847, a third was captured, then harpooned and drawn ashore.

In 1848, a vessel going to the coast of Maine for humpback whales, fell in with many of this species off Cape Elizabeth, and secured several of them. A tradition exists among the fishermen, that this species was taken in quite large numbers one hundred years ago, in the spring, for their oil.

This species was described and figured by Lesueur, from a specimen taken near New York, in 1822, as being previously unknown to naturalists, under the name of *Squalus elephas*. The specimen seen by Lesueur was afterward examined by Dekay, who has given us Lesueur's figure with some alterations; having been taken from a preserved specimen it fails to give some of its characteristics. Some of the figures of this fish, found in different works of natural history, are exceedingly unnatural. This fact is thus accounted for by Yarrell in his description of the species: "The difficulty of obtaining a perfect view of this unwieldy fish, either when floating in water, or when, from its great weight, it lies partly imbedded in the soft soil of the sea-shore, has led to the differences which appear in the representations of it which have been published by different naturalists."

Greenland, FABINIUS. Massachusetts, STORER. New York, MITCHILL, DEKAY. New Jersey, LESUEUR.

GENUS V. ACANTHIAS. RISSO.

Two dorsal fins, with a spine before each; first dorsal behind the line of the pectorals; the second dorsal over the space between the ventral and caudal fins; no anal fin. Skin rough in one direction; the scales heart-shaped, with a central spine directed backward. Temporal spiracles large. Several rows of teeth in both jaws, cutting and sharp, the points directed outward and backward.

ACANTHIAS AMERICANUS, *Storer*.*The Dog-fish.*

(PLATE XXXVIII. FIG. 1. 1 a. Jaws.)

- Spinax acanthias*, *Picked Dog-fish*, STORER, Report, p. 187.
 " " *Spinous Dog-fish*, DEKAY, Report, p. 359, pl. 64
 " " *Dog-fish*, AYRES, Bost Journ. Nat Hist, iv. p. 289.
Acanthias americanus, STORER, Synopsis, p. 506.

Color. All the upper part of the body is of a slate color, which is deeper upon the head, and lighter below the lateral line. Body beneath, white; a row of circular white spots are situated just under the anterior portion of the lateral line, and a few similar spots are irregularly distributed upon the back; these spots, in some specimens, are arranged with much more regularity than in others. The young of this species are much more spotted than the adults. In several fetuses I have examined, there have been noticed several white spots on the tops of the shoulders, — two in front of, and two just behind, the first dorsal fin; also spots on the sides, which, becoming confluent, form a white band extending almost the whole length of the body.

In a male specimen, twenty-three inches in length, I could scarcely observe a spot upon its entire surface.

Description. Body elongated, cylindrical, with a slight ridge on the back, which is more perceptible between the dorsal fins. A distinct carina on each side of the abdomen, posterior to the second dorsal fin. The entire surface is rough. The head, which is flattened above, and tapers to a blunted snout, is equal to one seventh the entire length of the fish. The eyes are horizontally elongated; the pupils are small, black; the irides are silvery with a cupreous tint. The orbits are large, allowing great motion to the eyes. The distance between the eyes is equal to more than one half the length of the head. The temporal orifices are back of, and just above, the posterior angles of the

eyes; they are furnished anteriorly with a cartilaginous valve; their length is equal to the short diameter of the eyes. Between the eyes, are two longitudinal patches of numerous mucous pores, which are indistinctly continued nearly to the extremity of the snout. All the lower portion of the head, in front of the mouth, is covered with similar mucous orifices, which, like those just mentioned, exude, when pressed, a gelatinous secretion. The nostrils are double, and are situated nearer to the eye than to the snout; the outer orifice is circular, the inner transverse; they are situated transversely with regard to each other. The mouth is moderate, nearly circular when expanded. In the upper jaw, are three rows of teeth; in the lower jaw, are two rows; these teeth have very sharp edges, and their points are turned outwardly from the centre of the jaw. The tongue is large, rounded at its tip, and, like the whole interior of the mouth, is white. The branchial orifices, five in number, are situated directly in front of the pectoral fins; the posterior is rather the largest.

The lateral line, which is situated on the upper half of the side, pursues nearly a straight course to the extremity of the fleshy portion of the tail, from whence it passes obliquely upward to the outer edge of the fin.

The first dorsal fin arises on the anterior third of the body; it is convex before, emarginated above, and terminates posteriorly above in an acute angle. A strong triangular spine, almost black at its base and white at its tip in some specimens, nearly half the height of the fin, arises at its anterior base, and is concealed in nearly half its height by the fin.

The second dorsal fin of the same form as the first, but much smaller, is situated back of the first dorsal, at a distance from it equal to one fourth the whole length of the fish. A spine similar in its form and situation to that in the first dorsal, but nearly as high as the fin itself, is also here observed.

The pectorals are large, subtriangular, emarginated posteriorly; they commence at the last branchial orifice, their length is rather less than half their height. The ventrals are small and subtriangular; they are situated just anterior to the second dorsal, with the anus between them.

The caudal fin is very large and powerful; its upper portion is broad, and as long again as the lower.

Length, one to three feet; weight, eight to fifteen pounds.

Remarks. In the Spring and Autumn, this species makes its appearance in shoals in our bay; they are frequently met with in immense numbers. These shoals seldom remain in shallow water, or near the shore more than three or four days. They feed upon

mackerel and other fishes, and also upon the offal and garbage thrown upon the bottoms by the fishermen.

It is usually caught with the hook. On account of the sharpness of the teeth of this species, an ordinary line will not answer, as it would be severed at once; so that beneath the lead or sinker is suspended a piece of twisted line eight or nine inches in length, to which is attached, by a swivel, a firm leathern thong about twelve inches long on each side, supporting at each extremity a small chain about six or eight inches in length, each bearing a hook. Although it is not taken in quantities through the summer along the shore, yet so late as June 27, 1847, I noticed along the entire beach of Long Point, Provincetown, wherever the fishermen had cleared their nets of the Whiting they had caught the previous night, that more or less of this species also had been thrown away.

At their first appearance in May, they are quite abundant for about a fortnight at Chilmark, Martha's Vineyard, and the inhabitants take them in large quantities for their oil. During the spring of 1846, so numerous were they about Gay Head, that in half of a day, six hundred dog-fish were caught by the crew of a single boat by the hook. When this species comes into Massachusetts Bay in the early part of June, it tarries but for a few days; and as the fishermen at Provincetown are engaged in taking mackerel, they pay no attention to it at that time. But when they again appear in September, to remain until the middle of November, the fishermen being more at leisure, fit out their smacks for the sole purpose of capturing them for their livers. About one thousand livers furnish a barrel of oil, which is worth twelve dollars. When the livers are preserved, without being tried out, they are sold for about four dollars per barrel. After the fishery is over, the oil is boiled out of the livers and it is prepared for the market, where it will be worth from twenty-five to thirty cents per gallon; it is not very salable however, in cold weather, as it frequently becomes very hard when cold. The oil from this species is of an inferior quality, and is readily detected by its odor and lighter color; so that if a small quantity of dog-fish oil is mixed with shore oil it is condemned by the speculators. This shore oil is used by the tanners and curriers; it is prepared by putting the livers in barrels or butts in the sun; in a short time the water separates and sinks, and the oil is dipped out.

The fish itself on some parts of Cape Cod was formerly dried for fuel, and its skin was considerably used for polishing, by the mechanic.

These are some of the benefits derived from this species: but, upon the whole, those fishermen who catch mackerel in nets consider them very unwelcome visitors, as they not unfrequently swim near the surface of the water during the night and devour large

quantities of mackerel entangled in the nets, by biting them in pieces; they also become themselves entangled in the nets, and by their teeth and rough skin nearly destroy them.

Northerly, beyond the coast of Labrador, DEKAY. Massachusetts, STORER. Connecticut, AYRES. New York, DEKAY.

GENUS VI. SCYMNUS. Cuv.

All the fins small; two dorsal fins, the first but little before, and the second but little behind the line of the ventrals; no anal fin. Skin rough. Temporal orifices or spiracles large, placed rather high upon the head, above as well as behind the eyes. Teeth in the lower jaw crooked at the point, equilateral at the base; in the upper jaw lancet-shaped, but little curved; the points in both jaws diverging from the centre. Gill openings small.

SCYMNUS BREVIPINNA, *DeKay*.

The Nurse or Sleeper.

(PLATE XXXVIII. FIG. 2. a. Teeth of upper jaw. b. Teeth of lower jaw. c. Spine in skin.)

Somniosus brevipinna, *Nurse or Sleeper*, LESUEUR, Journ. Acad. Nat. Sciences, I. p. 222, pl.

“ “ “ “ STORER, Report, p. 189.

Scymnus brevipinna, *Nurse*, DEKAY, Report, p. 361. pl. 61. fig. 202.

“ “ “ STORER, Synopsis, p.

Leiodon echinatum, WOOD, Proceed. Bost. Soc. Nat. Hist., II, p. 174.

Color. A purplish gray, with numerous white spots distributed over its surface.

Description. Body robust, subtriangular to the posterior line of the first dorsal fin, slightly convex in front of the dorsal fin, posterior to which it is cylindrical, and rapidly diminishes in its diameter. The entire length of the specimen before us is seven feet nine inches, measured from the tip of the snout to the extremity of the upper lobe of the tail. The depth of the body, across from the first dorsal fin, is eighteen inches; the depth at the anal, is five inches; the depth at the origin of the tail is three inches. The length of the head is fourteen inches; it is elongated, and terminates in a blunted snout, which is rounded above, somewhat flattened beneath, and six inches deep at its base. The eyes are circular, one and a half inches in diameter, situated seven inches posterior to the tip of the snout. The nostrils are large, situated beneath the base of the edge of the snout, four inches anterior to the eyes.

The mouth is of moderate size; the upper jaw is covered with five rows of small,

sharp, incurved, lancet-shaped teeth. The lower jaw has two rows of broad, quadrangular teeth, divided in their centres by a perpendicular ridge, and having their apices armed with a horizontally subtriangular cutting edge, directed, on each side of the centre of the jaw, toward the angle of the jaw. There are about twenty-six teeth on each side of the centre of the jaw. The temporal orifices are small; they are situated rather more than three inches posterior and superior to the eyes. The branchiæ, about two and a half inches in length, are eight inches back of the eyes. The entire surface of the body, including the fins, is thickly covered with minute conical recurved spines; these spines are grooved longitudinally, particularly upon their convex surfaces.

The lateral line is scarcely perceptible in the recent fish, but is readily traced on the dried specimen: it is a somewhat irregular black line, which, arising above the eyes, and passing along the whole length of the body, is lost upon the upper lobe of the caudal fin; from its under edge pass downward numerous lines of about one quarter of an inch in length, of the same color as the line itself, separated about a half inch from each other.

The first dorsal fin is subtriangular, — eight inches high from its base to its posterior tip; three inches long; the posterior portion of the fin is prolonged three inches beyond the base.

The second dorsal fin arises twenty inches back of the first; it is three inches high and eight inches long at its base; its posterior portion is elongated five inches beyond the base.

The pectorals are situated thirteen inches back of the angle of the jaws; their height is eleven inches, their length six inches, — they are rounded posteriorly.

The ventrals are subquadrangular, and are situated just in front of the second dorsal fin; their height is six inches, their length five inches, their posterior prolongation three inches in extent.

The caudal fin is emarginated; the height of the upper lobe is fifteen and a half inches; that of the lower lobe is twelve inches. The distance from the tip of the upper lobe to the lower edge of the lower lobe is twenty inches.

Length, eight to twenty feet.

Remarks. In the year 1818, Lesueur described and figured this species, from a stuffed specimen he saw at Marblehead. Never having been able to obtain a specimen, I was obliged to transcribe Lesueur's description into my "Report," published in 1839. Dekay followed my example in his "Report on the Fishes of New York," which appeared in 1842, in copying Lesueur; but not satisfied, with, to use his words, "an illy-constructed

genus," he retained the species to the genus *Scymnus*, which classification I accepted in my Synopsis.

A specimen of this species, sixteen feet in length, was taken on the coast of Maine, about eighty miles east of Portland, in August, 1846. After being skinned and stuffed, it was seen and described by William Wood, M. D., of Portland. He supposed it to be new, and called it *Leiodon echinatum*. His description appeared in the second volume of the "Proceedings of the Boston Society of Natural History." In the month of January, 1848, Capt. N. E. Atwood brought me, from Provincetown, a specimen he had taken the day previous while fishing for cod. I at once described it and had it figured, supposing it to be a new species. The accompanying description and figure give its characters while recent. When, however, it had been stuffed and dried, it proved to be Lesueur's species; its aspect being materially changed by the process of being skinned and preserved. Another specimen was caught at Nahant, in November, 1848. It was drawn upon the beach where it remained alive during the night. At its death it was brought to the city for exhibition. A third was harpooned at Provincetown in April, 1849, at Long Point, fifteen feet long; and still a fourth was taken on the 24th of April, the same year, at Provincetown, near the Long Point light-house. These are the only instances with which I am acquainted of its capture. I have learned from conversation with an intelligent fisherman, however, that individuals are captured every winter, and that it is more numerous than is generally supposed. Sometimes it is very large—measuring twenty feet in length, and weighing two tons or more, on these the cutaneous spines attain a great size. In the vicinity of Provincetown, its most common resort is near Race Point, in a gully famous for halibut and star-fish. The liver furnishes five or six gallons of oil—in one case, a single half lobe filled a flour barrel, and yielded fifteen gallons of oil. It is called by the fishermen *gurry* or *ground shark*, from its feeding on the offal which is thrown overboard from the smacks. It is sometimes attracted, like other species of sharks, by the carcasses of whales killed in Massachusetts Bay.

There is a description of a species of *Scymnus*, accompanied by a figure by Valenciennes in the "Nouvelles Annales du Museum," tom. 1, 1832, which he calls *microp-terus*. The fish was taken near the mouth of the Seine. He considered it distinct from the dried specimen of Lesueur. There is a very strong resemblance, however, between the descriptions of the recent fish.

Massachusetts, LESUEUR, STORER.

GENUS VII. ZYGÆNA. Cuv.

Head depressed, more or less truncated in front; the sides extend horizontally to a considerable length, with the eyes at the external lateral extremity. Teeth of the same shape in the upper and lower jaw, namely, the points directed toward the corner of the mouth, with a smooth edge when young, but distinctly serrated in adult specimens. Branchial openings, five. Two dorsal fins,—the first in a line close behind the pectorals; the second, over the anal fin.

ZYGÆNA MALLEUS, Val.

The Hammer-headed Shark.

(PLATE XXXVIII. FIG. 3.) *a.* Head beneath.)

- Squalus Zygaena*, *Hammer-headed Shark*. Mitch. Trans. Lit. and Phil. Soc. of N. Y., 1. p. 284.
Zygaena Malleus, VAL. Mem. du Mus. D'Hist. Nat. v. 9. p. 283., pl. 2, fig. a, 1, 6.
 " " *The Hammer-headed Shark*, STORER, Bost. Journ. Nat. Hist. iv. p. 185.
 " " VAL., Synopsis, p. 256.
 " " DEKAY, Report, p. 362. pl. 62, fig. 204.

Color. The upper part of body a dark grayish brown, lighter on sides; beneath, white; posterior inferior parts of head, bluish; anterior margin of head tinged with white.

Description. Head somewhat rounded anteriorly, semicircular directly in front, with a smaller curve on each side of this, widely expanded and much compressed at sides. The external margin of the sides of the head rounded, having the eyes situated at their anterior extremity; the anterior angle in front of the eyes is very prominent. The width of the head is equal to twice its length, and is also about the length of the upper lobe of the caudal fin, and one fourth the length of the fish. The expanded sides of the head are two thirds the length of the head. The nostrils are situated beneath and front of this angle, in the extremity of an emargination that extends along the smaller curves previously mentioned. The posterior portion of the head is bordered by a stout, fleshy, and concave membrane. The eyes are large and prominent. The mouth is situated beneath; its posterior angles on a line with the posterior edges of the head. Several rows of sharp teeth are seen in each jaw,—their points are directed toward the sides, and have a prolonged base. Branchial apertures, five. The under surface of the head abounds in mucous pores, disposed in patches, the largest of which is of a triangular form, and directly in front.

The lateral line, which is quite indistinct, commencing on the side of the occiput, passes obliquely backward to a line above the third branchial orifice, and then assuming a straight line, runs the whole length of the body, and is lost upon the posterior extremity of the caudal fin.

The first dorsal fin is somewhat triangular, rounded anteriorly, with its posterior base elongated and free. It is situated in the anterior half of the body.

The second dorsal fin arises just anterior to the caudal fin. It is quadrangular, quite small, having its anterior margin slightly rounded, and its posterior extremity prolonged into a filament.

The pectorals arise at the base of the fourth branchial orifice, and are rounded anteriorly.

The ventrals, of a quadrangular form, commence just back of the middle of the body.

The anal fin commences on a line just in front of the second dorsal, resembling somewhat that fin in shape, but more deeply emarginated posteriorly.

The upper lobe of the caudal fin is very long, and curved at its extremity, its lower portion, a thin membrane, ends posteriorly in a small triangular expansion. The lower lobe is much smaller than the upper, and triangular.

Length, two to twelve feet.

Remarks. Although some slight discrepancies might be pointed out between our species and that described by Valenciennes, I have but little doubt that they are identical, and as such classify them. This species is exceedingly rare in our waters. In my "Report," published in 1839, I observed that "Dr. Yale had informed me that a species of *Zygæna* was found at Holmes Hole." In October, 1841, I had an opportunity to see a specimen which had been brought to this city by Winslow Lewis, Esq., from Chatham, Cape Cod, at which place it had been taken with a second specimen in a net. This individual I described in the second number of the fourth volume of the Boston Journal of Natural History, for September, 1842. In 1851, I received a specimen from Provincetown, from Mr. Jonathan E. Smith, taken accidentally in a net. Capt. Atwood also saw some half of a dozen of this species taken that season, one being seven feet in length. Previous to these, he had never seen but two or three, and those very small, in Massachusetts Bay. He had, however, seen them south of Cape Cod in some abundance. In September, 1857, I received a specimen from Capt. Atwood, taken at Provincetown, which is above described.

Massachusetts, STORER, New York, MITCHILL, DEKAY. Caribbean Sea, BANCROFT.
"From Nantucket to Brazil," DEKAY.

FAMILY XXIX. RAIIDÆ.

Body very much flattened out, resembling a disk. Pectorals very large, uniting in front with the snout, and extending backward to near the base of the ventrals. Tail, more or less long and slender. Mouth, nostrils, and branchial openings, beneath. Eyes and temporal orifices, above. Dorsals (when present), almost always on the tail.

GENUS I. RAI A. LIN.

Disk rhomboidal. Tail slender; with two small dorsals near the tip, and sometimes the vestige of a caudal fin. Teeth slender, close set, arranged in quincunx.

RAIA DIAPHANES, *Mitchill*.*The Clear-nosed Ray.*

(PLATE XXXIX. FIG. 1.)

- Raja diaphanes*, *Clear-nosed Ray*, MITCH, Trans Lit and Phil Soc N. Y. I p 478
Raja ocellata, *The Ocellated Ray*, MITCH, STORER, Report, p 191.
Raja diaphanes, *Clear-nosed Ray*, DEKAY, Rep p 366, pl 77, fig 215
 " " " LINSLEY, Cat. of Fishes of Connecticut
 " " " STORER, Synopsis, p. 510.

Color. The body above is of a light brown color, thickly sprinkled over its entire surface with more or less circular black spots or blotches, varying in their size from one half of a line to two lines in diameter; beneath, white. Pupils black, irides golden and stellated.

Description. In this species the pectorals are rounded; in front of them is a concavity on the sides of the head, which is preceded by a slight convexity of the margin. Snout obliquely projecting, blunted at extremity, with an emargination on each side. The length of the head is equal to about one-seventh the length of the body; its width across the pectorals more than half the length of the body; its width directly back of the eyes across occiput, as long again as the length of the head; the distance between the eyes is equal to one third the length of the head. The eyes are prominent, horizontally oval. The temporal orifices are situated obliquely, directly back of the eyes, and shorter than they. The length of the mouth is rather more than one third the length of the head. An aperture extends from the exterior angle of the mouth to the nostrils, which are situated directly in front of the mouth, large, and protected by fleshy elongations. The

branchial openings are situated at equal distances from each other. In front of, and at the sides of the mouth, and at the anterior portion of the pectoral fins, are seen a large number of minute black points which are mucous pores. The space between the anterior orbital ridge and the snout is naked and diaphanous. Minute sharp spines upon the snout, from which extend a series of spines on each side to the anterior orbital ridge; numerous exceedingly minute spines occupy the space between the eyes. From the anterior edge of the emargination on the sides of the snout, along the edge to the posterior portion of the head, are situated several rows of prominent recurved spines. Two rows of very prominent sharp spines, about a dozen in a row, are seen toward the outer portion of the pectoral fins. Two rows of spines on each side of the back of the tail; those at the posterior extremity are the largest, and between the two central rows is a naked groove. The remainder of the upper part of the surface of the body is destitute of spines. The anterior portion of the pectorals is reddish at the edge; posterior portion bordered with white rays very numerous and easily distinguished. The ventrals are quite large, containing about twenty-four rays; those next to the pectorals are very strong and lobed; these fins resemble very much the posterior wings of some of the *Phalænæ*.

Two subtriangular dorsal fins, of nearly equal size, and rough upon their surface, are situated a short distance in from the extremity of the tail; they are united to the tail by a delicate transparent membrane.

The tail is more than half the length of the entire fish, and is bordered by a membranous expansion upon its inferior edge.

The sexes are readily distinguishable by the ventral fins. From the ventrals in the male, extends a cylindrical appendage about half the length of the tail, measuring from the anal orifice, which is called the clasper; at its posterior outer portion it is fissured, and contains on its lower division a large falciform bony hook; and on the upper, a small projecting tooth, somewhat like a shark's tooth; the ventrals of the female are destitute of these appendages. Besides this sexual difference, in the female there are fewer spines upon the surface of the body generally, and particularly upon the fleshy portions of the pectorals. The male has fewer spots; his teeth are less prominent and less sharp than those of the female; the anal orifice of the male is circular, in the female it is a simple incision.

Length, two to three feet.

Remarks. This species, which grows to the length of three feet, is found along our whole coast; it is frequently taken while fishing for other species, and is found along the

beaches, swimming in shallow water. I have seen it at Provincetown, in great numbers, thrown upon the shores. It is so common at Nahant, that Mr. Jonathan Johnson, a fisherman of that place, informs me that it is not an unusual circumstance when a large number of hooks attached to the same line are baited, for a skate to be captured by each of them.

The specimen from which the above description and accompanying drawing were made, was taken with a hook from one of the bridges over Charles River.

I have never known them to be used as an article of food by our people, although Dekay says they are eaten in New York, by the poorer classes.

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

RAIA LÆVIS. *Mitch.*

The Smooth Skate.

(PLATE XXXIX. FIG. 2.)

Raia lævis, *Smooth backed Skate*, MITCH, Amer Month May 11, p 327.

" *batis*, *Skate*, STORER, Report, p 193.

" *lævis*, *Smooth Skate*, DEKAY, Report, p 370

" *batis*, *Skate*, LINSLEY, Cat of Fishes of Connecticut.

" *lævis*, STORER, Synopsis, p 511

Color. Above, of a light ash color, with a few indistinct symmetrically arranged yellowish ocelli; one in front of, and exterior to each eye; two posterior and exterior to each eye; two at the posterior base of each pectoral fin, and one on each ventral fin. All the under portion of the body is of a dingy white color. Pupils black; irides silvery, with a beautiful golden fringed curtain suspended from above.

Description. Rhomboidal. The entire length of the head is nearly equal to one fourth the length of the fish; the head is much compressed, with a furrow between the eyes, which extends to the posterior portion of the snout. Snout slightly blunted. The eyes are oblong and moderate in size. The distance between the eyes is less than one fourth the length of the head. The gape of the mouth is large. The jaws are composed of compact, hexædral teeth, forming almost a plane surface, the inner angle of the innermost middle ones, beginning to become acute. The nostrils are a short distance in front of the mouth. Branchial apertures situated obliquely, the anterior the longest. The greater part of the body is smooth above. A strong spine, naked at its tip, is situated at the anterior angle of each eye, and a smaller one exists at the posterior angle; back of the latter, is a strong spine at the posterior inner edge of the temporal orifices. A series of very minute spines along the inner edge of the orbit. The top of the snout is

covered with small, sharp, flexible spines; their extremities are naked; similar spines are continued along the edge of the head to the base of the pectoral fins; upon the anterior edge of the pectorals are numerous very minute spinules. On the upper portion of the pectorals, toward the lateral angle, are four or five longitudinal rows of very sharp, incurved, erectile spines, — some of the rows containing a dozen or more spines. A few short spines are distributed upon the posterior inferior base of the pectorals, — and some very minute asperities may be felt upon the ventrals. A row of prominent strong spines, — ten, twelve, or more in number, — commence just back of the eyes, and extend along the dorsum to the first dorsal fin. In the intervals between these, are numerous minute spinules; on each side of the central row is a perfectly regular series of small spines extending from the shoulder to the first dorsal fin. Two spines are situated upon each shoulder, — the posterior of which is the longer. On each side of the dorsum, passing from the shoulders to the posterior portion of the body, and also exterior to each shoulder, are seen lines resembling the lateral line, passing down to, and bifurcating upon the pectorals, from which, small mucous ducts are distributed at regular intervals. Body beneath perfectly smooth, with the exception of a very few spines scarcely perceptible, unless by the touch, on each side of the commencement of the caudal fin, and a small patch of equally minute spinules upon the middle of the tail, just in front of the termination of the ventral fins. Mucous pores are scattered over the greater portion of the under surface, appearing like black dots, in most instances distributed in a regular manner, although a longitudinal line of these is seen toward the middle of the pectorals, and another transverse one at the base of the ventrals.

The dorsal fins are of equal length; the first, a little the higher and connected at its base to the tail by a membranous prolongation; both dorsals rounded above. These fins are separated from each other by a short interval. The posterior terminates near the extremity of the tail.

Length, two to five feet.

Remarks. This species is common in Massachusetts Bay.

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL.

GENUS II. PASTINACA. CUV.

Tail slender, without fins; but armed with one or more long spines, which are dentated on the edges.

PASTINACA HASTATA, *Dekay*.*The Whip Sting-Ray.*

(PLATE XXXIX. FIG. 3.)

Raia centroura, *Prickly-tailed Sting-ray*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y. 1. p. 479.*Pastinaca hastata*, *Whip Sting-ray*, DEKAY, Report, p. 373. p. 65, fig. 214.*Trygon centourra*, " " " LINSLEY, Cat. of Fishes of Connecticut." *hastata*, DEKAY, STORER, Synopsis, p. 261.

Color. Body, pectorals, and ventrals, light brown above, whitish beneath; tail, dark brown throughout.

Description. Body ovoid, its lateral margins blending imperceptibly with the pectorals, which, continued anteriorly, form with the snout an almost unbroken curve. Greatest width of body, about equal to its length exclusive of the tail, and about five times the greatest depth.

Eyes oval, of moderate size, situated obliquely, the greatest divergence posteriorly; distance between them being about three quarters that to tip of snout. The temporal orifices are large, just behind the eyes, the anterior edge coming to a line with their middle point; situated obliquely, in opposite direction to that of the eyes. Nostrils small, their alæ, large and projecting. Mouth moderate, transverse, curved anteriorly; teeth sessile and smooth.

Surface of body without spines or projections, save a single row of large, irregular, horny tubercles posteriorly. These commence on the median line of the back, at its last quarter, and extend upon the tail. This organ, which is studded throughout with similar projections, is long, flexible and tapering. At the end of its anterior fourth there arise in succession, a pair of strong, elongated and pointed spines, flattened above and beneath and serrated upon their lateral edges. These spines are each received into a smooth longitudinal groove when at rest. Their number undoubtedly varies. Dekay speaks of three being present, — and in the specimen from which his description is drawn, but one is present, although the stump of a second, the anterior one and its distinctive groove, afford evidence of its former existence.

Anus longitudinal, near the origin of the tail.

The greatest depth of pectorals on a line with the temporal orifices.

The ventrals are fan-shaped, emarginated posteriorly. The claspers are rather more than one half the length of the ventrals.

Length of specimen here described, a male, from the snout to the commencement of the tail three feet and a half; from the snout to the end of the tail, nine feet.

Length, five to nine feet.

Remarks. Previous to the publication of my "Report on the Fishes of Massachusetts," I was aware that a species of sting-ray inhabited our waters. Thus, Dr. Yale, then of Holmes Hole, wrote me: "I have seen frequently in this harbor and have assisted in taking them; but, owing to their poisonous nature when wounded by their sting, we have been rather cautious about taking them into the boats, so that we seldom see one on shore. One or two individuals in this vicinity have come well nigh losing their lives by a wound from them. In July and August they are abundant on the flats in the harbor here." When captured they are taken by the harpoon. In October, 1840, I received from Dr. Yale the head and tail of a species, which I supposed to be Mitchill's *Raia centroura*, — and afterwards another tail of this species was sent me from Holmes Hole. In September, 1857, my friend E. W. Carpenter, M. D., of Chatham, Cape Cod, sent me the fine specimen from that place which has enabled me to present the above description and accompanying figure.

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL.

GENUS III. MYLIOBATIS. DUM.

Head projecting from the pectorals, and the latter more broad transversely than in the other Rays, which gives them somewhat the appearance of a bird of prey with the wings extended, and has caused them to be compared to the eagle. Their jaws are furnished with broad, flat teeth, arranged like the squares of a pavement, and of different proportions, according to the species; their tail, extremely long, is terminated in a point, and is armed like that of a trygon, with a strong spine, serrated on both sides, and has above, toward its base, in front of the spine, a small dorsal. Sometimes there are two or more spines.

MYLIOBATIS ACUTA, *Ayres.*

The Smooth-tailed Sting-Ray.

(PLATE XXXIX. FIG. 4.)

Myliobatis bispinosus, STORER, Proceed. Bost. Soc. Nat. Hist.

" " " Bost. Journ. Nat. Hist. iv. p. 187.

" " " AYRES, Bost. Journ. Nat. Hist. iv. p. 290, pl. 13, fig. 1.

Myliobatis acuta, LINSLEY, Cat. of Fishes of Connecticut, SILLIMAN, Journ.

" " STORER, Synopsis.

Color. The whole body and head above, reddish brown; tail lighter at the base, but nearly black toward the tip; beneath, whitish.

Description. Body above, smooth, entirely destitute of spines, even on the dorsal ridge. Entire length, three feet eleven inches; length, exclusive of the tail, one foot six inches; breadth across the pectorals, two feet five inches. Distance between the eyes, four and a quarter inches; eyes vertical, elliptical, greatest diameter one inch, least diameter three quarters of an inch. On the summit of the orbit of each eye is a hard, blunt, vertical projection, about one eighth of an inch in height, nearly white at the extremity. The head is rounded anteriorly, and extends backward, widening but little, four and a half inches, until opposite the eyes, where it joins the body. Mouth two inches in breadth, situated four inches posterior to the snout; jaws lined with numerous blunt, tessellated teeth. Nostrils about an inch and a half anterior to the mouth, each provided with a valve, and having a depression or channel leading back almost to the corner of the mouth. Branchial apertures five on each side; distance between the anterior pair, four inches. Spiracles situated behind the eyes, elliptical, one and a half inches in length.

On the tail are two reversely serrated spines, one situated directly above the other, of which the upper is the shorter; their lengths are two and three fourths and three and three fourths inches. Their insertion is at about five and a half inches from the origin of the tail; in color they are dingy white. Immediately before them is a small dorsal fin, one and a half inches in length, and one inch in height. Tail very slender, smooth to the tip, the inferior surface presenting no vestige whatever of fins. Anus beneath the origin of the tail; immediately posterior to it are two cylindrical, or slightly conic appendages, three and three fourth inches in length. As the specimen here described is the only one which has fallen under my notice, I am of course unable to determine whether all the characters which have been stated will prove to be constant. With respect to one, the relative length of the two spines upon the tail, variation may probably be expected. The upper spine will, in some instances, doubtless be the longer of the two. The specimen figured was apparently a male.

Length, three to four feet.

Remarks. In December, 1841, I presented to the Boston Natural History Society, the tail and portion of the jaw of a species of myliobatis which I had just received from Dr. Yale of Holmes Hole, — and from two spines which were situated upon the tail, I proposed the specific name of bispinosus. Mr. William O. Ayres, then of Hartford, Connecticut, afterwards found an entire specimen at Brookhaven, Long Island, and called it myliobatis acuta; this name, however, he withheld, and in his description of this species, prefixed the name I had indicated, — at the same time remarking, “It is a very clearly marked species, and as Dr. Storer was obliged to draw up his account from imperfect

materials, I have prepared a description and drawing." Yarrell in his generic characters of the genus *myliobatis*, which I had examined, speaks only of "a serrated spine" upon the tail; whereas, Dumeril, in his formation of the genus, says, "sometimes there are two or more spines." My specific name, heretofore, was evidently untenable,—and as Ayres published the first accurate description, his name *myliobatis acuta* should undoubtedly be acknowledged. I have never seen a perfect specimen, and have therefore given Ayres' description and figure.

Massachusetts, STORER. Connecticut, AYRES.

GENUS IV. TORPEDO. DUM.

The disk of the body nearly circular; pectoral fins large; two dorsal fins placed so far back as to be on the tail; surface of the body smooth; tail short and rather thick; teeth small and sharp.

TORPEDO OCCIDENTALIS, *Storer*.

The Cramp-Fish.

(PLATE XXXIX. FIG. 5)

Torpedo occidentalis, STORER, Amer Journ of Arts and Sciences, 45, p 165, pl 3
 " " " Synopsis, p 516

Color. The whole upper surface of this species is of a dark brown, with a few almost black spots distributed over it; beneath, white.

Description. The entire length of the specimen before me, which is a female, is four feet and two inches, and its greatest breadth is three feet. The globe of the eye, which is circular, is an inch and a quarter in diameter; the cornea is oval; its longest diameter is one half of an inch, and is directed obliquely outward; its shortest diameter is three eighths of an inch.

The spiracles are oval and smooth at their edge; they are one and a quarter inches in their largest diameter, and one inch in their shortest diameter, and are directed outward and a little forward. On the anterior and inner surface of the spiracles, just within the orifice, is a plaited membrane, the folds of which resemble somewhat the nasal septa; the longest of these folds are next to the median line, and they gradually diminish in length as they recede from it. The mouth, when closed, measures six inches across from the angles, and when opened to its widest extent, measures from the middle of the upper to the middle of the lower jaw, five inches. The teeth are numerous, small, and sharp,—broad at their bases, and pointed at their extremities, like spines.

When the fish is placed upon its under side, and the anterior extremity of the disk is turned backward, the nostrils are observed about three inches beneath its edge; they are covered above by a membranous prolongation, formed by a fold of the skin which arises from their exterior angle and is continued to the median line; the free edge of this fold is five eighths of an inch wide at its greatest width. A second fold commences at their outer upper angle, and passes downward and inward to the middle of the lower edge of the aperture. A third fold commences near the middle of the second, and is directed outward and a little downward. The nasal cavity is divided by a horizontal plate into two portions, and at right angles to this proceed numerous small septa going to the upper and lower margin of the nostrils.

The first dorsal fin, which is three inches and a quarter long and five inches high, is situated at the posterior portion of the pectorals, one half of its base being posterior to those fins.

The second dorsal fin is two inches long, and two inches and three quarters high; it is two and a half inches back of the first dorsal, and three inches anterior to the commencement of the upper lobe of the caudal fin.

The greatest length of the pectorals is two feet, and their greatest breadth is fifteen inches.

The ventrals are ten inches long, and five and a half wide. The anus is large, and is situated beneath the middle of the ventrals.

The caudal fin is nearly triangular; its lower portion is the larger; the depth of this fin, at its posterior extremity when expanded, is eleven inches; its posterior margin is straight.

Length, two to five feet.

Remarks. In the January number of the "American Journal of Science and Arts" for 1843, I made a slight reference to a species of torpedo, which had been taken a few weeks previously upon the coast of Massachusetts. The description of a species captured on the coast of Ireland, published by William Thompson, Esq., Vice President of the Belfast Natural History Society, in the "Annals of Natural History," answered so well to my specimen, that I was led to suppose it must be the *nobiliana*, Buanaparte. When, however, I carefully compared with mine, the description and figure of the foreign species, contained in the second edition of Yarrell's British Fishes, I found no slight differences in the form of the disk of the body, in the size of the pectoral and caudal fins, and in the situation and form of the temporal orifices in the two specimens; and at once suspected the American fish must be an undescribed species. As Yarrell's figure was en-

graved from a dried specimen, and consequently might not perfectly represent the form of this fish, I wrote to Mr. Yarrell, stating to him my doubts of the identity of the two fishes and presenting him with my figure. His opinion coincided perfectly with mine. I have, therefore, the pleasure to present a description of a torpedo hitherto unknown to science; and as no other species of this genus is known to exist on the shores of our hemisphere, I shall call it *Torpedo occidentalis*." The above remarks, I have copied from my communication upon this subject, in the October number of the American Journal of Science and Arts, for 1843. A portion of the following observations also will be noticed to have been transferred from the same paper.

Dr. Mitchill introduced the *Raia torpedo* into his "Fishes of New York," published in 1815, upon the authority of several fishermen with whom he had conversed, who had been electrified by a species of ray, when they were detaching it from the hook with which it was taken. He had never seen a specimen, but had no doubt of its being the *common* torpedo, and consequently catalogued it as such. Since the appearance of Dr. Mitchill's paper, I can find no further notice of the existence of an electrical ray in our waters. In my "Report on the Ichthyology of Massachusetts," published in 1839, I cited the testimony of several observers to prove that an electrical fish, known as the *cramp-fish*, was occasionally taken on the shore of Cape Cod, but had never been seen by a naturalist. During the month of November, 1842, a specimen of this long-looked-for species was captured at Wellfleet by Mr. Seth N. Covell; I fortunately obtained it, and from it prepared the above description. In Massachusetts Bay, this species appears to have been met with only on the eastern shore of Cape Cod, between Provincetown harbor and Orleans, an extent of about thirty miles; and is found in greater numbers upon the eastern shore of Long Point, a narrow neck of land west of the town of Provincetown, than at any other place. In these localities, it is observed only in the months of September, October, and November. The greater number of those taken run ashore upon the sandy beaches. Captain Atwood informs me he has known three individuals to be taken with the hook, by persons fishing for other species; and that others, being discovered in the day-time near the shore, are harpooned and dragged on shore. In the year 1819, and for four or five years afterwards, this species was unusually common at Provincetown — from sixty to eighty being seen in a year; since that time they have been comparatively scarce, and for the ten years preceding 1845, not more than thirty were found; in that year, 1845, a dozen were noticed. While on a visit at Gay Head, in August, 1846, I was informed by Captain Leonard West, of Chilmark, and Mr. Samuel Flanders, keeper of the light-house of Gay Head, that in Chilmark, three miles from Gay Head, they had known

at least fifteen or twenty of this species to be taken by hook and line, and also in seines, for several years in succession, in the spring of the year. Although I had supposed it was a southern species, this was the first positive information I had received of its being taken south of Cape Cod. During the latter part of October, 1845, Captain Atwood brought from Provincetown to Boston a living specimen, weighing about sixty pounds. It was found near the shore apparently benumbed, and was readily dragged ashore by attaching a rope to its tail. In company with my friend, J. B. S. Jackson, M. D., I visited it while it was still alive in the well of the smack in which it had been brought. Upon its being lifted upon the wet deck, it gave a distinct shock. This shock was scarcely perceptible while the fish was quiet, and was most marked when the portion directly over the electrical organs was excited. The most powerful effect was produced by seizing the tail with one hand, and grasping that portion of the pectoral fins which is supplied with nerves from the fifth pair; here, quite a shock was perceived in the arms as high as the elbows. In some cases, the shock produced by this fish, when in the water, is irresistible. The following anecdote I copy from my Report: "Mr. Newcomb, senior, the oldest fisherman in Boston market, stated to me, that his father, who resided at Wellfleet, had a dog which frequently waded into the shallow water of the coves and brought out flounders which he had seized with his mouth. In one of his fishing excursions he attacked a torpedo, which perfectly convulsed him; he dropped the fish, and ran away howling most piteously, and could never be persuaded to resume his fishing." Captain Atwood informs me that he has received a great many very powerful shocks which have thrown him upon the ground as quick as if he had been knocked down with an axe. He has also received many shocks by taking hold of the pole of an harpoon, when he was at the distance of eight or ten feet from the fish; and he has also felt its effects when holding the rope attached to the harpoon; but in this, and in removing the liver from the fish when it is nearly dead, there is generally nothing more than a numbness felt in the fingers, and they seem inclined to straighten; so that he has known it to be difficult to grasp the handle of the knife while cutting the fish.

The smallest individuals do not exceed twenty pounds in weight, while Capt. A. thinks the largest may weigh from one hundred and seventy to two hundred pounds. The largest circumference of any of them, is about twelve feet. They are taken for their oil. The livers of the largest specimens yield about three gallons of oil; those of the smallest ones, a pint; the ordinary sized livers furnish from one to two gallons. Many of the fishermen have an opinion that this oil is serviceable in cases of cramp when exteriorly applied, and relieves cramp in the stomach when internally administered.

But it is principally valued as lamp-oil; for this purpose it is superior to the oil obtained from any other fish, and is equal to purified sperm oil.

Massachusetts, STORER.

ORDER III. CYCLOSTOMI.

Gills purse-shaped, fixed, opening outwards by several apertures. Jaws represented by an immovable cartilaginous ring, formed by the union of the palatine and mandibular bones. Intestinal canal straight and narrow.

FAMILY XXX. PETROMYZONIDÆ.

Body elongated, cylindrical, eel-shaped. No pectorals nor ventrals. Fins without rays.

GENUS I. PETROMYZON. LIN.

Seven branchial apertures on each side of the neck. Maxillary ring armed with strong teeth. Mouth beneath.

PETROMYZON AMERICANUS. *Lesueur.*

The Great Lamprey.

(PLATE XXXVIII FIG. 4)

- Petromyzon marinus*, *Great Lamprey*, MITCH, Trans Lit and Phil Soc N Y 1 p 461
Petromyzon americanus, LESUEUR, Trans Amer Phil Soc, new series, 1 p 382
 " " *American lamprey*, STORER, Report, p 195
 " " *American sea lamprey*, DRAY, Report, p 379 pl 66, fig 216
 " " STORER, Synopsis, p 265

Color. Above, olive-brown, mottled with dark brown, almost black, confluent patches; beneath, of a uniform dull brown. Pupils black, irides golden.

Description. The anterior portion of the body is cylindrical; the posterior compressed. A slight carina is observed upon the back. Head rounded, somewhat flattened on the upper portion in front of the eyes. Snout obtuse. Eyes of moderate size. The distance of the eyes from the snout is less than one twelfth the length of the entire fish. A tubular orifice, a line in its longest diameter, is seen in front of, between the eyes. Posterior to each eye, are seven large branchial apertures, separated about a quarter of

an inch from each other, passing backward in nearly a straight line. When unattached the mouth of this fish is a longitudinal fissure; when attached it is circular, the lip forming a ring, within which are situated numerous hard, horny teeth of a yellow color. The anterior and the inner row of the lateral teeth are the larger; the posterior teeth are more numerous, and smaller. Mucous pores are seen upon the upper portion of the head.

The first dorsal fin arises posterior to the middle of the body; its height is less than one sixth its length.

The second dorsal fin is situated about an inch posterior to the first dorsal; its greatest height is equal to about one sixth its length. This fin is continued to, and united with, the caudal fin.

The anal fin is a mere fringe.

The caudal fin seems, like the extremity of the solid portion of the body, very much compressed, or is an expansion of the dorsal and anal fins.

Length, two to three feet.

Remarks. This species is occasionally taken in Massachusetts Bay attached to pieces of drift-wood and the bottoms of boats and larger vessels. In its spawning season, it ascends the mouths of rivers. In the Merrimac River, at Lowell, it is taken in large quantities. I am indebted to the late Elisha Bartlett, M. D., for the following interesting facts. He wrote me, that "they ascend the rivers a little earlier than the shad, and move mostly in the night. It is not known by the fishermen when they return, as they are never seen. There is a notion that they all die. They are often seen in the Summer in pairs at work together, constructing a little mound of stones. They build this about three feet in diameter at the base, and about two feet high, of stones from the size of an ounce bullet to that of the fish. They often aid each other in carrying the same stone. This is pretty evidently a *labor of love*, as they copulate once in five minutes, or so, during the whole time. The young go down the river when the water begins to freeze. They are from six to eight inches long."

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

PETROMYZON NIGRICANS. *Lesueur.**The Bluish Lamprey.*(PLATE XXXIX. FIG. 6. *a.* Mouth.)

<i>Petromyzon nigricans</i> ,	LESUEUR, Trans Amer Phil Soc, new series, vol 1 p 385
"	" <i>The bluish lamprey</i> , STORER, Report, p 197
"	" <i>The bluish sea lamprey</i> , DELAY, Report, p 381, pl 79, fig 247
"	" " " " LINSLEY, Cat of Fishes of Connecticut
"	" " " " STORER, Synopsis, p 517, 265

Color. The upper part of the body is of a deep bluish green color; beneath, bluish white. Pupils black; irides silvery. On the top of the head, between the eyes, a small white spot exists.

Description. The body is cylindrical anteriorly, compressed posteriorly, very much so at the tail, which terminates in a point. The head is oval, flattened on the top; the length of the head, measured from the snout to the posterior angle of the eye, is less than one eighth the entire length of the fish. The branchial orifices, of equal size, are situated obliquely back of the eyes. The eyes are of moderate size. The mouth is circular; its diameter is equal to two thirds the length of the head and surrounded by a fleshy margin; it is armed within by numerous incurved teeth or horny spines, projecting from widened bases resembling the spines with which the Raiæ are armed; these are much larger on the anterior portion of the disk, and quite small upon the posterior portion.

There are three teeth in the throat; two higher up than the third, which is in front of and between the others. Posterior to these, is a semicircular bony ridge similar to the jaws of the Orthogoriscus.

The first dorsal fin is situated on the posterior half of the fish; it is rounded posteriorly. The distance between the dorsals is equal to half the length of the first dorsal. The anterior portion of the second dorsal fin is considerably higher than the first dorsal. This fin is as long again as the first dorsal; it gradually diminishes in height toward the caudal fin, to which it is attached, and forms with it a continuous fin.

The caudal fin is a simple membrane, triangular at its termination, and uniting with the anal fin which is very small.

Length, three to seven inches.

Remarks. This species is found attached to other species of fishes. It is not unfrequently affixed to mackerel; less often to cod; and still less frequently to haddock.

Massachusetts, LESUEUR, STORER. Connecticut, LINSLEY.

AFTER this memoir on the Fishes of Massachusetts was completed, aware that several species had been described during its preparation, which I had not included in my communication, I requested Mr. Frederick W. Putnam, Curator of Ichthyology in the Boston Society of Natural History, and also in the Essex Institute, to furnish me with a list of these. He has placed me under great obligations by sending me the accompanying catalogue.

1. *Grystes fasciatus*, AG. (Black Bass of the Lakes)

This species, which is the common lake bass and black bass of the Great Lakes, Lake Champlain, and several lakes in New York, and which also extends farther south, has been introduced into Great Sandy Lake, in Wareham. In the Summer of 1862, a specimen of this fish was caught in Massachusetts Bay, by one of the members of the state legislature, and is now in the state cabinet. The fish had evidently found the salt water not much to its liking, as it was much emaciated, and had changed so in its general appearance as at first sight hardly to be recognized.

2. *Priacanthus altus*, GILL, Proc. Philad. Ac. Nat. Sci., 1863, p. 332.

A specimen of this most beautiful little fish was found alive on Marblehead Beach by Miss Mary Nichols, of Salem, and is now in the Essex Institute. Only three other specimens are known of this species.

3. *Bryttus obesus*, GIRARD, Proc. Philad. Ac. Nat. Sci. Syn. *Pomotis obesus*, GIR., Proc. B. S. N. H.

Girard's specimens were from Framingham. I have found it quite common in several ponds in Essex County, and also in Fresh Pond (Cambridge), and in a pond in Malden. It is probably a widely distributed species, and may prove to have been described by some of the earlier authors. (See Gill in Proc. Philad. Ac.)

4. *Cryptacanthodes inornatus*, GILL, Proc. Philad. Ac. Nat. Sci., 1863, p. 332.

Have seen a specimen of this pure white *Cryptacanthodes* taken off Swampscott.

5. *Gasterosteus Wheatlandi*, PUTN., Proc. E. I., v. p. 4, 1866.

Specimens of this species were taken at Nahant, on April 15, 1859, by the late Dr. R. H. Wheatland. The species is very strongly characterized.

6. *Zeus ocellatus*, STORER. *Zenopris ocellatus*, GILL, Proc. Philad. Ac., VI. p. 888.

7. *Trachynotus Corolinus*, GILL.

8. *Trachynotus ovatus*, GUNTHER.

These two species were collected at Wood's Hole by Prof. Baird. See Gill, Proc. Philad. Ac., 1863, p. 332.

9. *Blennius*. (*sp. ?*)

A specimen of Blenny, of a species unknown to me, was found on a barnacle taken from a ship in Salem, just arrived from Africa. The specimen is in the Essex Institute.

10. *Cyprinodon variegatus*, LA CEP.

I have seen specimens taken in several localities on Cape Cod. Gill (Proc. Phil. Ac. 1863, p. 332) mentions that Prof. Baird found species at Wood's Hole; and Lyman (Proc. B. S. N. H. VII p. 76) states that he found it at Yarmouth; (Lyman gives it under the name of *C. ovinus*.)

11. *Centriscus scolopax*, STORER, Proc. B. S. N. H. v. p. 178.

12. *Salmo eryox*.

Prof. Agassiz, in Proc. B. S. N. H., states that a specimen of this European trout or salmon was captured at the mouth of the Merrimac River. The *S. eryox* of Europe (Parnell and Kroger) is referred by Dr. Gunther to *S. trutta*.

13. *Salmo*. (*sp. ?*)

I have seen specimens of a small headed trout, similar to the "Blue back" of the Richardson Lakes, taken in the western part of the state; but have no specimens, and do not know the exact locality. The specimens were not *S. fontinalis*.

14. *Ciliata argentata*, GILL, Proc. Philad. Ac. Nat. Sci., 1863, pp. 241 and 332.

During one tide in the Summer of 1860, Mr. Caleb Cooke, of Salem, found a large number of specimens of this species, on Nahant Beach; and in 1861, I found three specimens in the surf at West's Beach, Beverly. Gill also mentions it from Nahant. (Col. by Dr. Slack.)

15. *Euchalarodus Putnami*, GILL, Proc. Philad. Ac. Nat. Sci., 1864, p. 216, and p. 221.

This species is described by Prof. Gill, from two specimens belonging to the Essex

Institute, which were taken off Beverly Bridge, in Jan., 1858, by my brother, C. A. Putnam.

16. *Liparis*, (*sp.?*) allied to *L. arctica*.

Several years ago, living specimens of this species were in Mr. Cutting's Aquarial Gardens, and were dredged in the bay. Afterwards I obtained two specimens from Mr. Fuller, of Portland, who collected them in Portland harbor. (These specimens are now in the M. C. Z. at Cambridge.) There is also a specimen in the state cabinet, collected at Nahant, by Charles Flint, Esq., and Mr. Alex. Agassiz has also collected specimens at Nahant, which are in the Museum at Cambridge.

17. *Leptocephalus gracilis*, STORER.

Mr. Caleb Cooke, of Salem, found four specimens of this species on Nahant Beach, in the Summer of 1860. These specimens are now in the Essex Institute, Boston Soc. Nat. Hist., and Museum of Comp. Zoölogy.

18. *Ammodytes dubius*, REINH.

Dr. Gunther (Cat. Fish, iv. p. 387) states that there is a specimen of this species, in the British Museum, which was taken in Boston. I much doubt the species being found so far south, though I have seen large specimens of *A. americanus*, that might be easily mistaken for *A. dubius*, from our bay.

19. *Syngnathus*, (*sp.?*)

I have seen three or four specimens of a *Syngnathus* from Cape Cod, which were three or four times the size of *S. peckianus*, and different in other respects from that species. (Specimens in the Essex Institute, and Museum of Comp. Zoölogy.)

20. *Hololepis fusiformis*, PUTN., Bul. Mus. Comp. Zoöl., 1863. Syn. *Boleosoma fusiforme*, GIR.

Girard's specimens were from Framingham. I have found it very plenty in several ponds in Essex County, and also in other parts of the state.

21. *Semotilus corporalis*, ABBOTT, Proc. Philad. Ac. Nat. Sci., 1861, p. 154.

Have collected specimens of this fish in the brooks near Williams College.

INDEX OF SCIENTIFIC NAMES.

	PAGE		PAGE		PAGE
Acanthias,	IX. 232	Anguillidæ,	VIII. 407	Carcharias obscurus,	IX. 219
Americanus,	232	Apodes,	407	vulpes,	221
Acanthocottus,	V. 73	Argentina sphyræna.	VI. 328	Carrasius auratus,	V. 281
quadricornis.	74	Argyreus,	V. 155	Catostomus,	290
variabilis,	74	capillaris,	155	Bostoniensis,	290
Virginianus,	76	unimaculatus,	156	gibbosus,	291
Acanthopterygii,	73	Argyreus,	287	tuberculatus,	291
Achirus,	VIII. 400	atronasus,	288	Centriscus scolopax,	IX. 255
mollis,	400	rubripennis,	288	Centropristes,	V. 58
Acipenser,	431	nasutus,	289	nigricans,	58
oxyrinchus,	431	Aspidophorus.	32	varius,	58
Agonus monopterygius,	V. 32	monopterygius.	32	Cephalis brevis,	VIII. 420
Alopias vulpes,	IX. 221	Atherinidæ,	165	Chcilonemus,	V. 285
Alosa,	VI. 332	Atherina,	165	pulchellus,	286
cyanonoton,	339	Boscii,	165	Chironectes,	V. 269
lineatus,	340	notata,	165	lævigatus,	270
menhaden,	336	Baione fontinalis,	VI. 332	Ciliata argentata,	IX. 255
præstabilis,	332	Balistes aurantiacus,	VIII. 423	Clupea,	VI. 330
sapidissima,	332	Balistidæ,	422	alosa,	341
tyrannus,	334	Batrachus,	V. 271	cœrulea,	330
vernalis,	334	tau,	271	elongata,	330
vulgaris,	332	Belone truncata,	VI. 314	harengus,	330
Aluterus,	VIII. 427	Blennius anguillaris,	V. 263	indigena,	332
cuspidata,	427	gunnellus,	260	menhaden,	334
monoceros,	427	labrosus,	263	sapidissima,	332
Ammodytes,	410	serpentinus,	257	serrata,	334
Americanus,	410	Bodianus rufus,	57	tyrannus,	334
dubius,	IX. 256	Boleosoma,	78	vernalis,	334
lancea,	VIII. 410	Olmstedii,	78	vitata,	341
tobianus,	410	tessellatum,	78	Clupeidæ,	330
Anarrhicas,	V. 265	Brosmius flavescens,	VI. 368	Cottus,	V. 72
lupus,	265	vulgaris,	368	Acadianus,	83
vomerrinus,	265	Bryttus obesus,	IX. 254	gobio,	72
Anguilla,	VIII. 408	Caranx chrysos,	V. 153	gracilis,	72
Bostoniensis,	408	Carcharias,	IX. 217	Groenlandicus,	74
tenuirostris,	408	Atwoodi,	222	monopterygius,	76
vulgaris,	408	griseus,	217	octodecimspinosus,	76

	PAGE		PAGE		PAGE
<i>Cottus quadricornis</i> ,	v. 74	<i>Esox longirostris</i> ,	vi. 314	<i>Gunnellus mucronatus</i> ,	v. 260
<i>scorpius</i> ,	74	<i>lucius</i> ,	311	<i>Gymnodontidæ</i> ,	viii. 417
<i>variabilis</i> ,	74	<i>ornatus</i> ,	313	<i>Gymnogaster argenteus</i> ,	v. 147
<i>Virginianus</i> ,	76	<i>pisciculus</i> ,	v. 294	<i>Hemitripterus</i> ,	83
<i>Cryptacanthodes</i> ,	81	<i>pisculentus</i> ,	294	<i>Acadianus</i> ,	83
<i>inornatus</i> ,	ix. 254	<i>radiatus</i> ,	vi. 311	<i>Americanus</i> ,	83
<i>maculatus</i>	v. 82	<i>reticulatus</i> ,	311	<i>Hippocampus</i> ,	viii. 415
<i>Ctenolabrus</i> ,	274	<i>tredecemlineatus</i> ,	311	<i>brevirostris</i> ,	46
<i>burgall</i> ,	274	<i>zonatus</i> ,	v. 294	<i>Hudsonius</i> ,	416
<i>chogset</i> ,	274	<i>Etheostoma Olmstedii</i> ,	78	<i>Hippoglossus</i> ,	vi. 370
<i>cæruleus</i> ,	274	<i>Euchalarodus Putnami</i> ,	ix. 255	<i>vulgaris</i> ,	370
<i>Cybium</i> ,	145	<i>Fistularia</i> ,	vi. 318	<i>Hololepis fusiformis</i> ,	ix. 256
<i>maculatum</i> ,	145	<i>serrata</i> ,	318	<i>Hydrargyra</i> ,	vi. 309
<i>Cyclopteridæ</i> ,	viii. 401	<i>Fistularidæ</i> ,	318	<i>fasciata</i> ,	v. 294
<i>Cyclopterus cæruleus</i> ,	402	<i>Fundulus</i> ,	v. 293	<i>flavula</i> ,	vi. 309
<i>lumpus</i> ,	402	<i>fasciatus</i> ,	294	<i>formosa</i> ,	309
<i>Cyclostomi</i> ,	ix. 251	<i>multifasciatus</i> ,	296	<i>multifasciata</i> ,	v. 296
<i>Cyprinidæ</i> ,	v. 280	<i>nigro-fasciatus</i> ,	295	<i>nigro-fasciata</i> ,	295
<i>Cyprinodon flavulus</i> ,	vi. 309	<i>pisculentus</i> ,	294	<i>ornata</i> ,	294
<i>variegatus</i> ,	ix. 255	<i>viridescens</i> ,	294	<i>pisculenta</i> ,	294
<i>Cyprinodontidæ</i> ,	v. 293	<i>zebra</i> ,	294	<i>trifasciata</i> ,	vi. 309
<i>Cyprinus</i> ,	280	<i>zonatus</i> ,	294	<i>vernalis</i> ,	309
<i>atronasus</i> ,	288	<i>Gadidæ</i> ,	vi. 343	<i>Hypsolepis</i> ,	v. 284
<i>auratus</i> ,	281	<i>Gadus æglefinus</i> ,	355	<i>cornutus</i> ,	284
<i>catostomus</i> ,	290	<i>albidus</i> ,	363	<i>Johnius regalis</i> ,	122
<i>chrysoleucas</i> ,	283	<i>callarias</i> ,	343	<i>Jugulares</i> ,	vi. 343
<i>cornutus</i> ,	284	<i>compressus</i> ,	360	<i>Labeo gibbosus</i> ,	v. 291
<i>Dactylopterus</i> ,	69	<i>flavescens</i> ,	368	<i>Labrax</i> ,	54
<i>volitans</i> ,	70	<i>longipes</i> ,	365	<i>lineatus</i> ,	54
<i>Diodon mola</i> ,	70	<i>merlucius</i> ,	363	<i>mucronatus</i> ,	57
<i>Echeneidæ</i> ,	viii. 404	<i>pruinus</i> ,	357	<i>rufus</i> ,	57
<i>Echeneis</i> ,	404	<i>purpureus</i> ,	358	<i>Labridæ</i> ,	274
<i>albicauda</i> ,	404	<i>tomcodus</i> ,	357	<i>Labrus Americanus</i> ,	276
<i>naucrates</i> ,	404	<i>Gasterosteus</i> ,	v. 88	<i>appendix</i> ,	62
<i>quatuordecemlaminatus</i> ,	406	<i>apeltes</i> ,	89	<i>chogset</i> ,	274
<i>Eleutheropomi</i> ,	430	<i>biaculeatus</i> ,	88	<i>squeteague</i> ,	62
<i>Enchelyopus Americanus</i> ,	vi. 365	<i>Dekayi</i> ,	91	<i>tautoga</i> ,	276
<i>Engraulis</i> ,	341	<i>occidentalis</i> ,	91	<i>versicolor</i> ,	127
<i>Mitchilli</i> ,	341	<i>pungitius</i> ,	91	<i>Lactophrys Yalei</i> ,	viii. 429
<i>vittata</i> ,	341	<i>quadracus</i> ,	88	<i>Lamna</i> ,	ix. 225
<i>Esocidæ</i> ,	311	<i>Wheatlandi</i>	ix. 254	<i>punctata</i> ,	225
<i>Esox</i> ,	311	<i>Gobidæ</i> ,	v. 91	<i>Leiodon echinatum</i>	ix. 235
<i>belone</i> ,	314	<i>Grystes fasciatus</i> ,	ix. 254	<i>Leptocephalus gracilis</i> ,	256
<i>fasciatus</i> ,	311	<i>Gunnellus</i> ,	v. 260	<i>Leuciscus Americanus</i> ,	v. 283
<i>flavulus</i> ,	309	<i>macrocephalus</i> ,	261	<i>argenteus</i> ,	286

	PAGE		PAGE		PAGE
<i>Leuciscus atronasmus</i> ,	v. 288	<i>Mustelus canis</i> ,	ix. 227	<i>Phycis Americanus</i> ,	vi. 365
<i>Boscii</i> ,	283	<i>Myliobatis</i> ,	245	<i>filamentosus</i> ,	369
<i>chrysoleucas</i> ,	283	<i>acuta</i> ,	245	<i>furcatus</i> ,	365
<i>cornutus</i> ,	284	<i>bispinosus</i> ,	245	<i>Pimelodus</i> ,	v. 279
<i>nasutus</i> ,	289	<i>Ophidium mucronatum</i> ,	v. 94	<i>atrarius</i> ,	279
<i>pulchellus</i> ,	286	<i>Orthagoriscus</i> ,	viii. 420	<i>catus</i> ,	279
<i>Storeri</i> ,	286	<i>mola</i> ,	420	<i>nebulosus</i> ,	279
<i>Lercosomus</i> ,	282	<i>Osmerus</i> ,	vi. 326	<i>Plagiostomi</i> ,	ix. 217
<i>Americanus</i> ,	282	<i>eperlanus</i> ,	327	<i>Planidæ</i> ,	vi. 370
<i>Lophidæ</i> ,	267	<i>viridescens</i>	327	<i>Platessa</i> ,	viii. 389
<i>Lophius</i> ,	267	<i>Ostracion Yalei</i> ,	429	<i>dentata</i> ,	391
<i>Americanus</i> ,	267	<i>Ostracionidæ</i> ,	429	<i>ferruginea</i> ,	392
<i>bufo</i> ,	271	<i>Otolithus</i> ,	v. 92	<i>glabra</i> ,	393
<i>piscator</i> ,	267	<i>regalis</i> ,	122	<i>oblonga</i> ,	395
<i>piscatorius</i> ,	267	<i>Pagrus</i> ,	127	<i>ocellaris</i> ,	397
<i>Lophobranchii</i> ,	viii. 412	<i>argyrops</i> ,	127	<i>plana</i> ,	389
<i>Lota</i> ,	vi. 360	<i>Palinurus</i> ,	151	<i>quadrocellata</i> ,	397
<i>compressa</i> ,	360	<i>perciformis</i> ,	152	<i>Plectognathi</i> ,	417
<i>Lumpus</i> ,	viii. 402	<i>Pastinaca</i> ,	ix. 243	<i>Pleuronectes</i> ,	398
<i>anglorum</i> ,	402	<i>hastata</i> ,	244	<i>aquosus</i> ,	398
<i>vulgaris</i> ,	402	<i>Pelamys</i> ,	v. 141	<i>maculatus</i> ,	398
<i>Merlangus</i> ,	vi. 358	<i>sarda</i> ,	141	<i>oblongus</i> ,	395
<i>purpureus</i> ,	358	<i>Peprilus cryptosus</i> ,	162	<i>hippoglossus</i> ,	vi. 370
<i>Merluccius</i> ,	363	<i>Perca</i> ,	51	<i>Polynemus sex-radiatus</i> ,	v. 70
<i>albidus</i> ,	363	<i>acuta</i> ,	52	<i>Pomotis</i> ,	60
<i>vulgaris</i> ,	363	<i>flavescens</i> ,	52	<i>appendix</i> ,	62
<i>Molva Huntii</i> ,	360	<i>gracilis</i> ,	52	<i>rubricauda</i> ,	62
<i>Monacanthus</i> ,	viii. 423	<i>granulata</i> ,	52	<i>vulgaris</i> ,	60
<i>aurantiacus</i> ,	423	<i>marina</i> ,	86	<i>Priacanthus altus</i> ,	ix. 254
<i>Massachusettsensis</i> ,	425	<i>minima</i> ,	78	<i>Prionotus</i> ,	v. 63
<i>signifer</i> ,	426	<i>Mitchilli</i> ,	54	<i>Carolinus</i> ,	66
<i>Morcielago</i> ,	v. 70	<i>Norvegica</i> ,	86	<i>lineatus</i> ,	64
<i>Morrhua</i> ,	vi. 343	<i>serrato-granulata</i> ,	52	<i>palmipes</i> ,	66
<i>æglefinus</i> ,	355	<i>varia</i> ,	58	<i>pilatus</i> ,	68
<i>Americana</i> ,	343	<i>Percidæ</i> ,	51	<i>strigatus</i> ,	64
<i>pruinosa</i> ,	357	<i>Percina minima</i> ,	78	<i>Raia</i> ,	ix. 240
<i>tomcodus</i> ,	357	<i>Petimbuabo Brazil</i> ,	vi. 318	<i>centroura</i> ,	244
<i>Motella</i> ,	361	<i>Petromyzon</i> ,	ix. 251	<i>diaphanes</i> ,	240
<i>caudacuta</i> ,	361	<i>Americanus</i> ,	251	<i>lævis</i> ,	242
<i>Mugil</i> ,	v. 167	<i>marinus</i> ,	251	<i>ocellata</i> ,	240
<i>lineatus</i> ,	167	<i>nigricans</i> ,	253	<i>Raiidæ</i> ,	240
<i>Mugilidæ</i> ,	167	<i>Petromyzonidæ</i> ,	251	<i>Rhinichthys nasutus</i> ,	viii. 289
<i>Muraena Bostoniensis</i> ,	viii. 408	<i>Pholis</i> ,	v. 258	<i>Rhombus</i> ,	v. 161
<i>Muraenoides guttata</i> ,	v. 260	<i>subbifurcatus</i> ,	258	<i>aquosus</i> ,	viii. 395, 398
<i>Mustelus</i> ,	ix. 227	<i>Phycis</i> ,	vi. 365	<i>cryptosus</i> ,	v. 162

	PAGE		PAGE		PAGE
<i>Rhombus triacanthus</i> ,	v. 162	<i>Semotilus corporalis</i> ,	IX. 256	<i>Temnodon saltator</i> ,	v. 159
<i>Salmo</i> ,	VI. 315	<i>Seriola</i> ,	v. 157	<i>Tetraodon</i> ,	VIII. 417
<i>eperlanus</i> ,	VI. 327	<i>zonata</i> ,	157	<i>lævigatus</i> ,	418
<i>eryox</i> ,	IX. 255	<i>Serranus Norvegicus</i> ,	86	<i>mathematicus</i> ,	418
<i>fontinalis</i> ,	VI. 320	<i>Siluridæ</i> ,	278	<i>mola</i> ,	420
<i>nigricans</i> ,	322	<i>Sommosus brevipinna</i> ,	IX. 235	<i>turgidus</i> ,	417
<i>salar</i> ,	320	<i>Sparidæ</i> ,	v. 120	<i>Thynnus</i> ,	v. 143
<i>Salmonidæ</i> ,	320	<i>Sparus</i> ,	126	<i>secundo dorsalis</i> ,	143
<i>Sargus</i> ,	v. 125	<i>argyrops</i> ,	127	<i>vulgaris</i> ,	143
<i>ovis</i> ,	126	<i>Sphyræna borealis</i> ,	163	<i>Torpedo</i> ,	IX. 247
<i>Scomber</i> ,	129	<i>Spinax acanthias</i> ,	IX. 232	<i>occidentalis</i> ,	247
<i>chrysos</i> ,	153	<i>Squalidæ</i> ,	217	<i>Trachinotus argenteus</i> ,	v. 152
<i>colias</i> ,	130	<i>Squalus vulpes</i> ,	221	<i>Carolinus</i> ,	IX. 255
<i>Dekayi</i> ,	130	<i>canis</i> ,	227	<i>ovatus</i> ,	255
<i>græx</i> ,	132	<i>elephas</i> ,	229	<i>Trichiurus</i> ,	v. 147
<i>maculatus</i> ,	146	<i>maximus</i> ,	229	<i>argenteus</i> ,	147
<i>plumbeus</i> ,	159	<i>peregrinus</i> ,	229	<i>lepturus</i> ,	147
<i>sarda</i> ,	141	<i>punctatus</i> ,	225	<i>Trigla Carolina</i> ,	64
<i>vernalis</i> ,	132	<i>zygæna</i> ,	238	<i>lineata</i> ,	64
<i>zonatus</i> ,	157	<i>Stilbe chrysoleucas</i> ,	v. 283	<i>palmipes</i> ,	66
<i>Scomberesox</i> ,	VI. 315	<i>Stromateus cryptosus</i> ,	162	<i>volitans</i> ,	70
<i>equirostrum</i> ,	315	<i>triacanthus</i> ,	162	<i>Triglidæ</i> ,	63
<i>scutellatum</i> ,	315	<i>Syngnathidæ</i> ,	VIII. 412	<i>Trygon centroura</i> ,	IX. 244
<i>Storeri</i> ,	315	<i>Syngnathus</i> ,	412	<i>Umbrina</i> ,	v. 123
<i>Scombridæ</i> ,	v. 129	<i>fasciatus</i> ,	412	<i>alburnus</i> ,	124
<i>Scopelus Humboldtii</i> ,	VI. 328	<i>fuscus</i> ,	412	<i>nebulosa</i> ,	124
<i>Scorpena flavula</i> ,	v. 83	<i>hippocampus</i> ,	415	<i>Uranidea quiescens</i> ,	72
<i>Norvegica</i> ,	86	<i>Peckianus</i> ,	412	<i>Xiphias</i> ,	149
<i>purpurea</i> ,	83	<i>typhle</i> ,	412	<i>gladius</i> ,	149
<i>rufa</i> ,	83	<i>viridescens</i> ,	412	<i>Zeus capillaris</i> ,	155
<i>Scymnus</i> ,	IX. 235	<i>Sturionidæ</i> ,	430	<i>ocellatus</i> ,	IX. 255
<i>brevipinna</i> ,	225	<i>Tautoga</i> ,	v. 276	<i>Zoarces</i> ,	v. 263
<i>Sebastes</i> ,	v. 86	<i>Americana</i> ,	276	<i>anguillaris</i> ,	263
<i>Norvegicus</i> ,	86	<i>cœrulea</i> ,	274	<i>labrosus</i> ,	263
<i>Selachus</i> ,	IX. 228	<i>niger</i> ,	276	<i>Zygæna</i> ,	IX. 238
<i>maximus</i> ,	229	<i>Temnodon</i> ,	159	<i>malleus</i>	238

INDEX OF POPULAR NAMES.

	PAGE		PAGE		PAGE
Albicore,	v. 145	Broad-hiner, cryptous,	v. 162	File-fish, orange,	VIII. 423
Alewife,	VI. 334	Bull-head,	80	sharp tailed,	427
American,	334	common,	76	unicorn,	427
bay,	334	Greenland,	74	Flat-fish of New York.	389
spring,	334	river,	72	rusty,	392
Anchovy, American,	341	Burbot, compressed,	VI. 360	Flounder, four spotted.	397
Angler, American,	v. 267	Butter-fish, American,	v. 260	long-toothed,	395
common,	267	Caranx, yellow,	153	oblong,	395
Ape, sea,	VI. 221	Carp, American,	283	of Massachusetts,	389
Argentine,	328	golden,	281	New York,	391
Argyreiose, hair-finned,	v. 155	Chogset,	274	rusty,	392
Aspidophore, American,	80	Cod, American,	VI. 343	spotted,	395
with one dorsal,	80	common, of New York,	343	watery.	395
Barracuda, northern,	163	Tom,	357	Gar-fish,	VI. 314
Bass, Black Sea,	58	Codling,	365	banded,	314
rock,	54	Conner,	v. 274	Globe-fish, brown,	VIII. 418
ruddy,	57	Coryphene perch,	VI. 152	Goose-fish,	v. 267
small American,	57	Cramp-fish,	IX. 247	Green-fish,	159
striped,	54	Cusk,	VI. 368	Ground-fish,	79
Basse, fry,	VI. 310	Dab-rusty,	VIII. 392	Grunter,	64
Bat fish,	v. 70	Dace, black nosed,	v. 288	web-fingered,	66
Bellows fish,	267	long nosed,	289	Gudgeon, New York,	VI. 310
Bergall,	274	roach,	286	Gunnell, spotted,	v. 260
Bergylt,	86	silvery,	286	big-headed,	261
Bill-fish,	VI. 315	Darter, tessellated,	78	Gurnard,	64
Black-fish,	v. 276	Dog-fish, picked,	IX. 227, 232	banded,	64
Black pilot,	152	spinous,	232	flying,	70
Blenny, eel shaped,	257	Dory, hair-finned,	v. 155	web-fingered,	66
large lipped,	263	one spotted,	156	Haddock, common American,	VI. 355
snake shaped,	257	Eel, fresh water,	VIII. 408	Norway,	v. 86
thick lipped,	263	little sand,	410	Hair-tail, silvery,	147
Blue-back,	VI. 339	sand,	410	Hake,	VI. 363
Blue-fish,	v. 159, 274	of Massachusetts,	408	American,	363
Bonetta,	141	New York,	408	squirrel,	367
Bonito,	141	Eel-pout,	VI. 360	white,	365
Bony-fish,	VI. 336	File-fish, long tailed unicorn,	VIII. 427	Halibut,	370
Bream, red tailed,	v. 62	Massachusetts,	425	Hard-head,	336

	PAGE		PAGE		PAGE
Harvest-fish, short-finned,	v. 162	Perch, American,	v. 53	Robin, sea,	v. 64
Hemdurgan,	86	black,	58	Rose-fish,	VIII. 86
Herring, common American,	VI. 330	common, of Massachusetts,	53	Rough-head,	284
of Massachusetts,	330	pond,	59	Rudder-fish,	152
Horned-pout,	v. 278	red,	59	Sail-fish,	IX. 229
Hound, smooth,	IX. 227	sea,	86	Salmon, common,	VI. 320
Killifish, banded,	v. 294	sharp-nosed,	53	common sea,	320
barred,	294	white,	57	Sand-launce, banded,	VIII. 410
big,	294	yellow,	53	Scapung,	v. 127
striped,	VI. 310	Pickrel, common,	VI. 311	Sculpin, common,	76
white bellied,	v. 294	smaller,	313	deep-water,	83
yellow bellied,	294	varied,	311	Scup,	127
King-fish,	124	Pike, federation,	311	Sea-horse, short-nosed,	VIII. 416
Lamprey,	IX. 251	long-jawed, fresh water,	314	Hudson River,	416
American,	251	Pipe-fish, American,	318	Sea-wolf,	265
American sea,	251	banded,	VIII. 412	Sebastes, northern,	86
bluish,	253	brown,	412	Shad, American,	VI. 332
bluish sea,	253	green,	412	hickory,	340
great,	251	Peck's,	412	Shanny, radiated,	v. 258
Leuciscus, beautiful,	v. 286	sea-horse,	416	Shark, basking,	IX. 229
silvery,	286	tobacco,	VI. 318	dusky,	219
Lump-fish,	VIII. 402	Plaice,	VIII. 393	elephant,	229
sucker,	402	New York,	398	gray,	217
Mackerel, banded,	v. 156	Pollock,	VI. 358	fox,	221
bull-eyed,	132	of New York,	358	green-backed,	225
chub,	132	Pond-fish, common,	v. 60	hammer-head,	238
fall,	132	black-caud,	60	long-tailed,	221
horse,	159	Porbeagle, mackerel,	IX. 225	mackerel,	225
Spanish,	130	Porgee,	v. 127	man-eater,	222
spotted,	146	big,	127	thresher,	221
spring,	132	Puffer, common,	VIII. 417	Sheep's head,	v. 126
thimble-eyed,	132	lineated,	418	Shiner,	283
yellow,	153	smooth,	418	Silverside, dotted,	165
Marsh-bankers,	VI. 336	Raven, American sea,	v. 83	small,	165
Menhaden,	336	Ray,	IX. 240	Skate, smooth,	IX. 242
Minnnow, banded,	v. 295	clear-nosed,	240	smooth-backed,	242
barred,	296	ocellated,	240	Skip-jack,	v. 142
brook,	288	prickly-tailed,	244	Sleeper,	IX. 235
ornamented,	294	smooth-tailed,	245	Smelt, American,	VI. 327
Mouse-fish, smooth,	270	whip-sting,	244	Snapper,	v. 86
Mullet, striped,	167	Red-fin,	v. 284	Sole, New York,	VIII. 401
Nurse,	IX. 235	Remora, fourteen plaited,	VIII. 406	Sparus, silver-eyed,	v. 127
Ophidium, spinous,	v. 260	Indian,	404	Spirling,	VI. 331
Osseus fishes	51	white-tailed,	404	Stickleback, bloody,	v. 89
Peprilus, three spined,	162	Roach, harlequin,	v. 66	four spined,	89

INDEX OF POPULAR NAMES.

263

	PAGE		PAGE		PAGE
Stickleback, many spined,	v. 91	Swallow, sea,	v. 70	Trout, spotted,	vi. 322
ten spined,	91	Swell-fish,	417	Trunk-fish, Yale's,	viii. 429
two spined,	88	Swordfish, common,	149	Tunney, American,	v. 143
Sturgeon, sharp-nosed,	viii. 431	Tautog,	276	Turbot,	viii. 398
Sucker,	v. 290	Tetraodon, mathematical,	viii. 418	Tusk, yellow,	vi. 368
chub,	291	Toad-fish, common,	v. 271	Weak fish,	v. 122
gibbous,	291	Trout, black,	vi. 322	Whiting, New York,	vi. 363
horned,	291	common,	322	Wide-gab,	v. 267
Sun-fish, short,	420	common brook,	322	Wolf-fish, American,	265
short-headed,	420	speckled,	322	Wry-mouth, spotted,	82

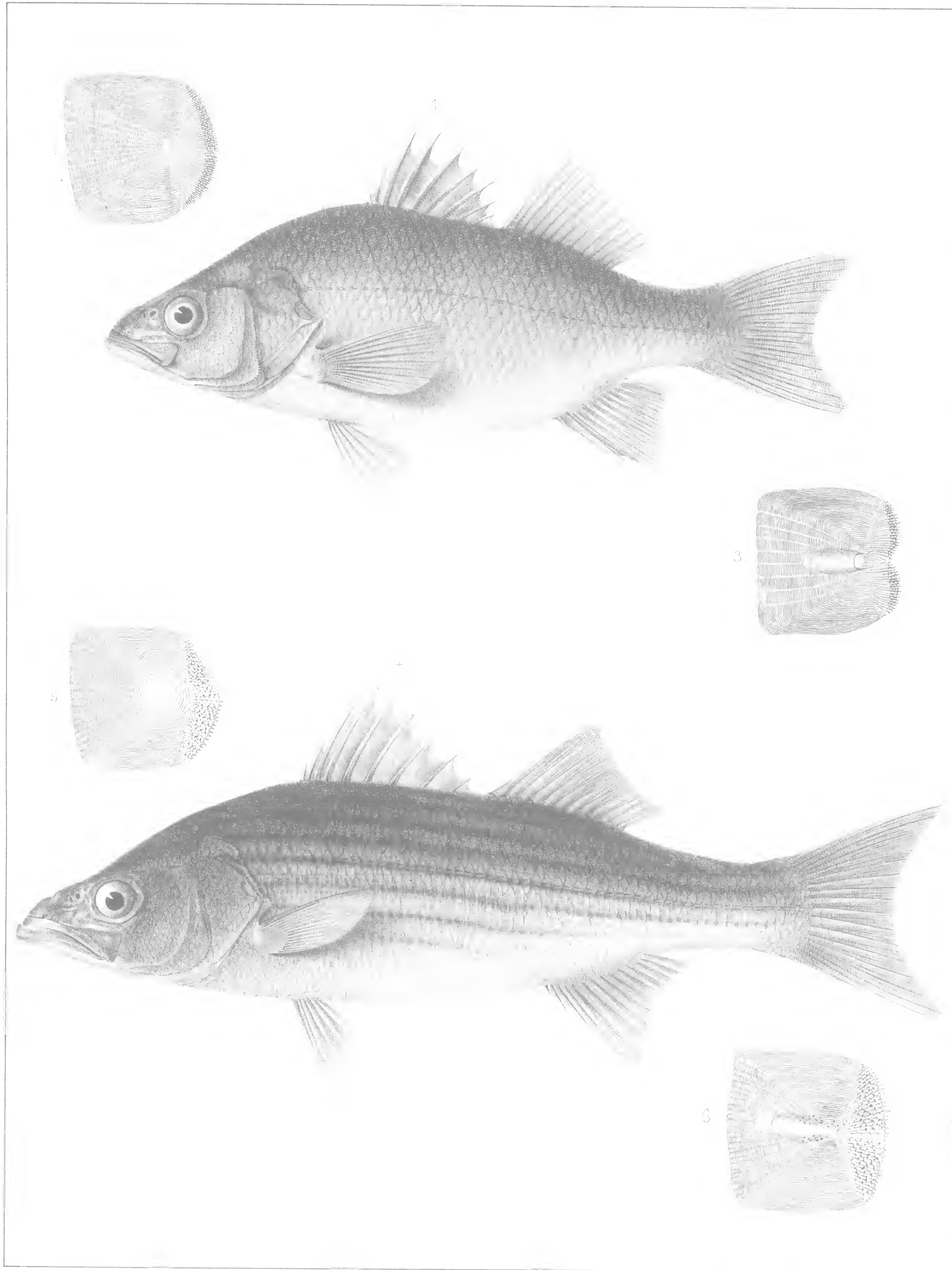
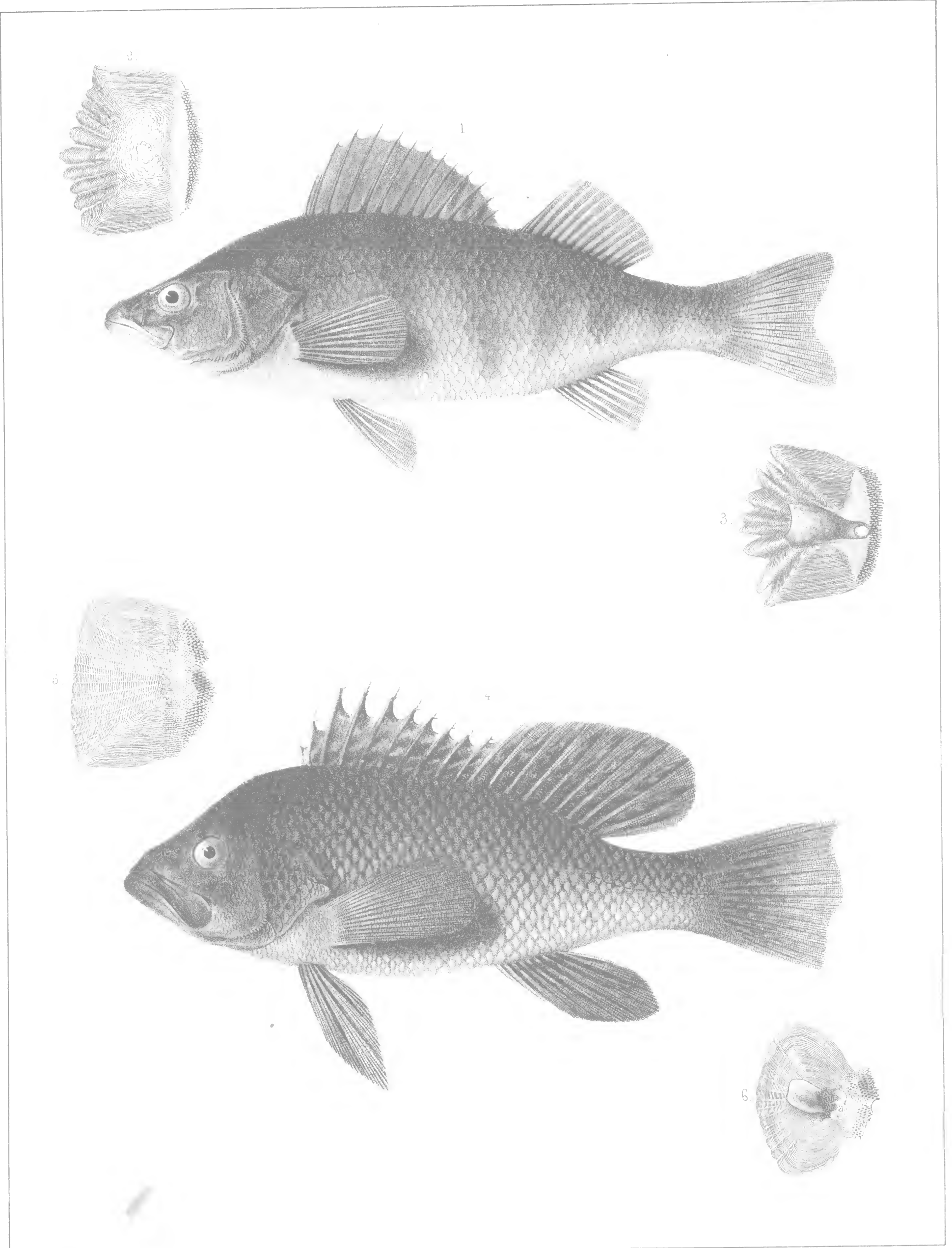


Figure 3 Plate 1005. 1006

A. Sowerby del. 1005

1-3 LABRAX RUFUS DeKay

4-6 LABRAX LINEATUS Cuv.

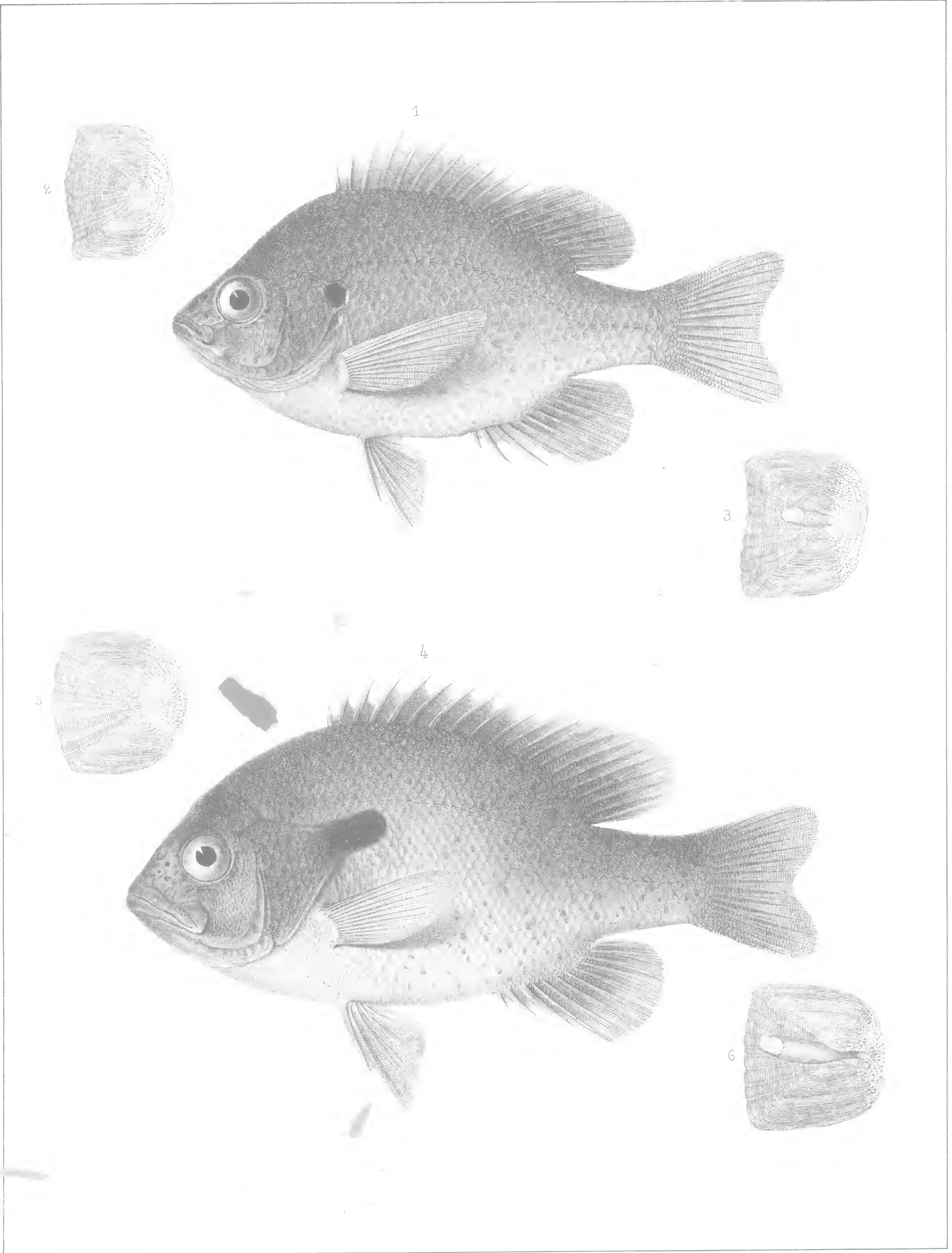


after R. S. Steadman's work

A. S. Soper on stone

1-3. PERCA FLAVESCENS Cuv.

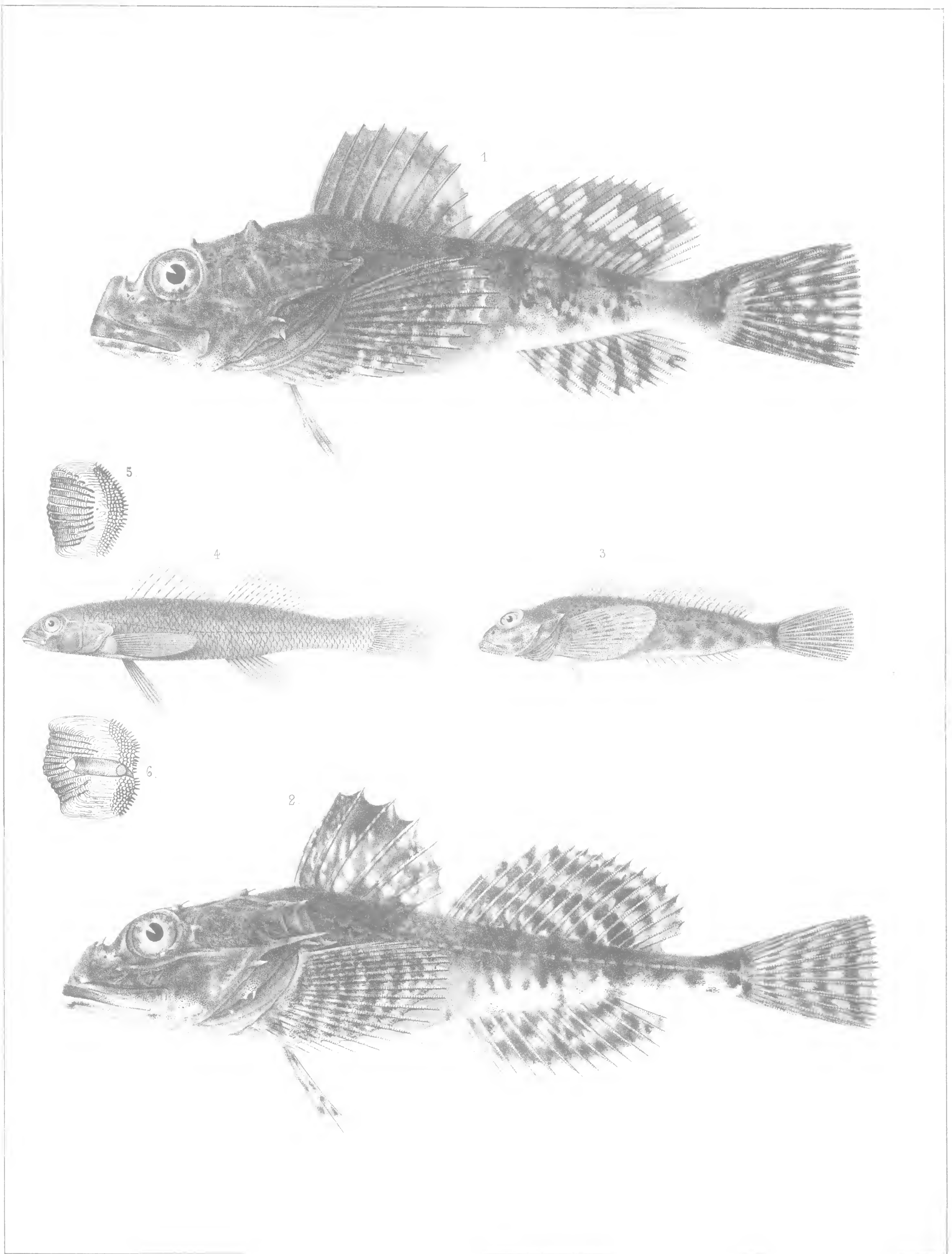
4-6. CENTROPRISTES VARIUS Storer.



upr. 8. 1861. d. 1862.

A. Sonrel on stone.

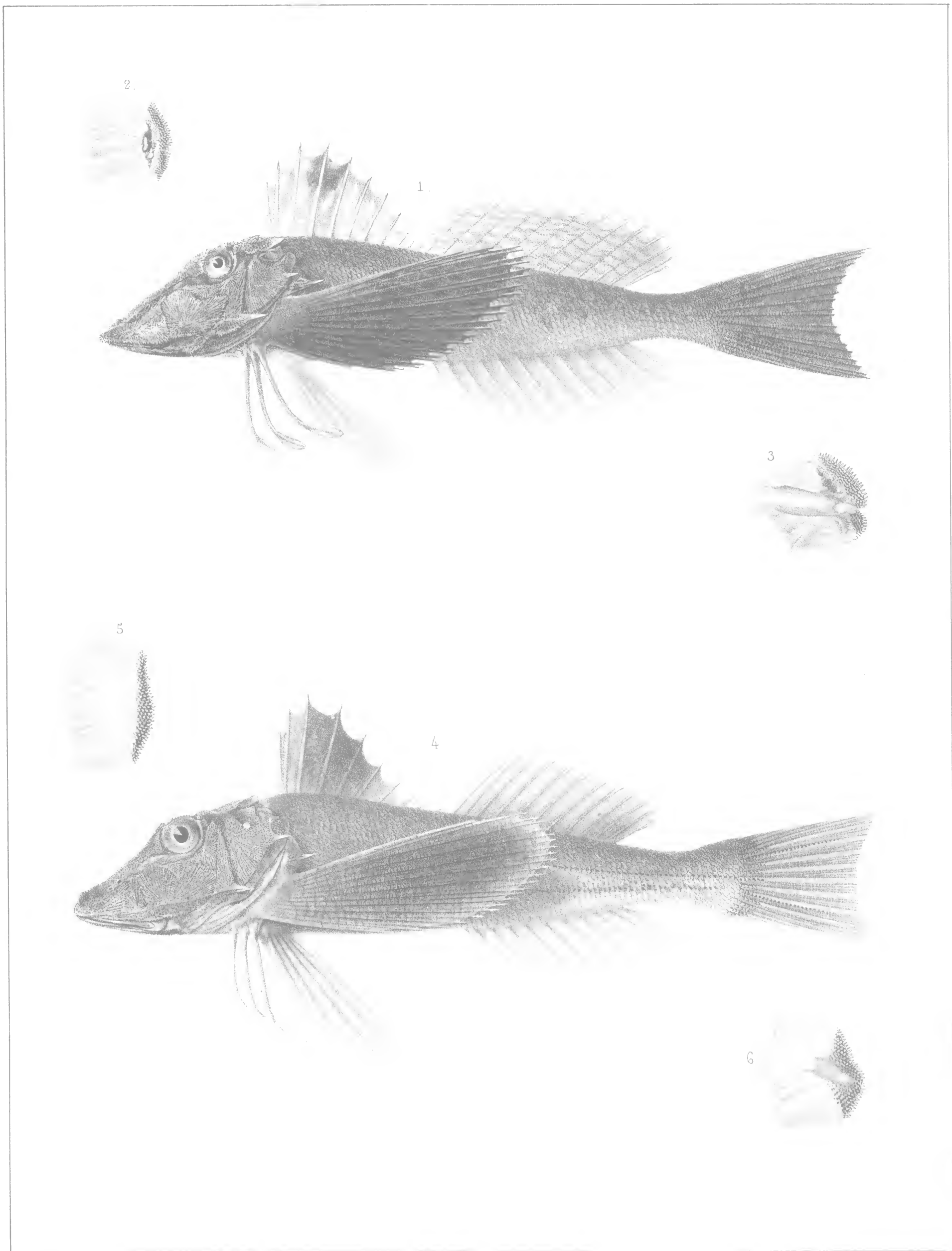
1-3 POMOTIS VULGARIS Cuv. - 4-6. POMOTIS APPENDIX Dekay.



A. Sonrel.

Printed by Tappan & Bradford.

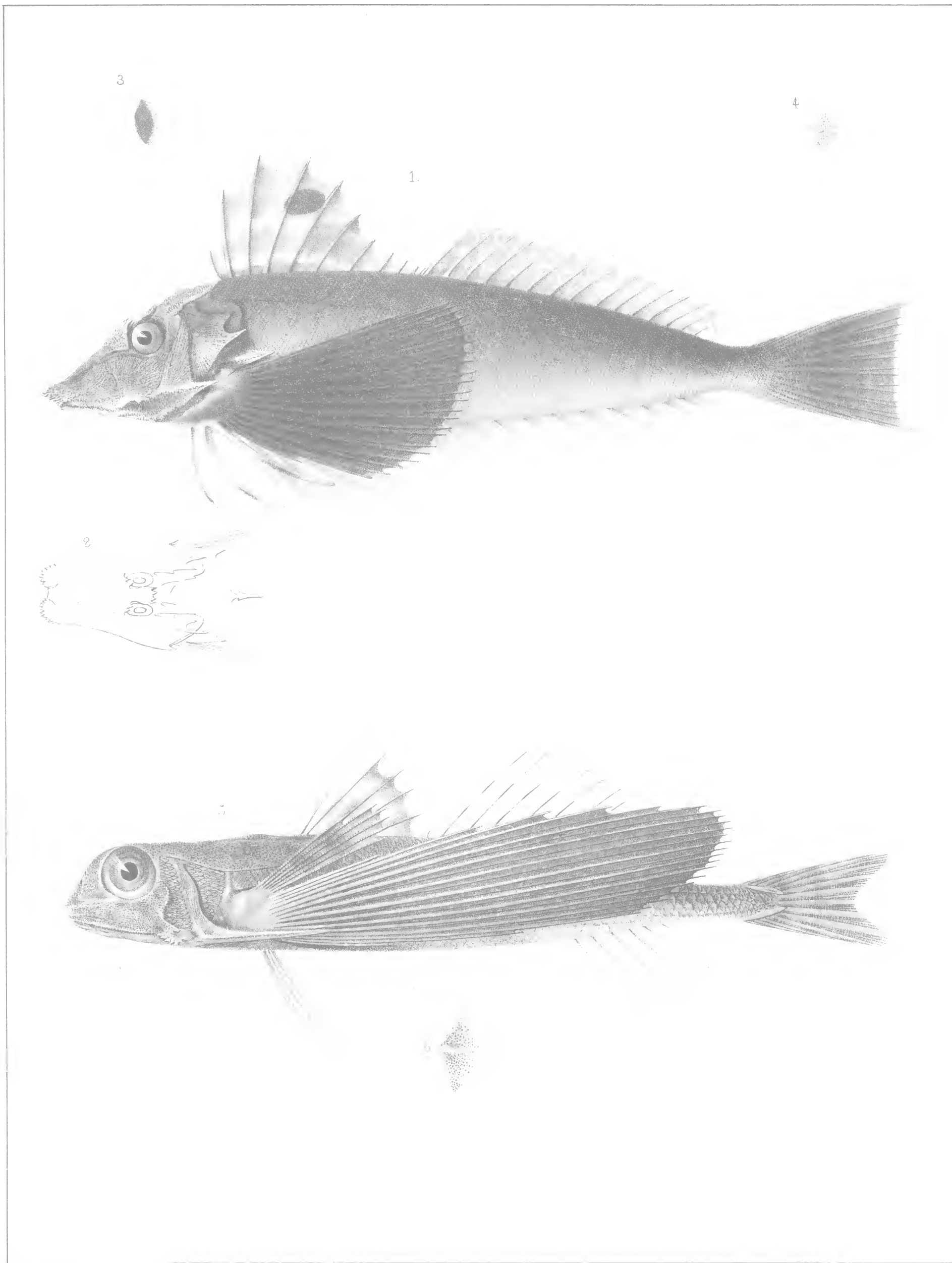
1. ACANTHOCOTTUS VARIABILIS Girard. — 2. A. VIRGINIANUS Girard.
 3. COTTUS GRACILIS Heckel. — 4-6. BOLEOSOMA OLMSTEDI Ag.



A. S. S. S. S.

Printed by [unclear] Bradford

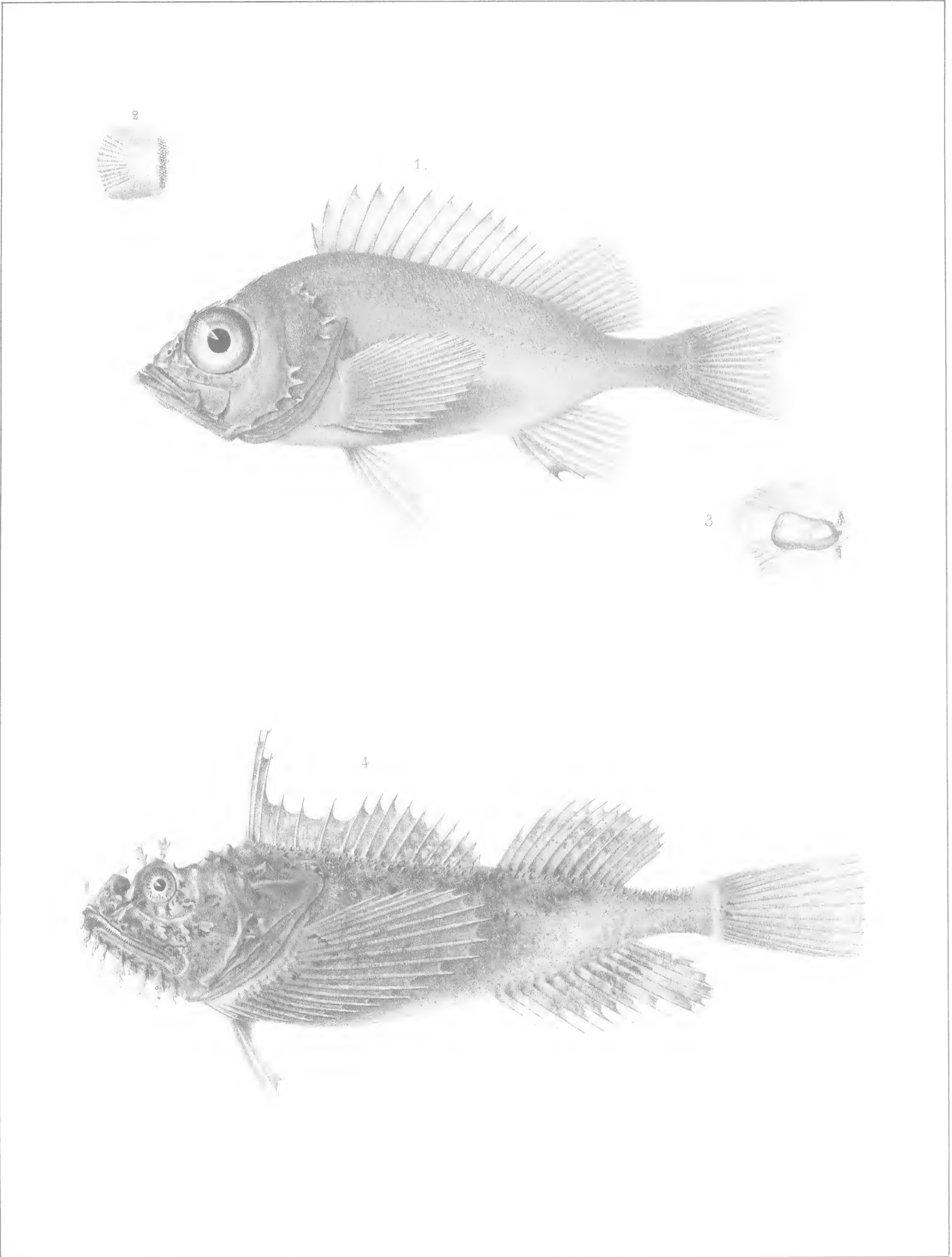
1-3. PRIONOTUS PALMIPES Storer.—4-6 PRIONOTUS LINEATUS Dekay



W.H. Tappan & A. Sonrel from nat.

Printed by Tappan & Bradford

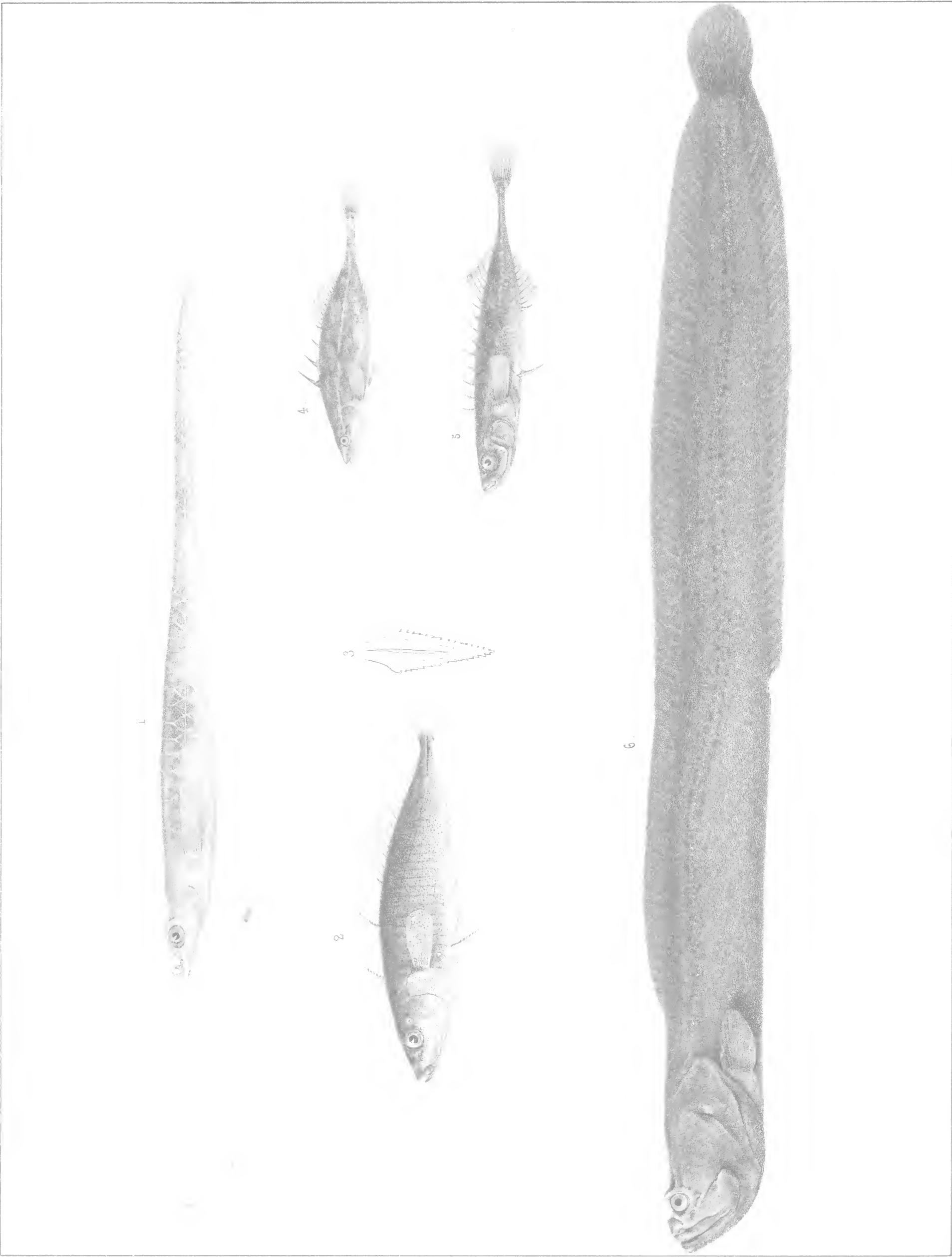
1-4. PRIONOTUS PILATUS Storer. — 5, 6. DACTYLOPTERUS VOLITANS Cuv.



A. Sonrel from nat.

Printed by Tappan & Bradford.

1-3. SEBASTES NORVEGICUS Cuv. — 4. HEMITRIPTERUS ACADIANUS Storer.



W. H. Tappan & A. S. Sargent, Fishes, etc.

Printed by Tappan & Bradford.

1. ASPIDOPHORUS MONOPTERYGIUS Cuv. — 2 3. GASTEROSTEUS BIACULEATUS Mitch. — 4. G. QUADRACUS Mitch.

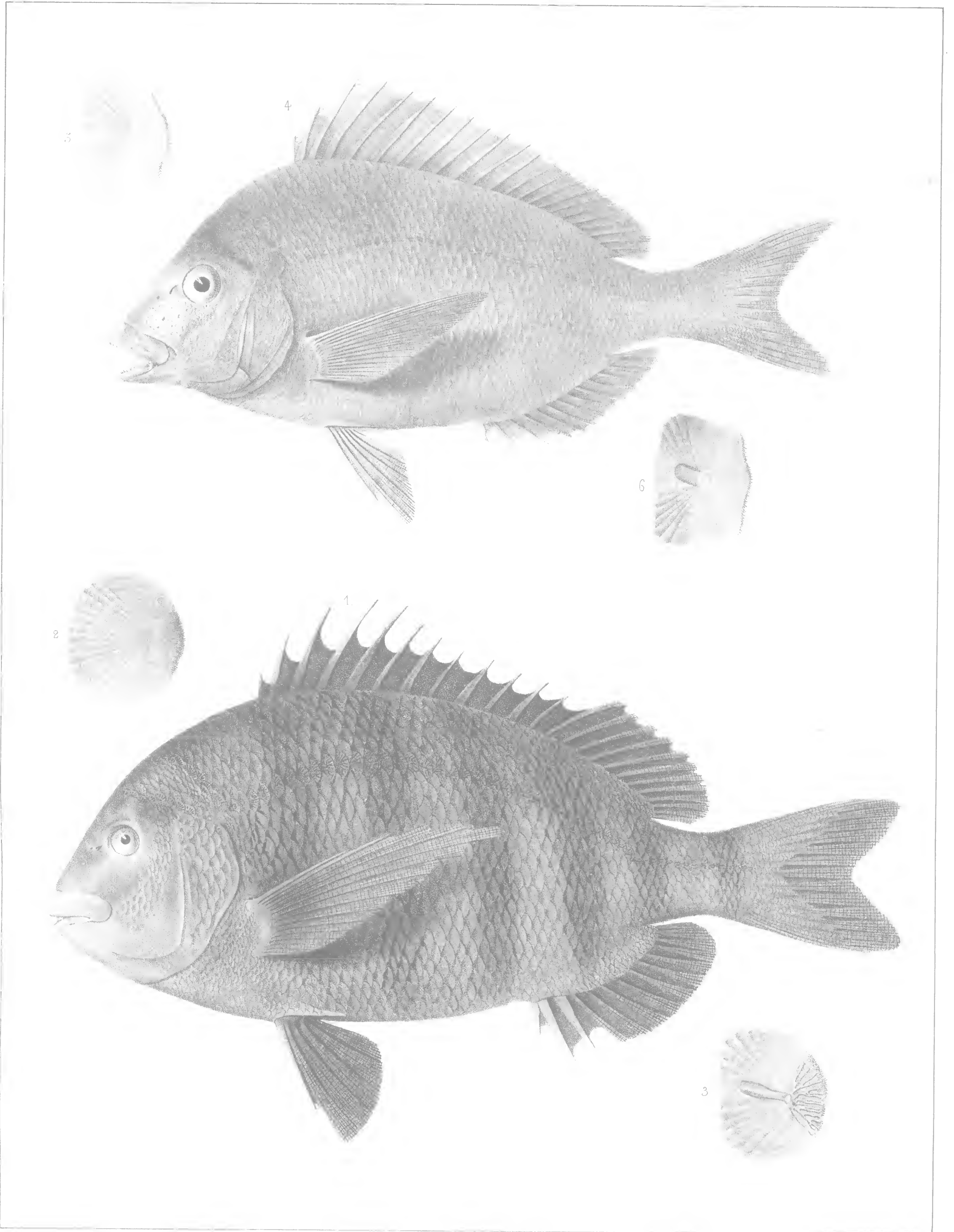
5. G. DEKAYI Ag. — 6. CRYPTACANTHODES MACULATUS Storer



Oppenheimer & Bradford

Printed by Oppenheimer & Bradford

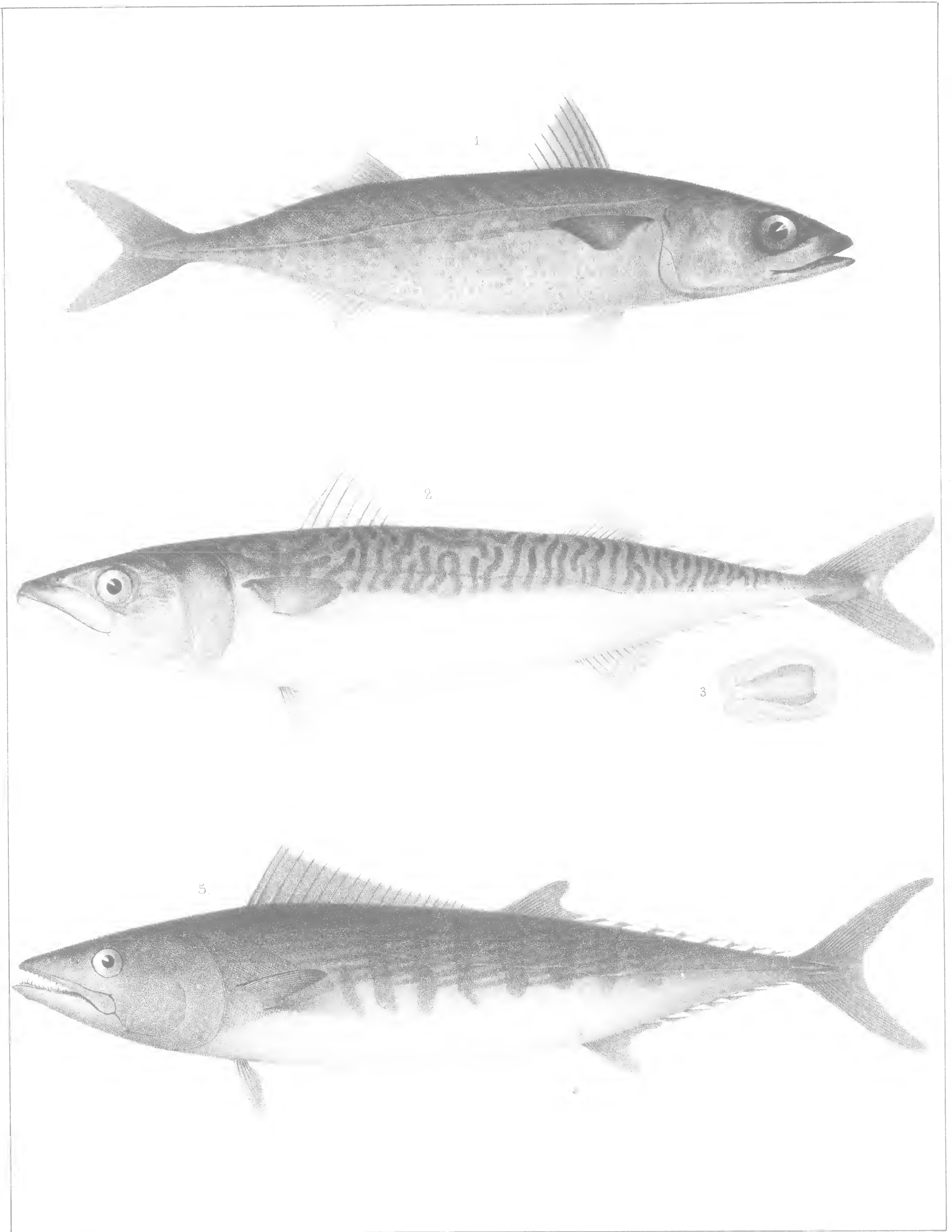
1. OTOLITHUS REGALIS Cuv - 4-6. UMBRINA NEBULOSA, Storer



A. Sargent, the artist.

Printed by J. P. Brantford.

1-3 *SARGUS OVIS* Mitch. - 4-6 *PAGRUS ARGYROPS*, Lin



Lappan & Souvel from nat.

Printed by Lappan & Bradford

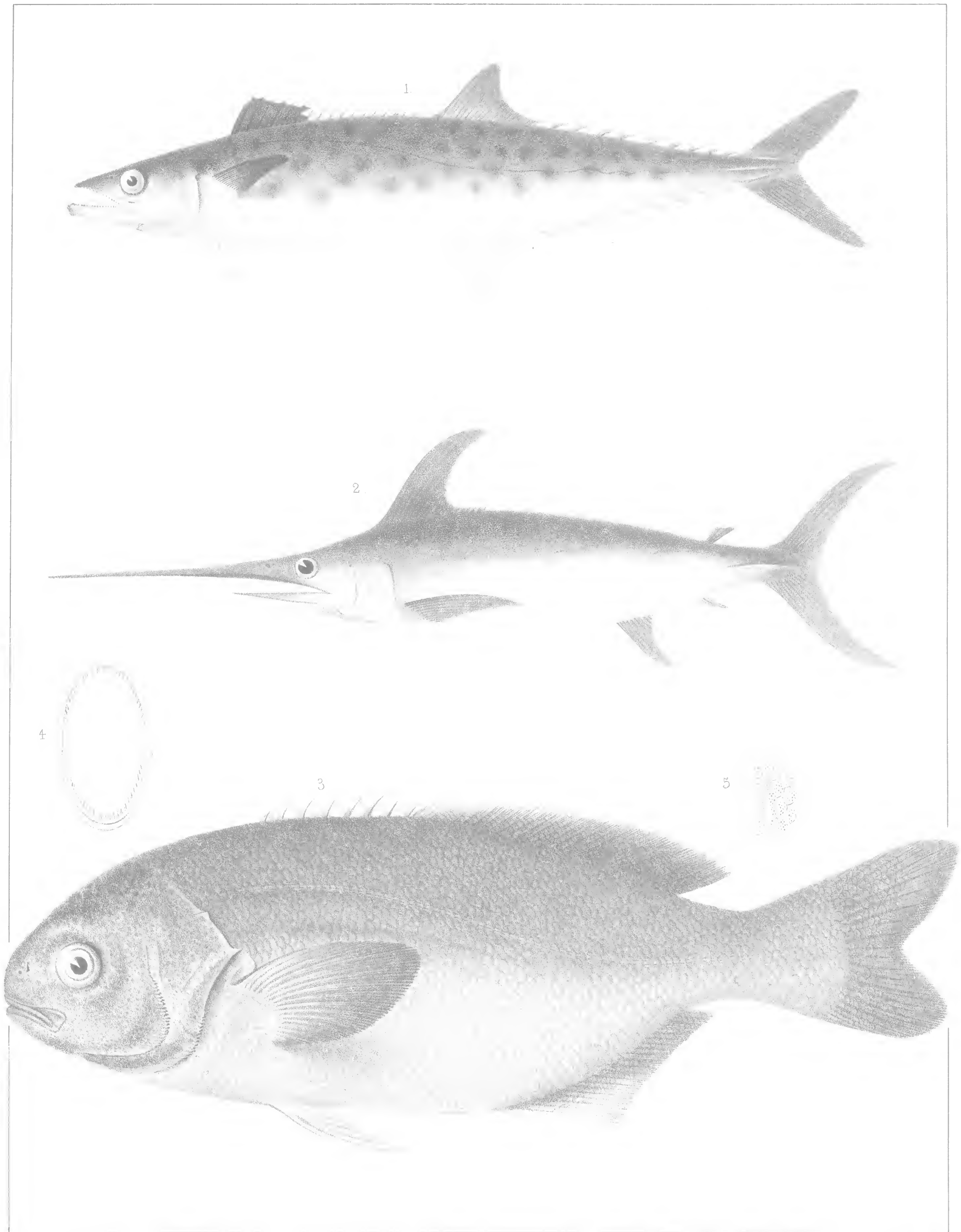
1, SCOMBER DEKAYI, Storer. - 2, 4. SCOMBER VERNALIS, Mitch.
5 PELAMYS SARDA, Cuv.



Lepper. X. 1857. p. 41.

Recherch. p. Fauna p. 2. Pl. 12.

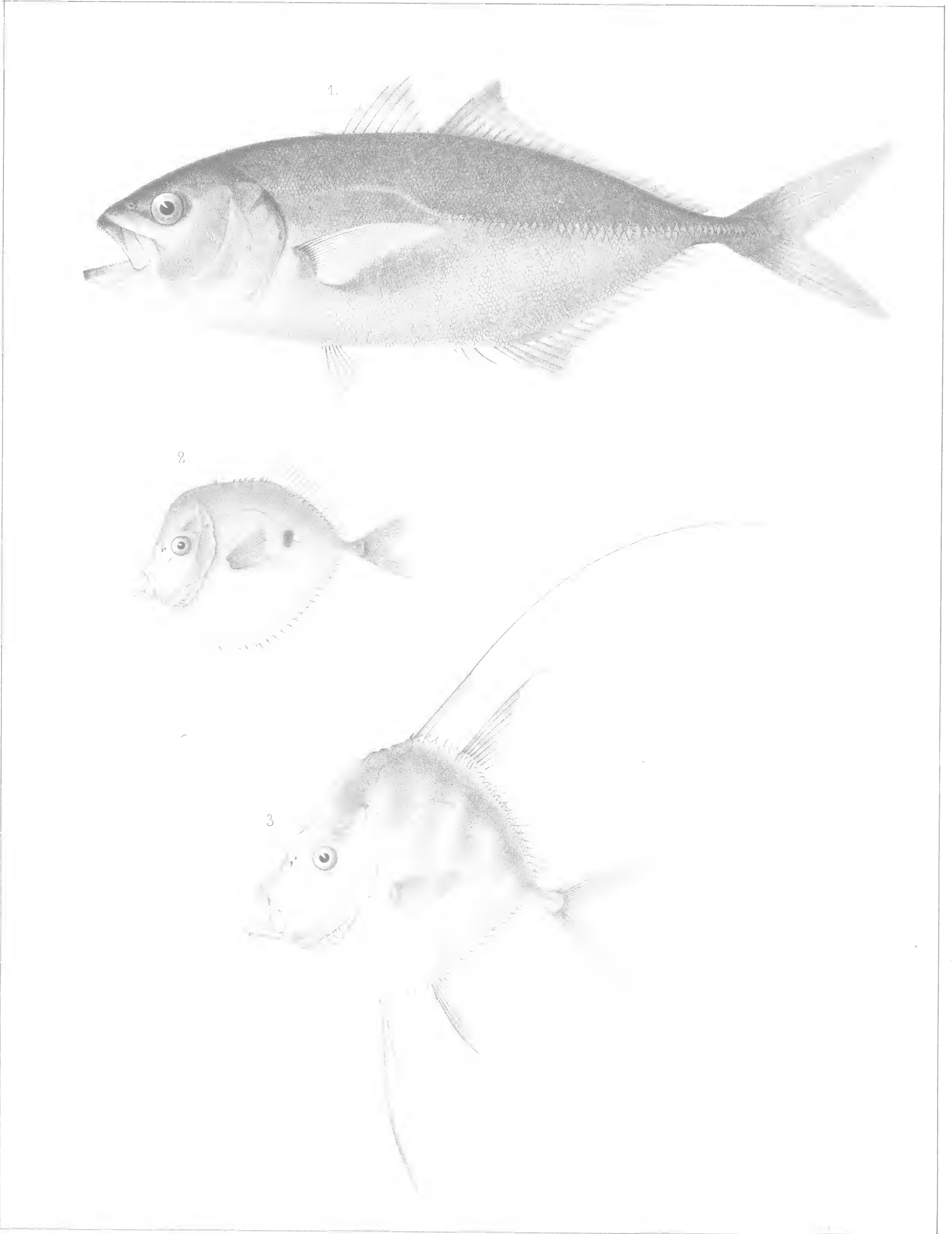
1,2 TRICHIURUS LEPPURUS LIT. - 3. SPHYRAENA BOREALIS, DeKay. 4. THYNNUS SECUNDO-DORSALIS, Shaw.



Tappan & Storm

Printed by Tappan & Bradford

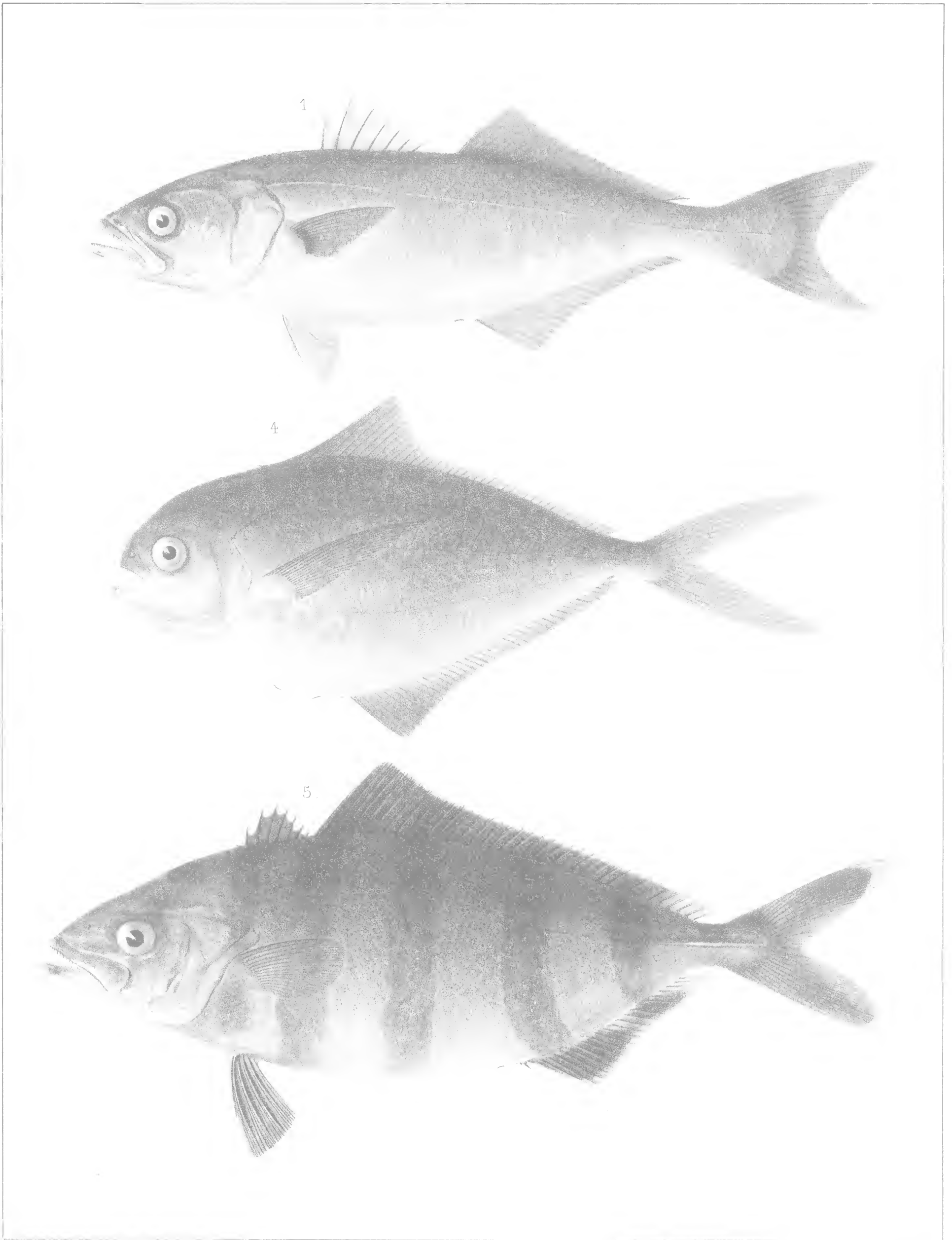
1. CYBIUM MACULATUM, Cuv. — 2. XIPHIAS GLADIUS, Lin
3 5. PALINURUS PERCIFORMIS, Dekay



W. H. & S. S. S. S.

Printed by Tappan & Bradford.

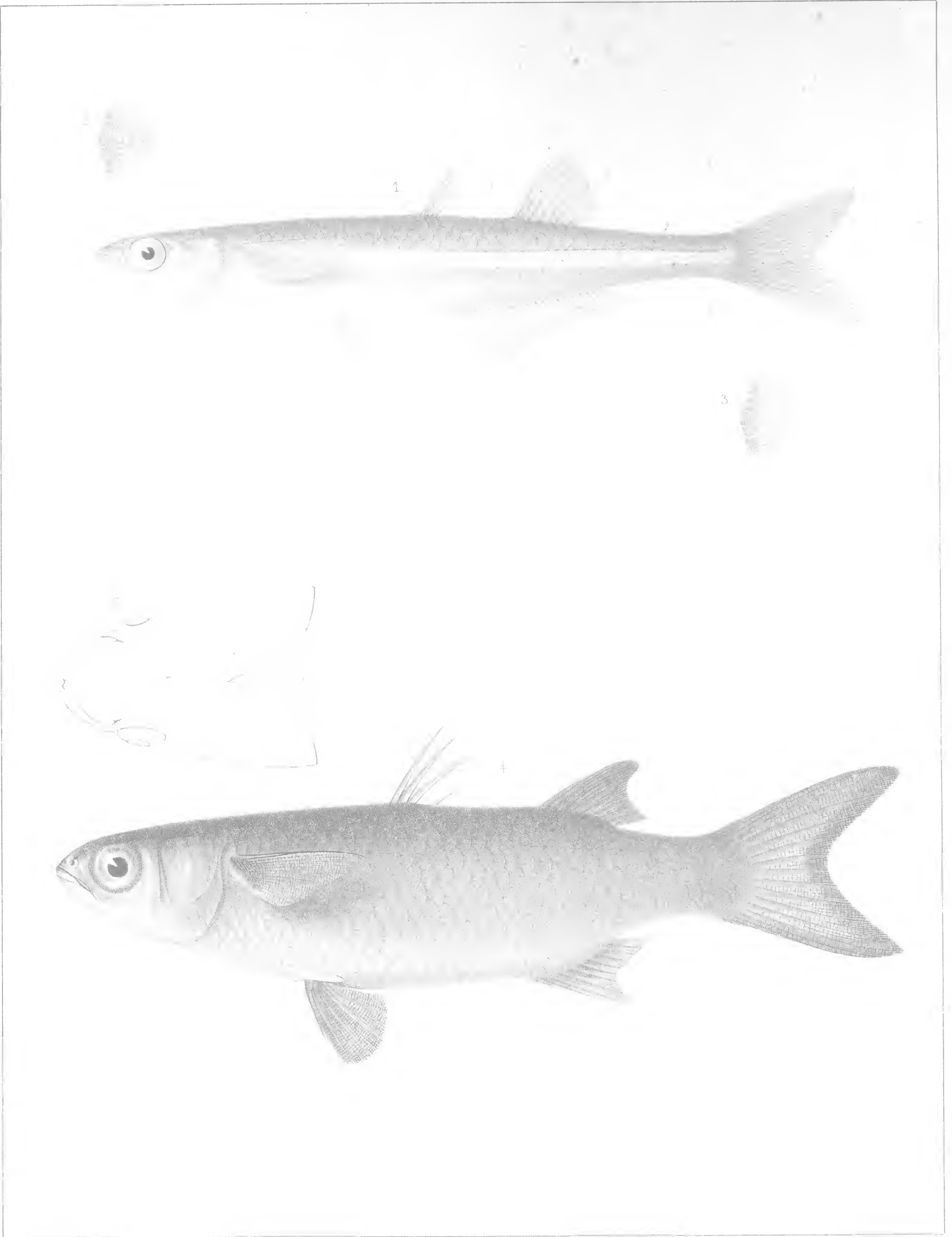
1. *CARANX CRYSOS*, Cuv. — 2 *ARGYREIOSUS UNIMACULATUS*, Batch.
3. *ARGYREIOSUS CAPILLARIS*, DeKay.



W. P. Appleton, Boston, U.S.A.

Printed by Tappan & Bradford

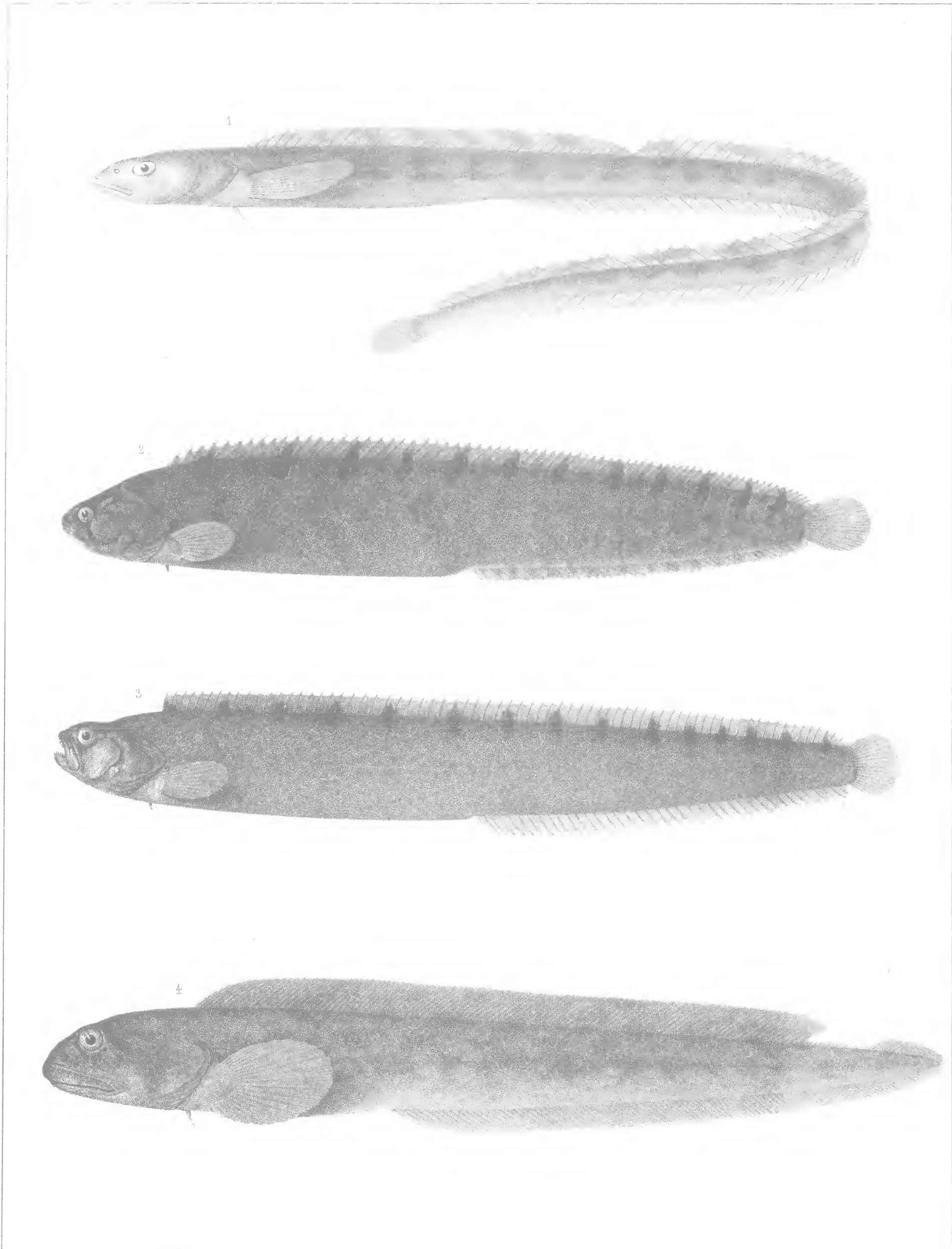
1. *MOONIA SALTATOR*, Cuv. — 4. *RHOMBUS TRIACANTHUS*, DeKay
5. *SERIOLA ZONATA*, Cuv.



1. 2000.

Printed by  Laplace.

1. *ATHERINA MUTAIA* Meek. - 4,5 MUCW. *LINLAIUS* Meek.



Tappan & Sonrel.

Printed by G. E. Peabody & Co.

1. BLENNIUS SERPENTINUS, Storer.

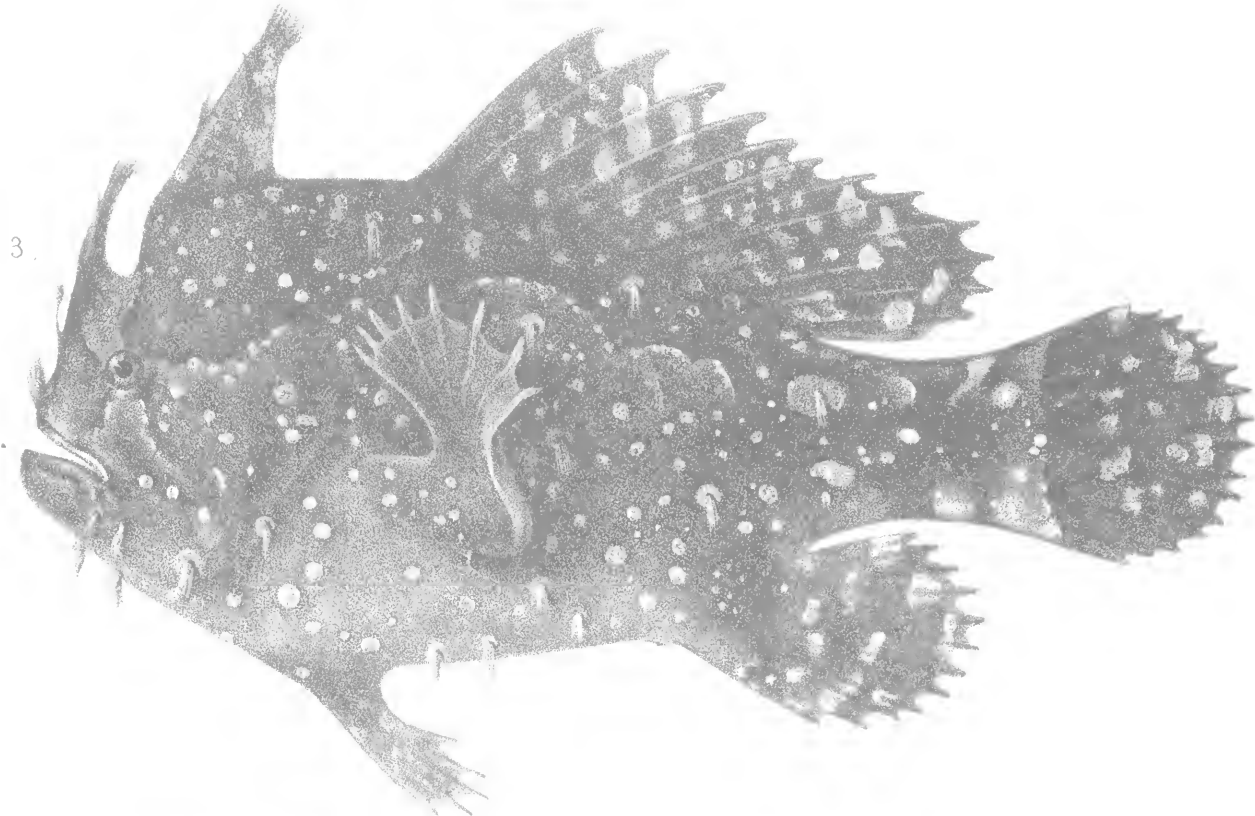
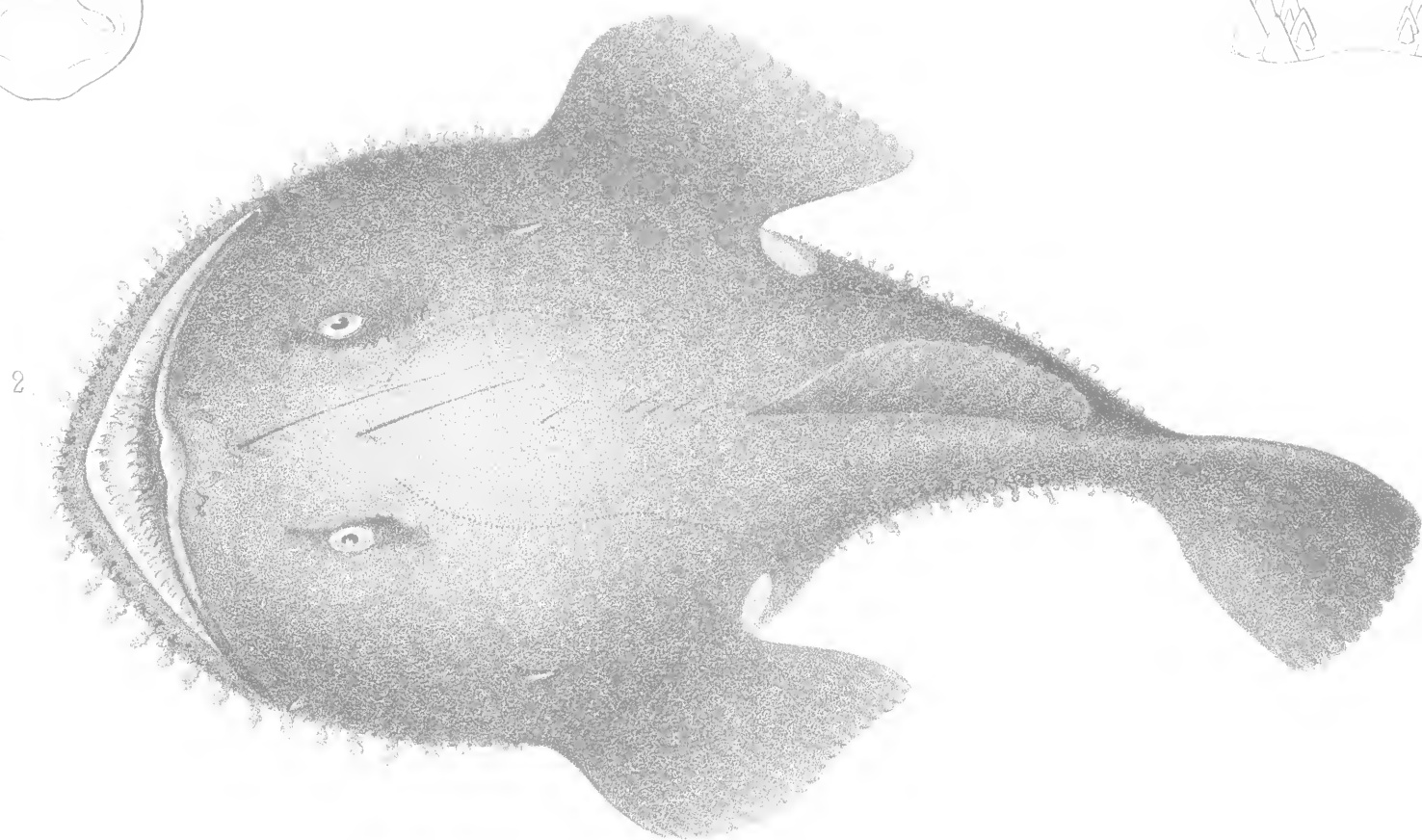
2. GUNNELIUS MUCRONATUS, Girard.

3. G. MACROCEPHALUS, Girard.

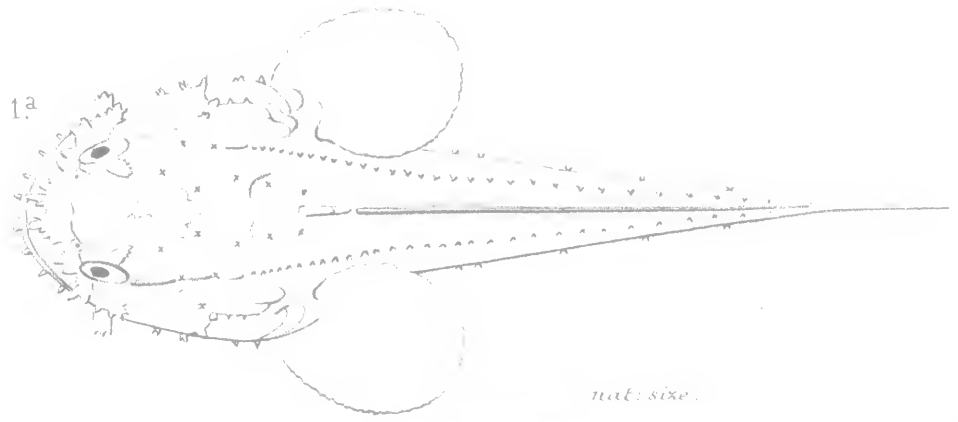
4. ZOARCES ANGUILLARIS, Storer.



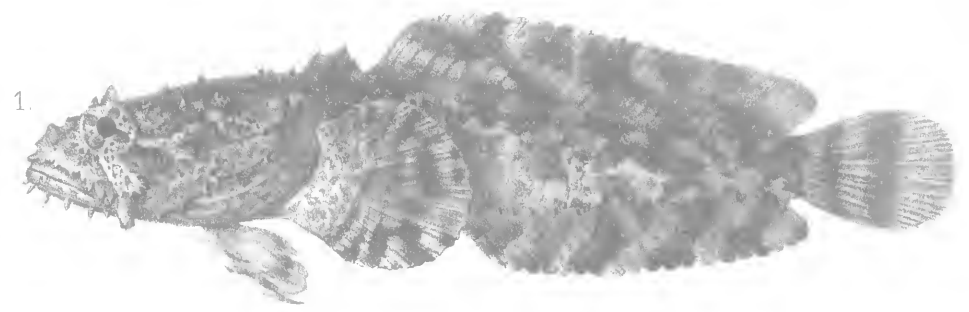
b



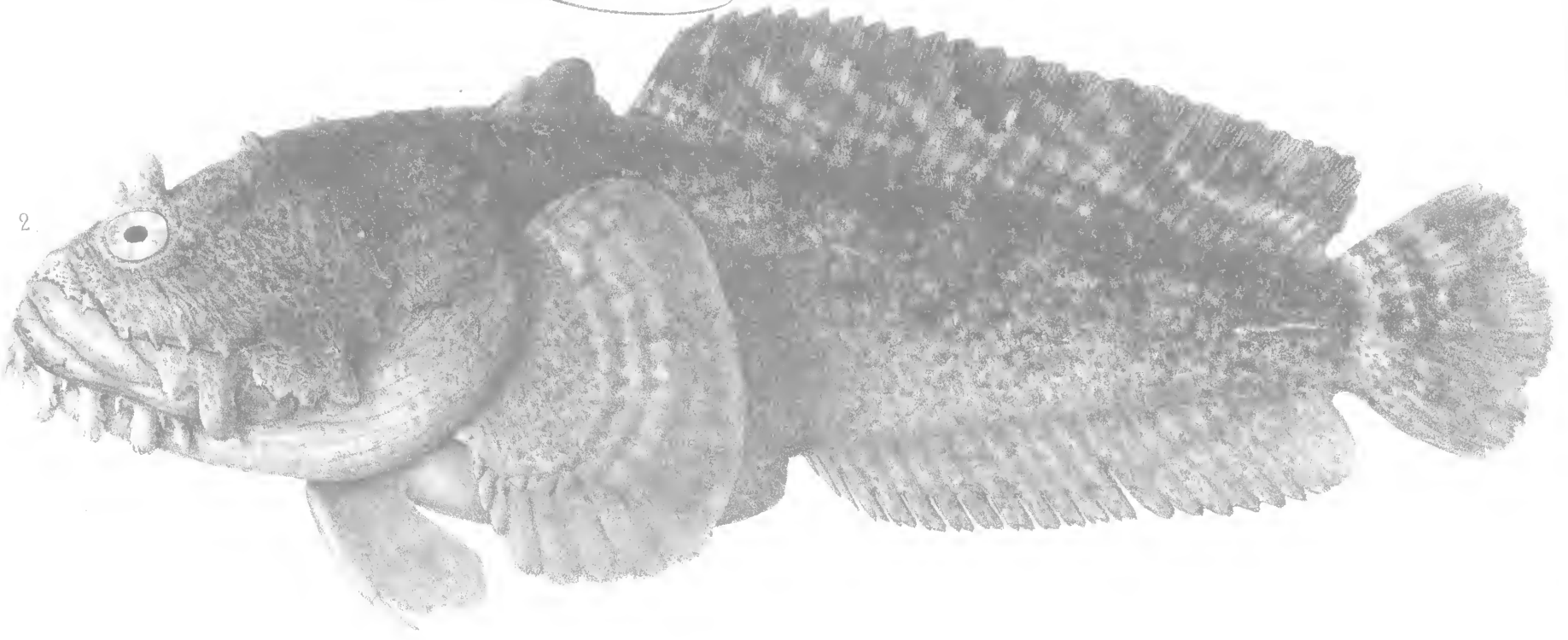
1. ANARRHICUS VOMERINUS Agass. 2. TURBOTUS AMERICANUS Gir. 3. CHIRONECTES LAEVIGATUS Cuv.



nat. size.



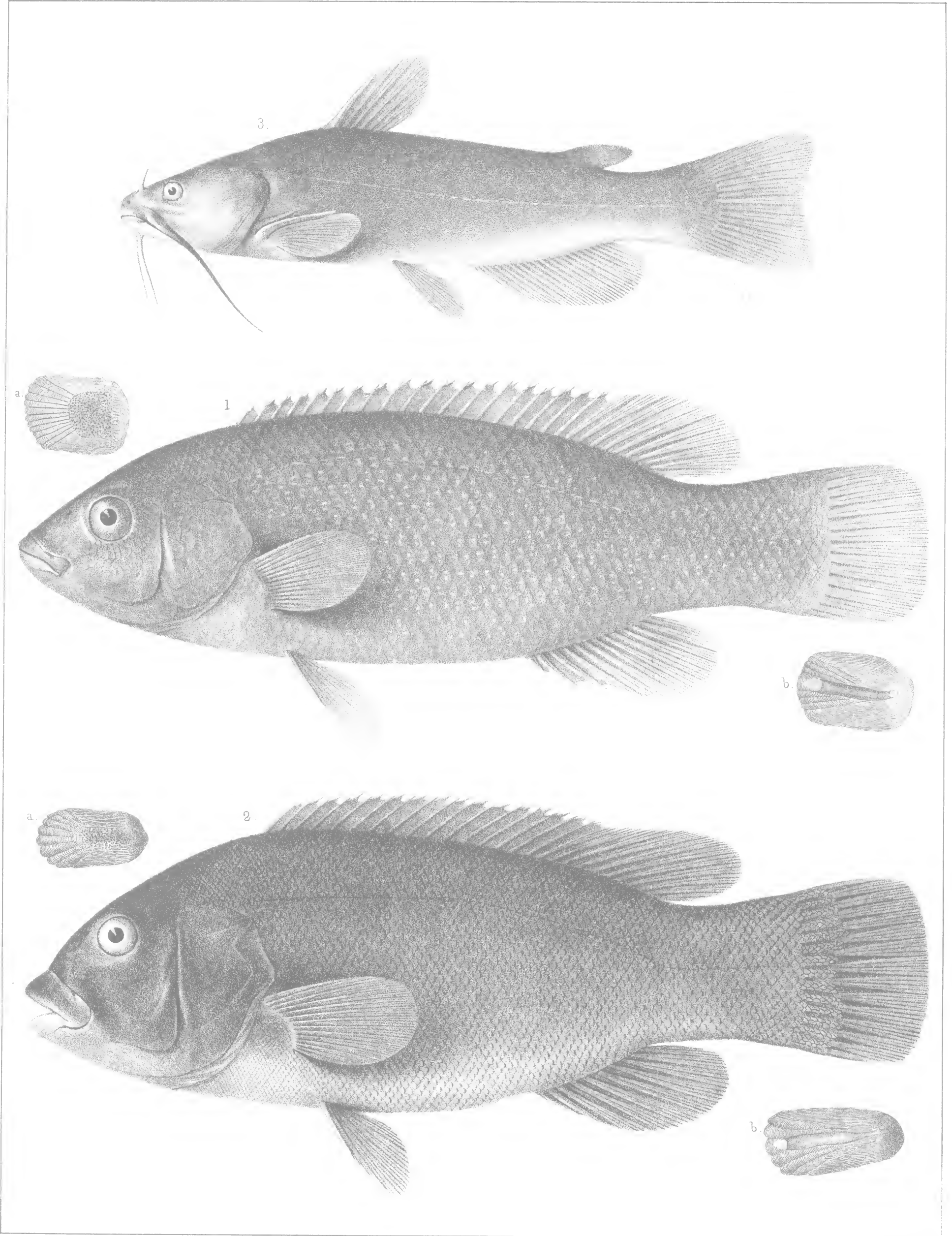
1/2 nat. size



A. Sargent's stone tray net

Tappan & Bradford's lithy

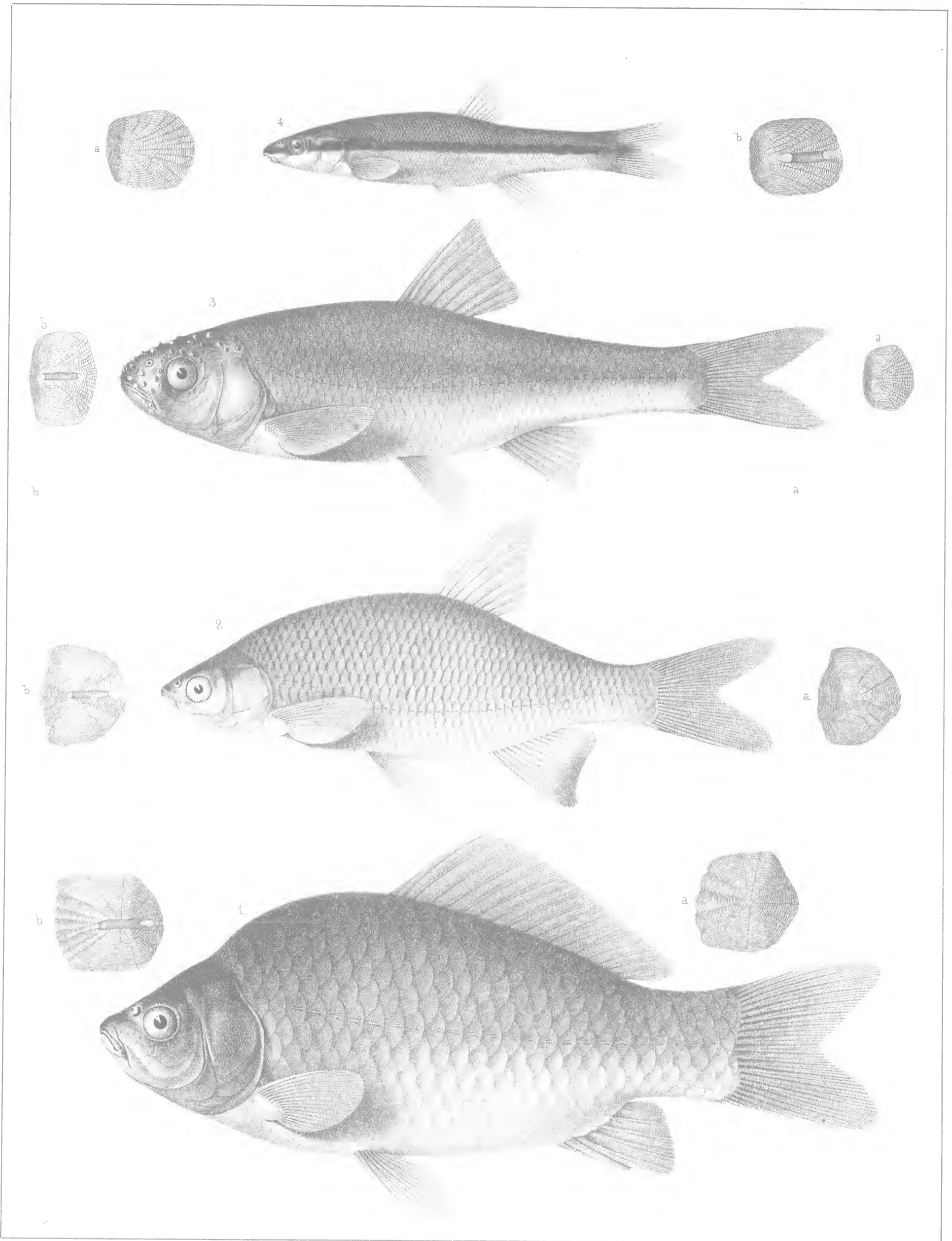
BATRACHUS TAU, Linn.



A. Sarrat.

Print. by L. H. Bradford & Co.

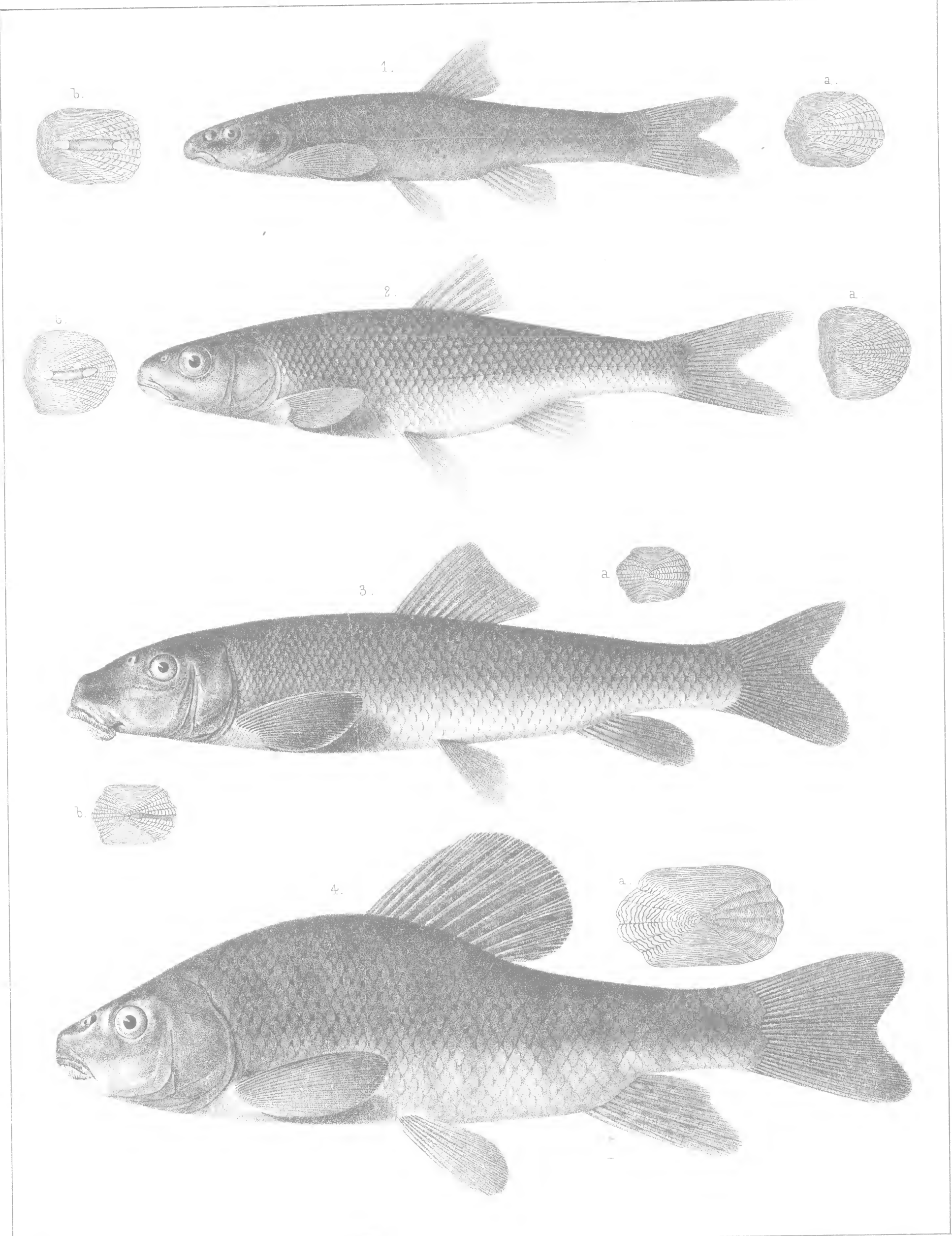
1. CTENOLABRUS CERULEUS Dekay. 2. TAUTOGA AMERICANA, Dekay. 3. PIMELODUS ATRARIUS, Dekay.



A. Conre

Printed by L. H. Bradford & Co.

1. CYPRINUS AURATUS, Lin. 2. LEUCOSOMUS AMERICANUS, Girard
 3. HYPSOLEPIS CORNUTUS, Girard 4. ARGYREUS ATRONASUS, Heck.



A. S. PIERCE.

Printed by L.H. Bradford & Co.

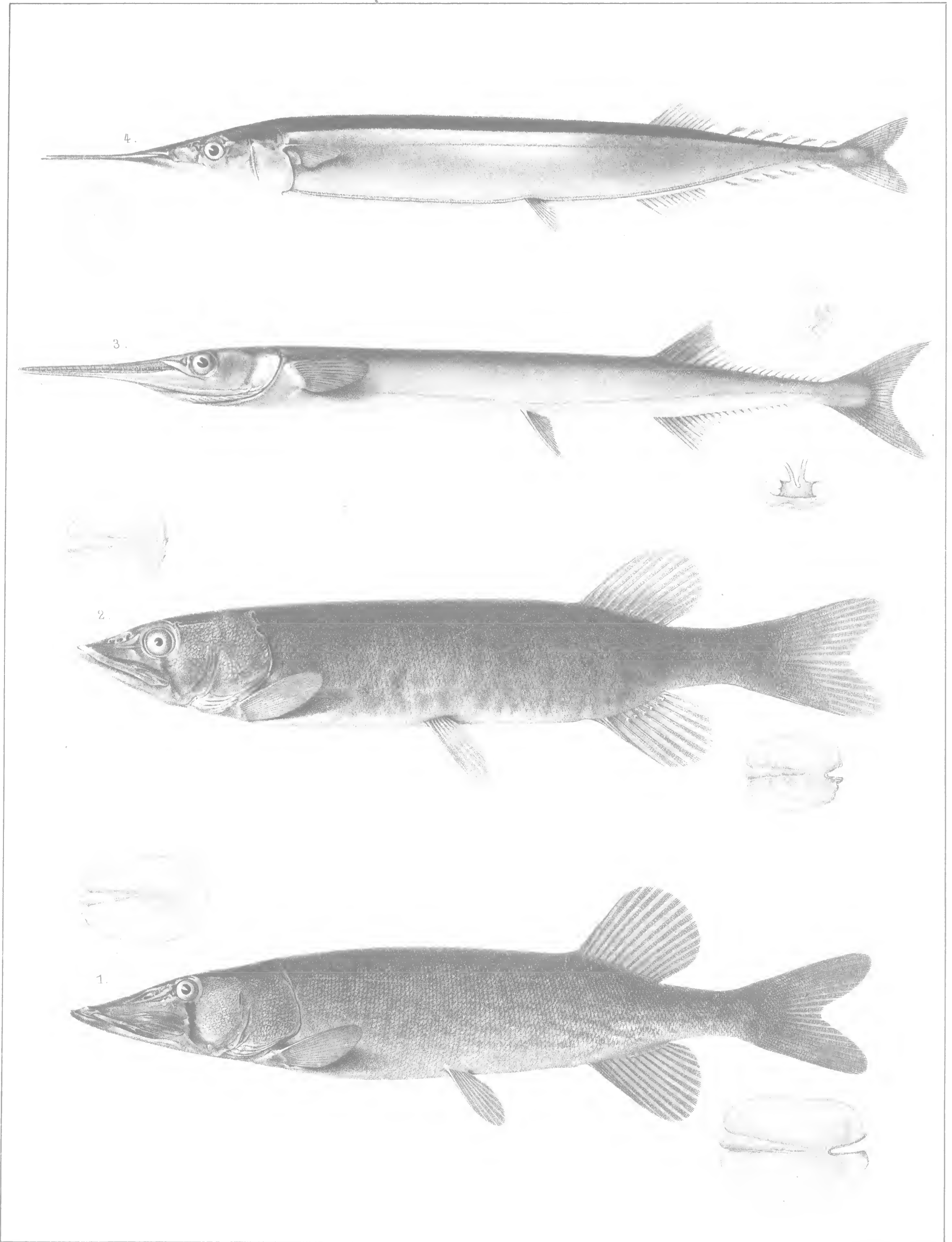
1. ARGYREUS NASUTUS, Girard 2. CHEILONEMUS PULCHELLUS, Girard
 3. CATOSTOMUS BOSTONIENSIS, Lesueur. 4. CATOSTOMUS GIBBOSUS, Lesueur.



A. Savel

Print. by L.H. Bradford & Co.

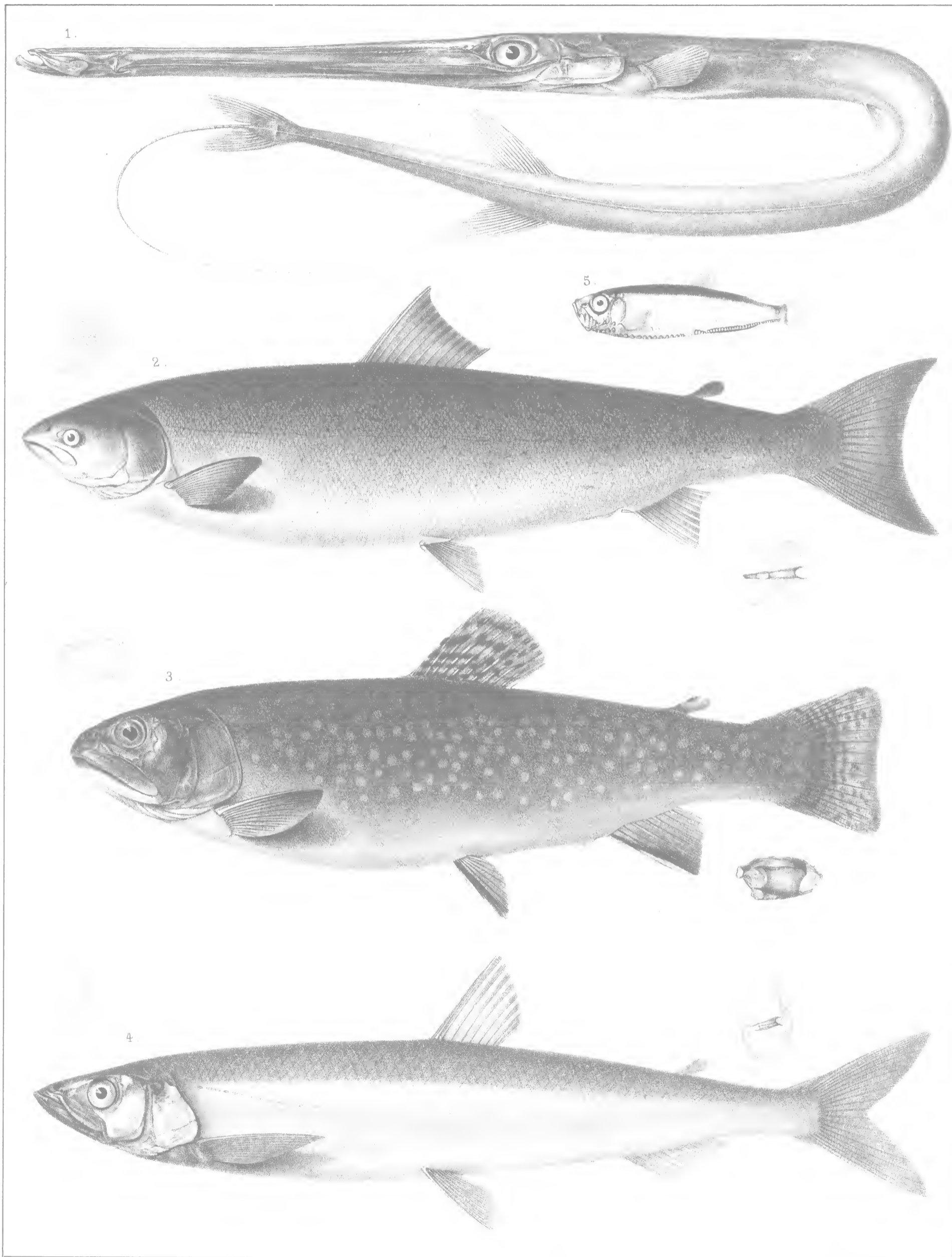
1. *FUNDULUS NIGROFASCIATUS*, Cuv & Val. 2. *F. MULTIFASCIATUS*, Cuv & Val
 3 & 4. *F. PISCULENTUS*, Cuv & Val. 5 & 6. *HYDRARGYRA FLAVULA*, Steen



A. Sonrel.

L.H. Bradford & Co print.

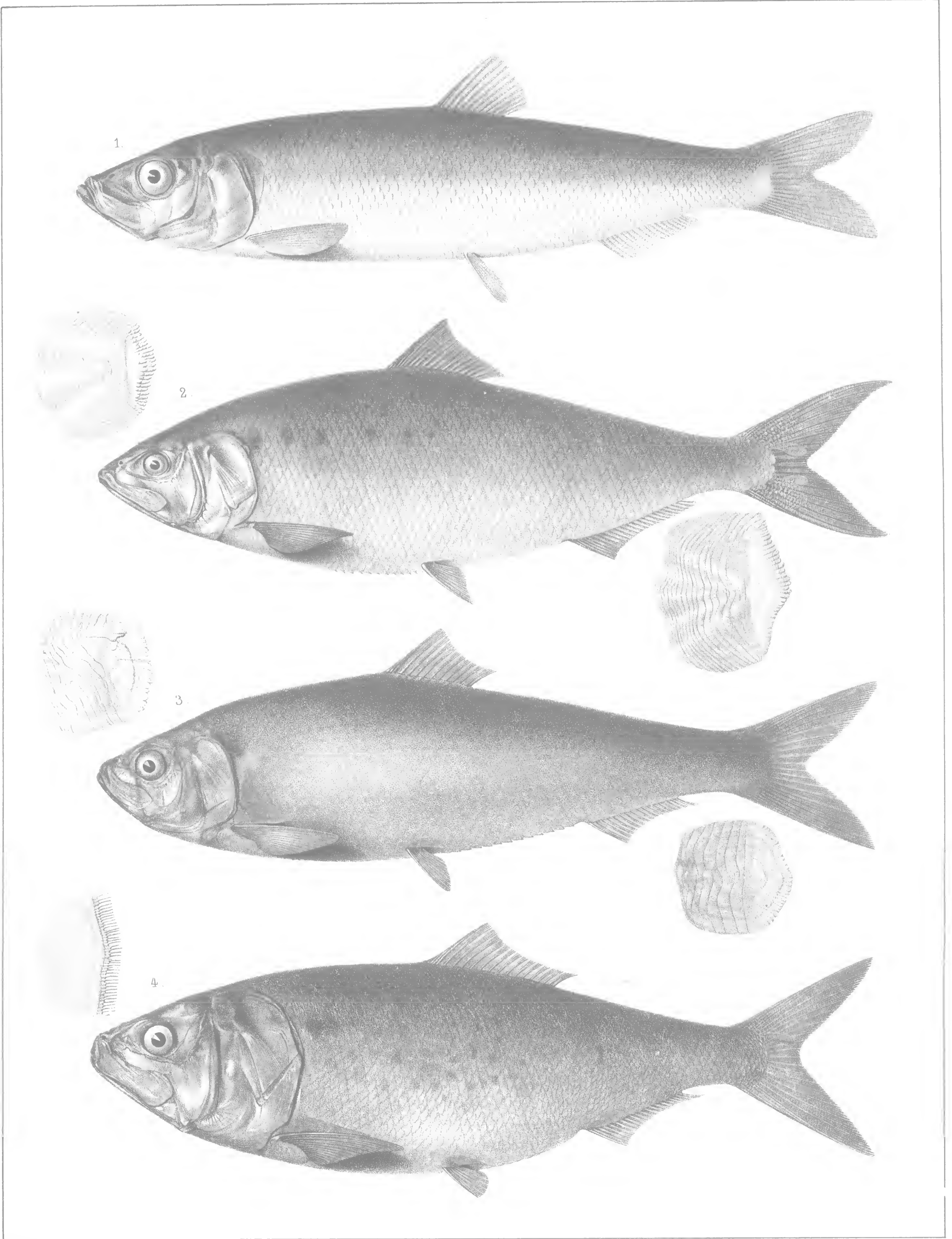
1. *ESOX RETICULATUS* LeS. 2. *ESOX ORNATUS* Gir.
3. *BELONE TRUNCATA* LeS. 4. *SCOMBERESOX STORERI* Dek.



A. Sonrel.

L. H. Bradford & Co print.

1. FISTULARIA SERRATA Bloch. 2. SALMO SALAR Linn. 3. S. FONTINALIS Mitch.
4. OSMERUS VIRIDESCENS LeS. 5. SCOPELUS HUMBOLDTII Cuv.



A. Sonrel.

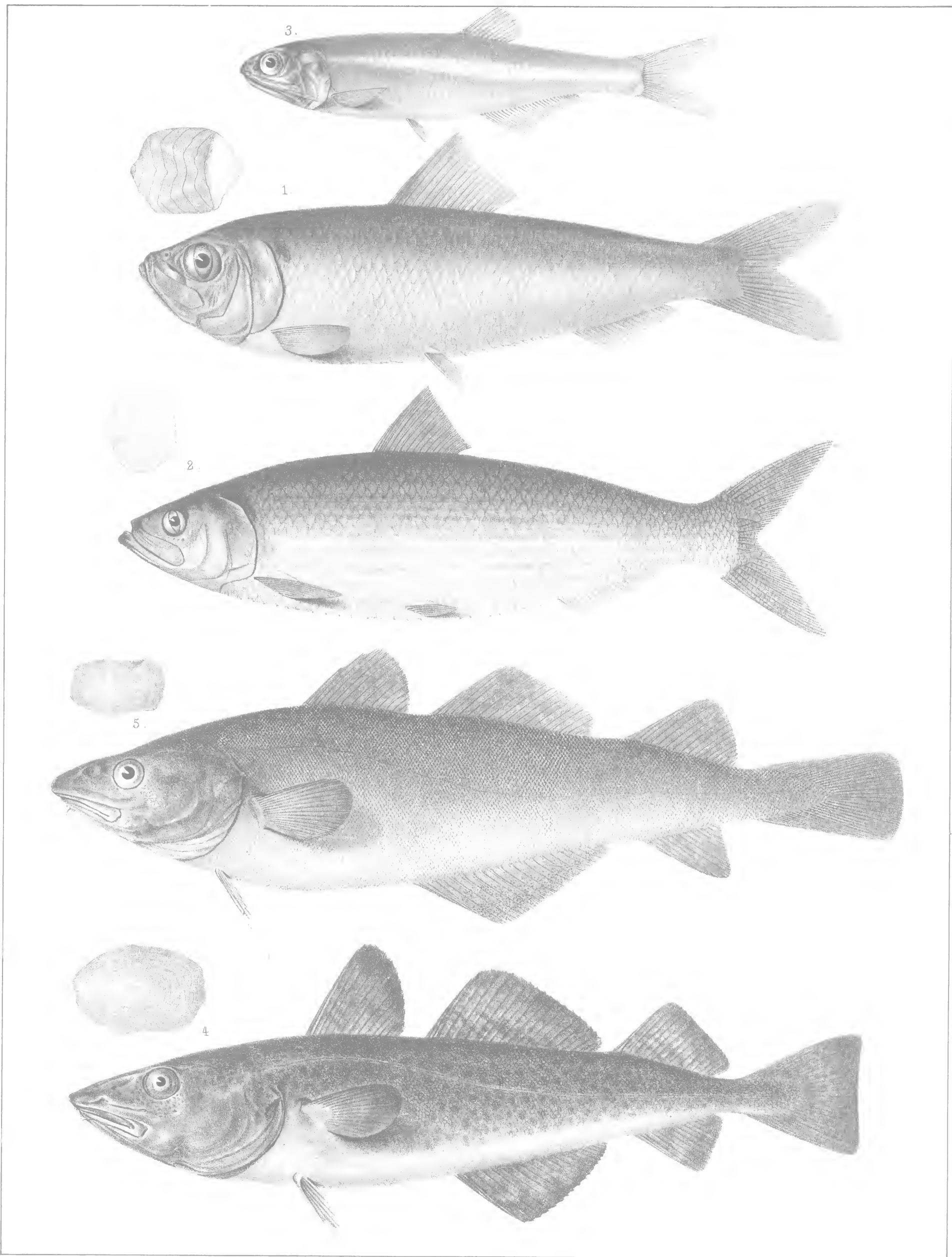
L.H. Bradford & Co. print.

1. CLUPEA ELONGATA LeS.

2. ALOSA PRAESTABILIS Dek.

3. ALOSA TYRANNUS Dek

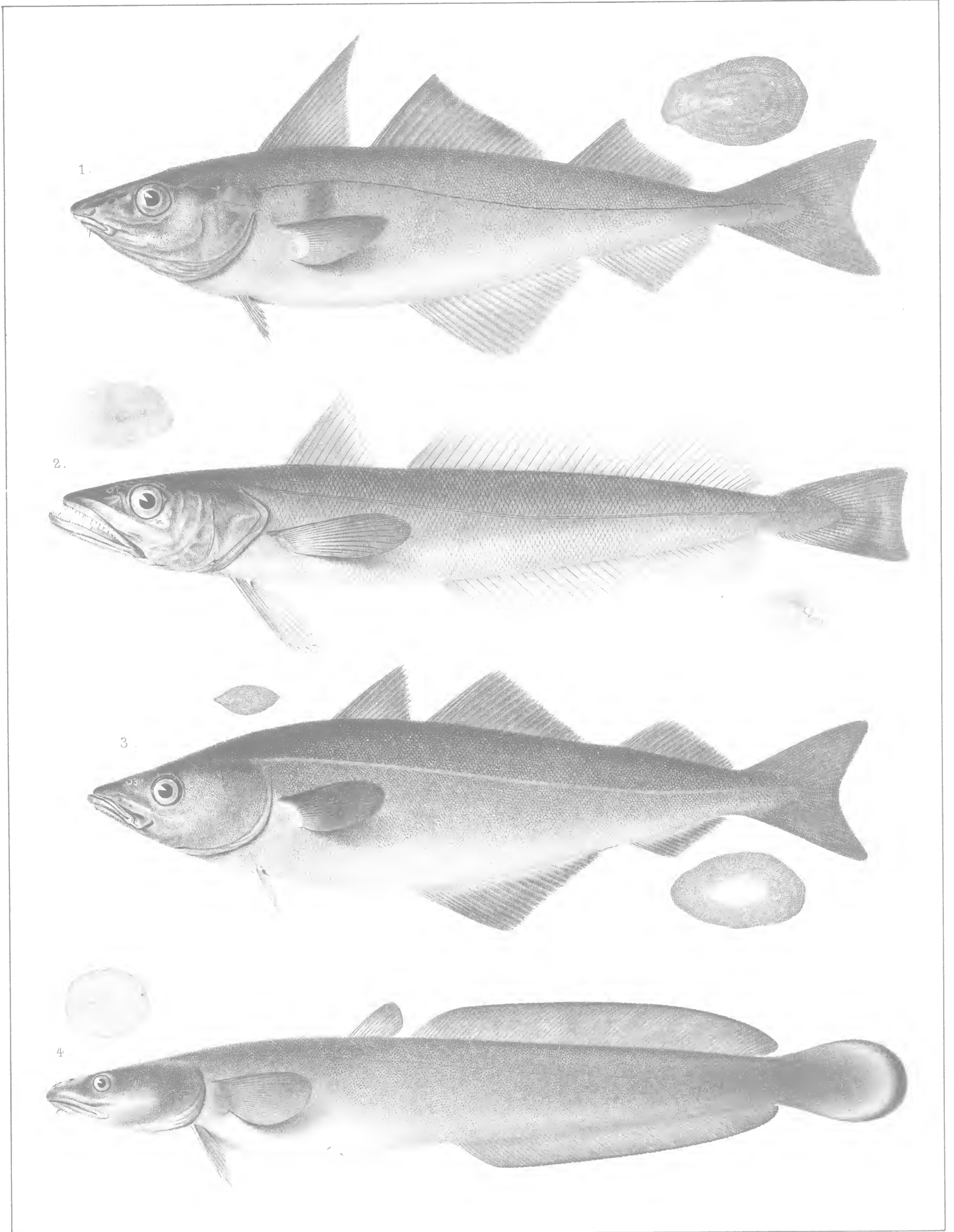
4. A. MENHADEN Storer.



A. Snnel.

L. H. Bradford & Co. print.

1. ALOSA CYANONOTON Storer. 2. A. LINEATA Storer. 3. ENGRAULIS VITTATUS B. & G.
4. MORRHUA AMERICANA Storer. 5. M. PRUINOSA Dek.

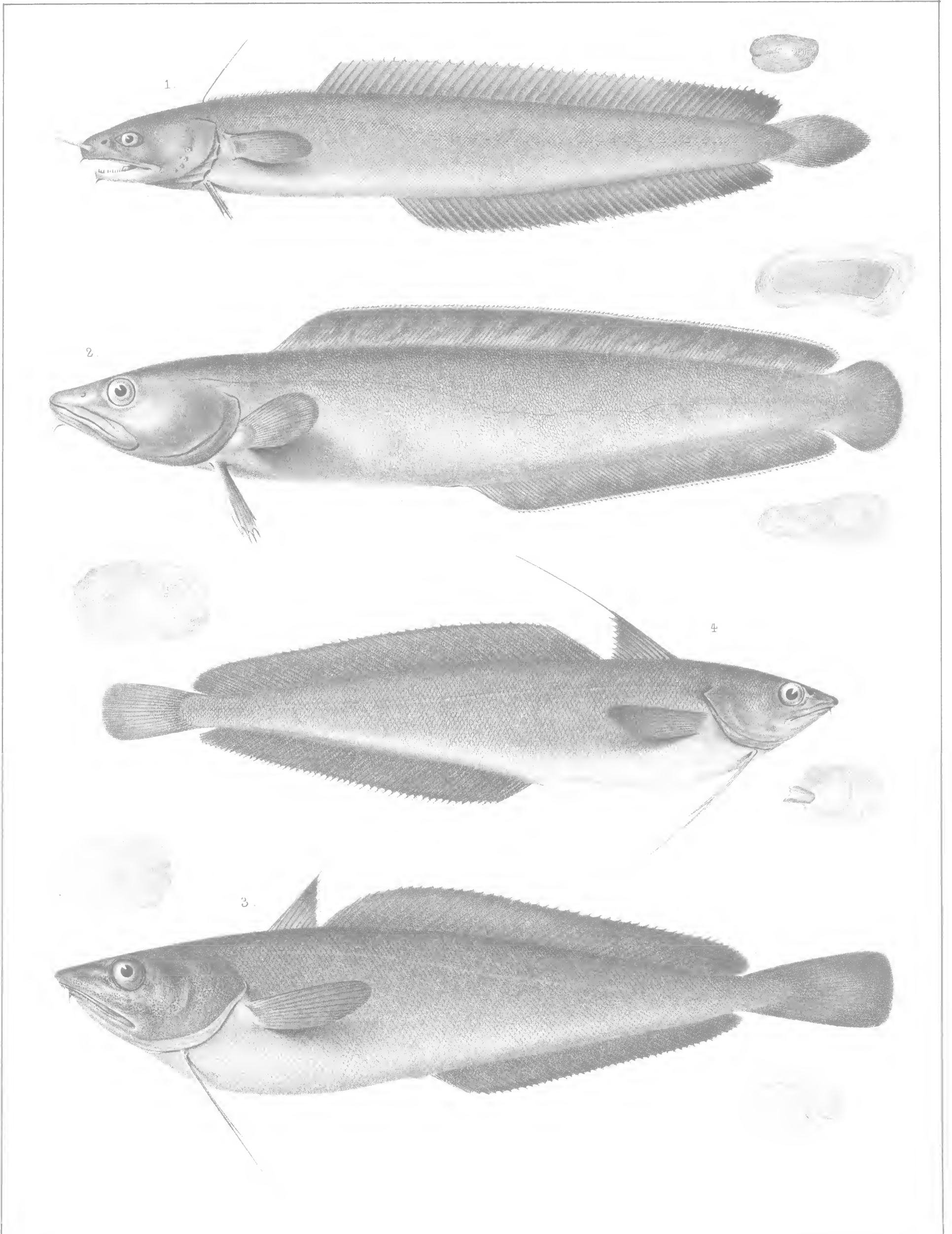


A. Sonrel.

L. H. Bradford & Co. print.

1. MORRHUA AEGLEFINUS Linn.
3. MERLANGUS PURPUREUS Storer.

2. MERLUCIUS ALBIDUS Dek.
4. LOTA COMPRESSA LeS



A. Sonrel.

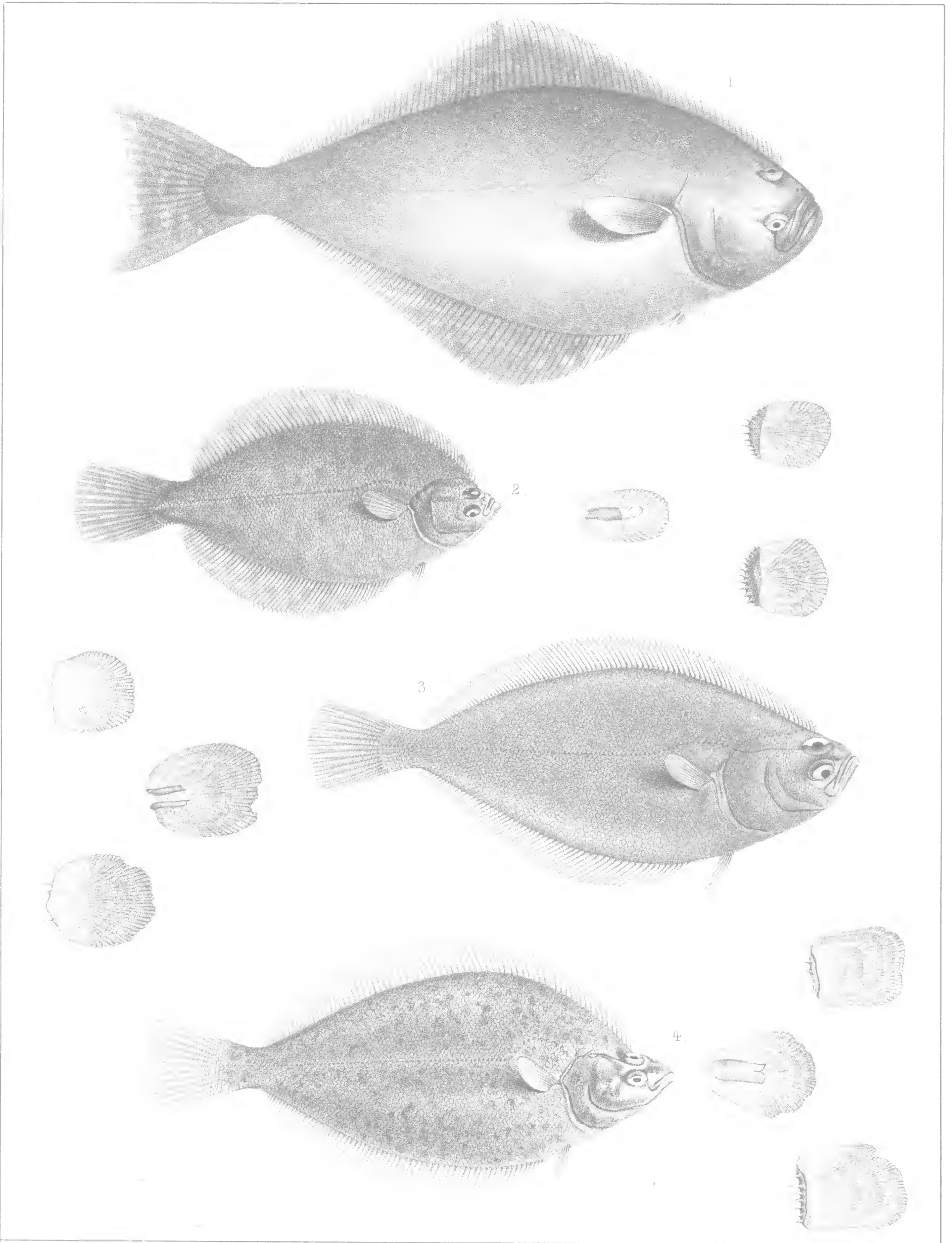
L. H. Bradford & Co print.

1. MOTELLA CAUDACUTA Storer.

2. BROSMIUS FLAVESCENS LeS.

3. PHYCIS AMERICANUS Storer

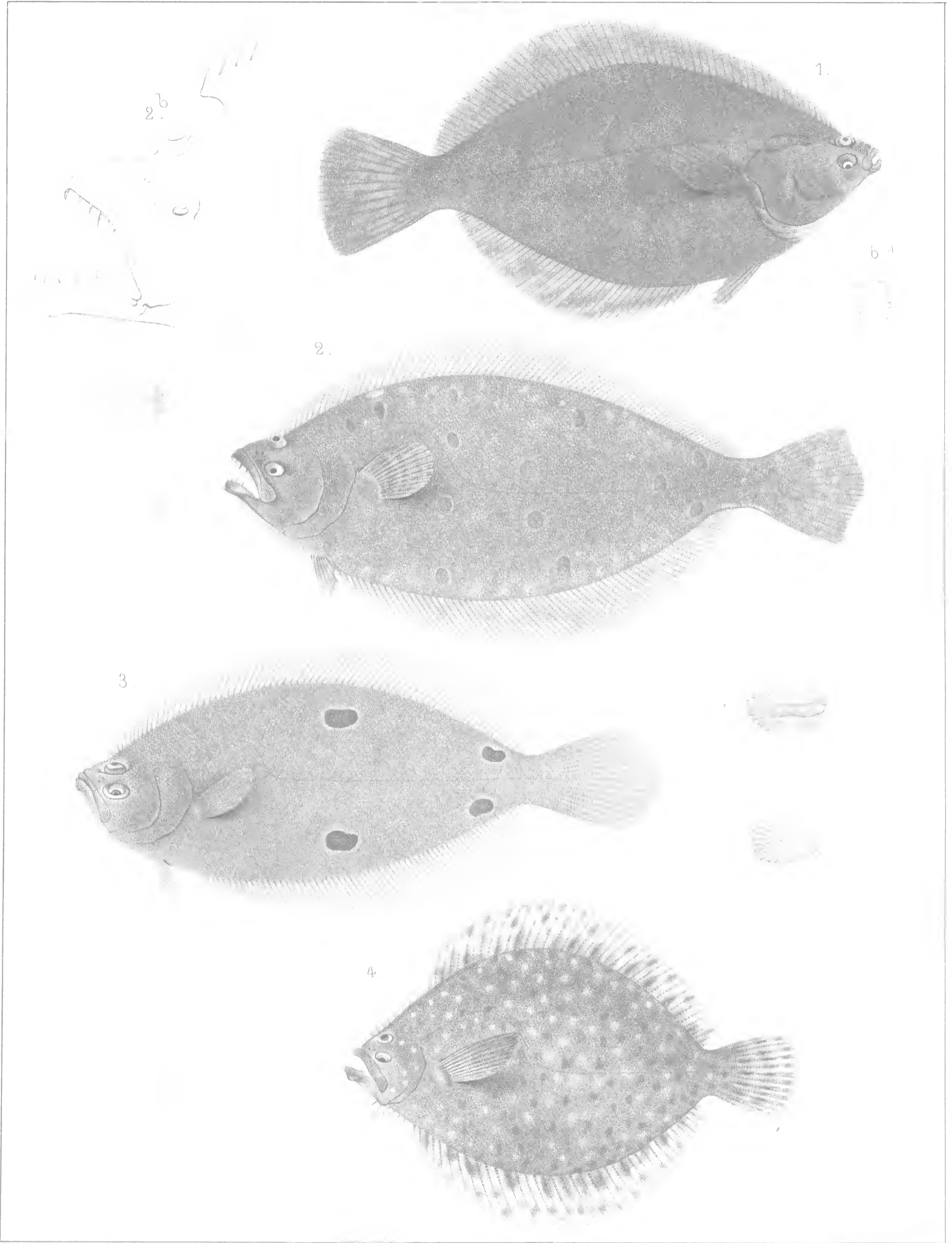
4. P. FILAMENTOSUS Storer



A. Sordet

Printed at J. H. Bufford's

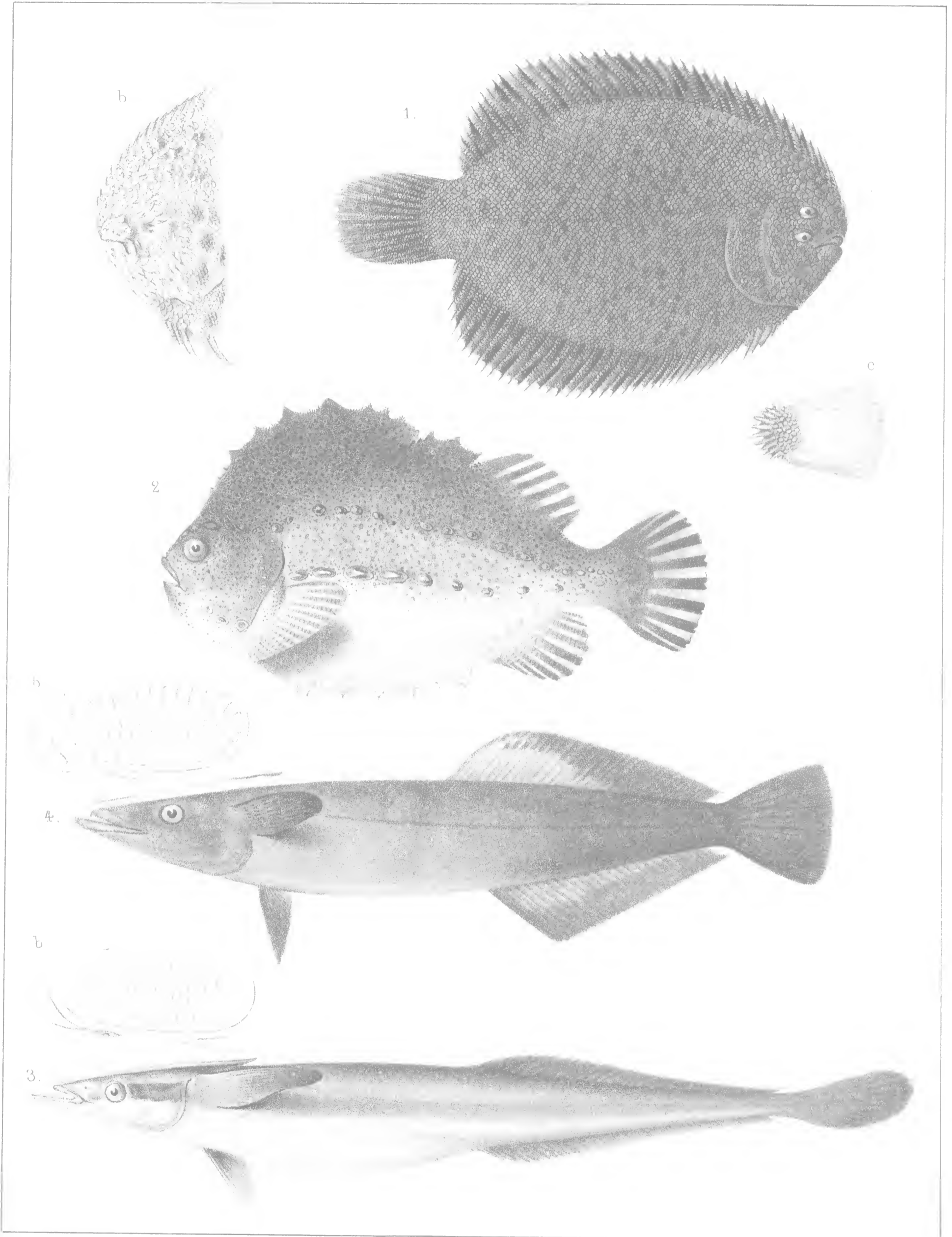
1. HIPPOGLOSSUS VULGARIS Cuv. — 2. PLATESSA PLANA Mitch
 3. PL. DENTATA Mitch — 4. PL. FERRUGINEA Storei



A. Sauer & Co. Lith.

Printed at ...

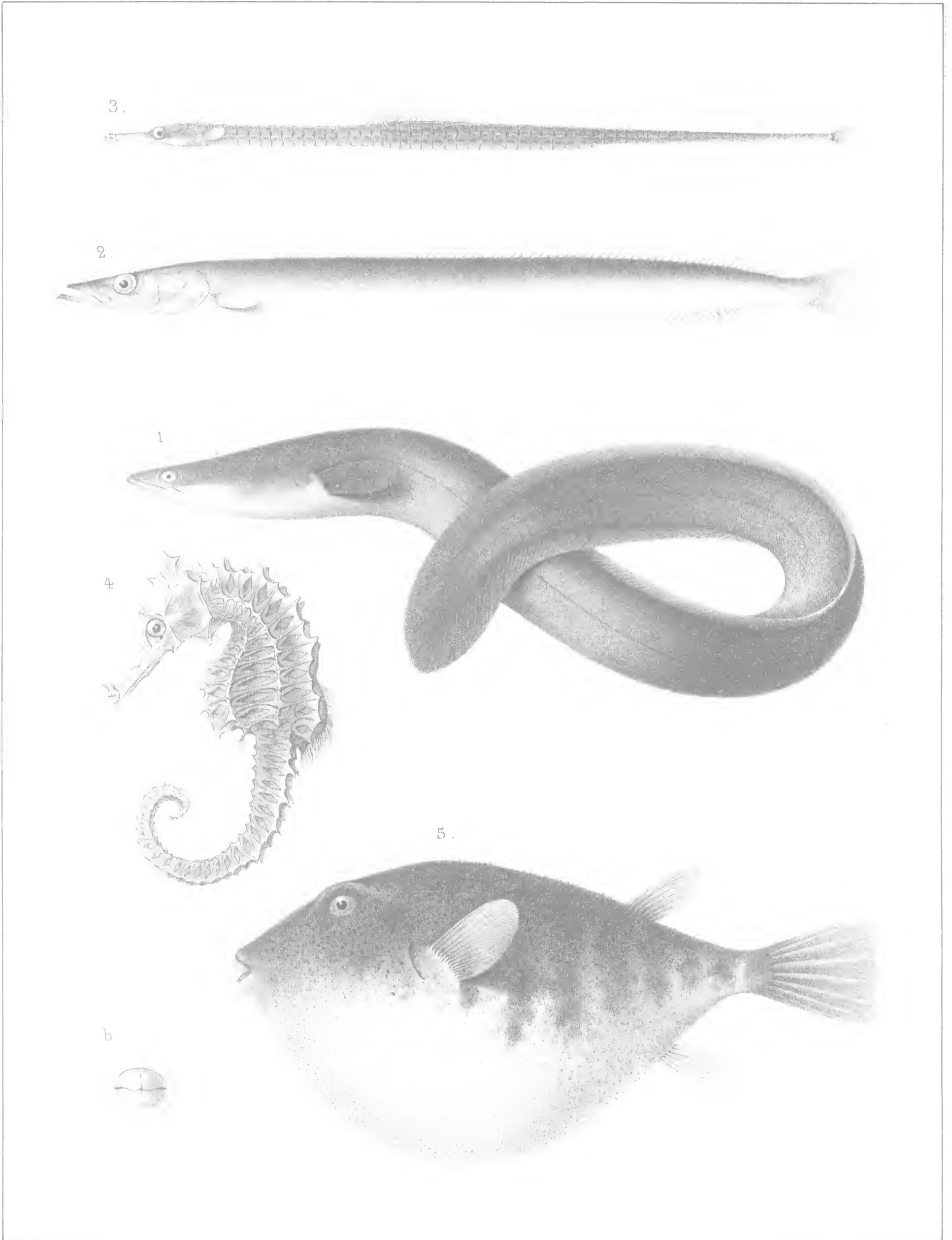
1. PLATESSA GLABRA Storer — 2. PL. OBLONGA Dek.
 3. PL. QUADROCELLATA Storer. — 4. PLEURONECTES MACULATUS Mitch.



Tappan & Sonrel.

Printed at J. H. Bufford's

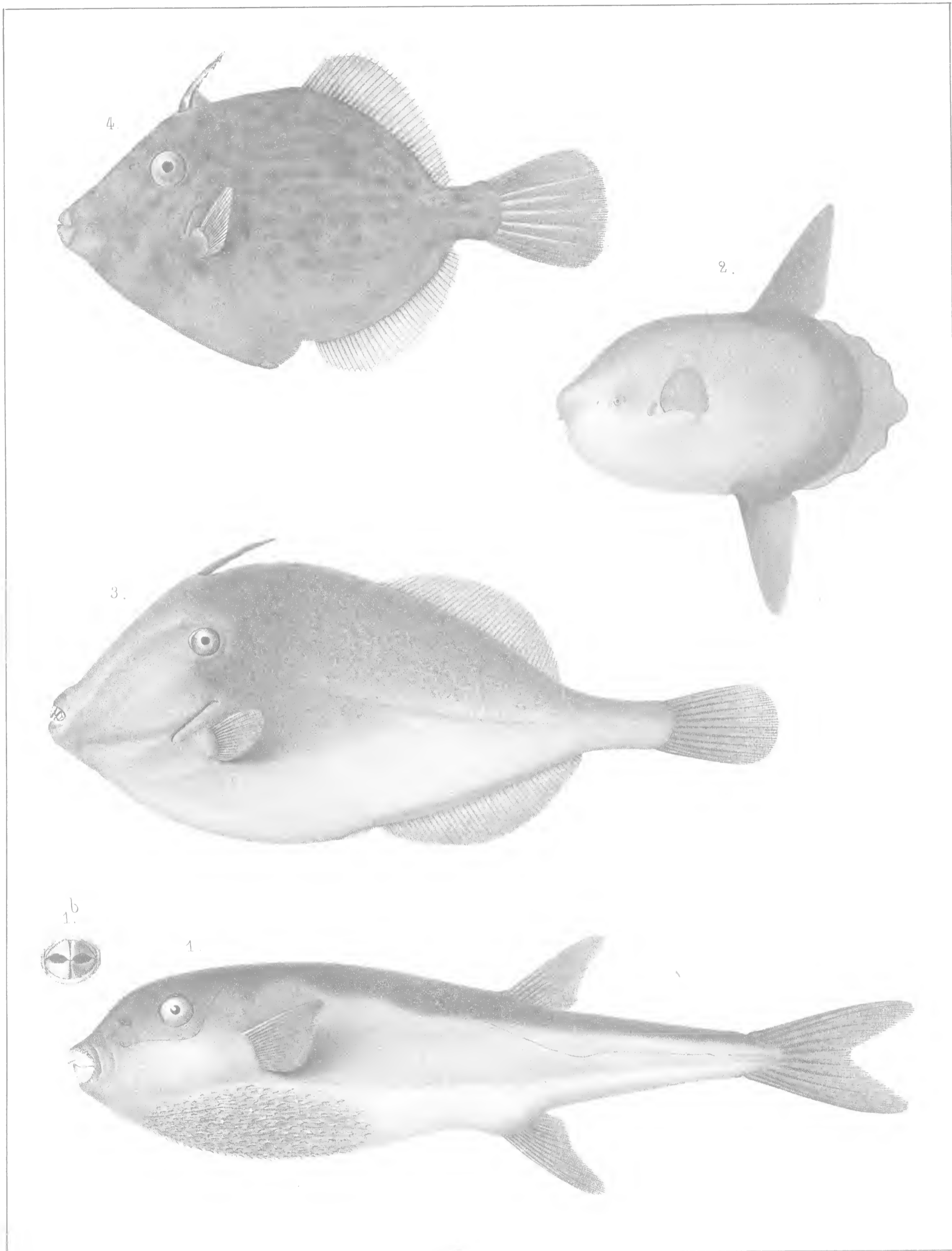
1. *ACHIRUS MOLLIS* Cuv. — 2. *LUMPUS ANGLORUM* Will.
3. *ECHENEIS ALBICAUDA* Mitch. — 4. *E. QUATUORDECIMLAMINATUS* Storer.



Tappan & Sewell

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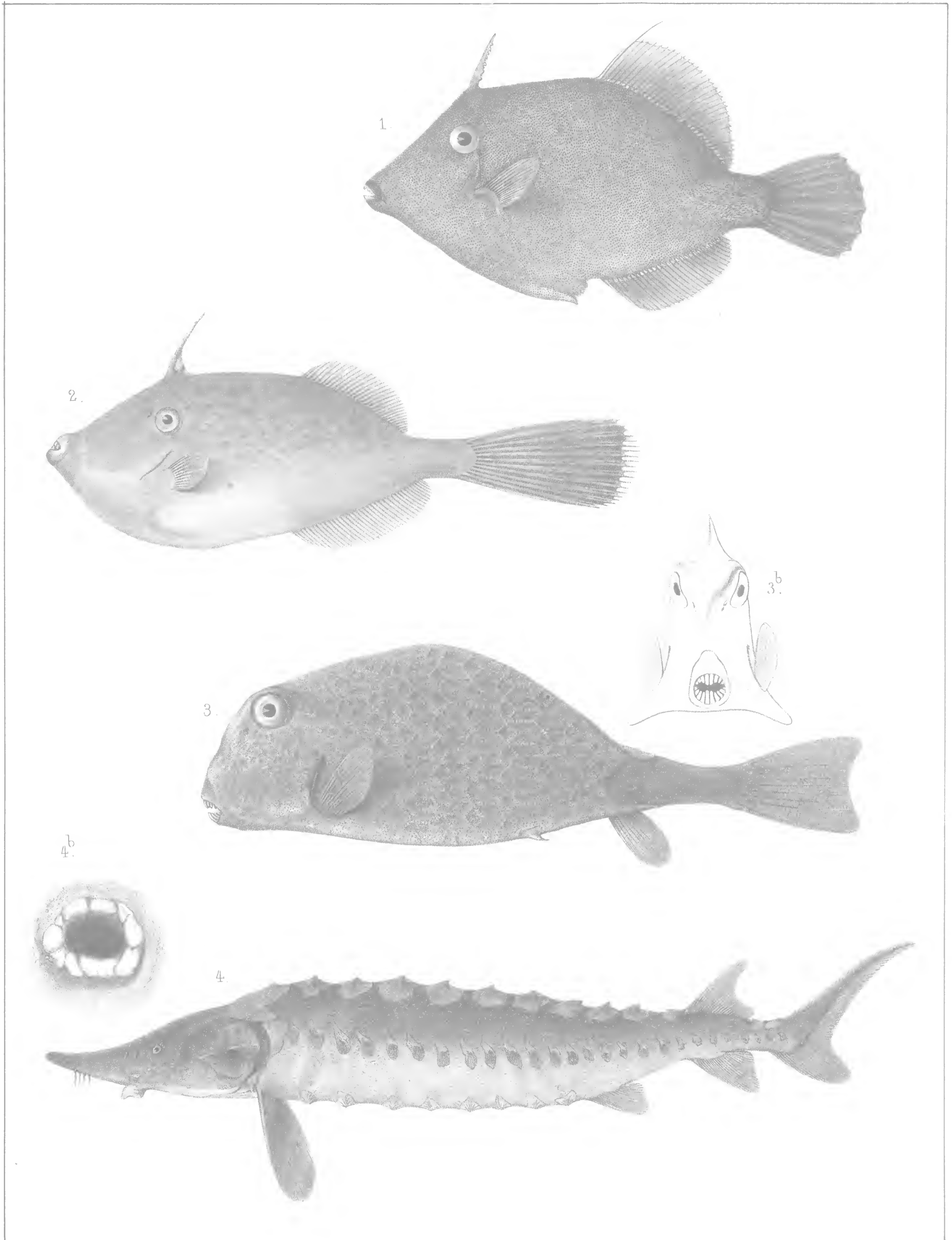
1. ANGUILLA BOSTONIENSIS Dek. — 2. AMMODYTES AMERICANUS Dek.
3. SYNGNATHUS PECKIANUS Storer. — 4. HIPPOCAMPUS HUDSONIUS Dek.
5. TETRAODON TURGIDUS Mitch.



Tappan & Sonnet.

Printed at J. H. Bufford's.

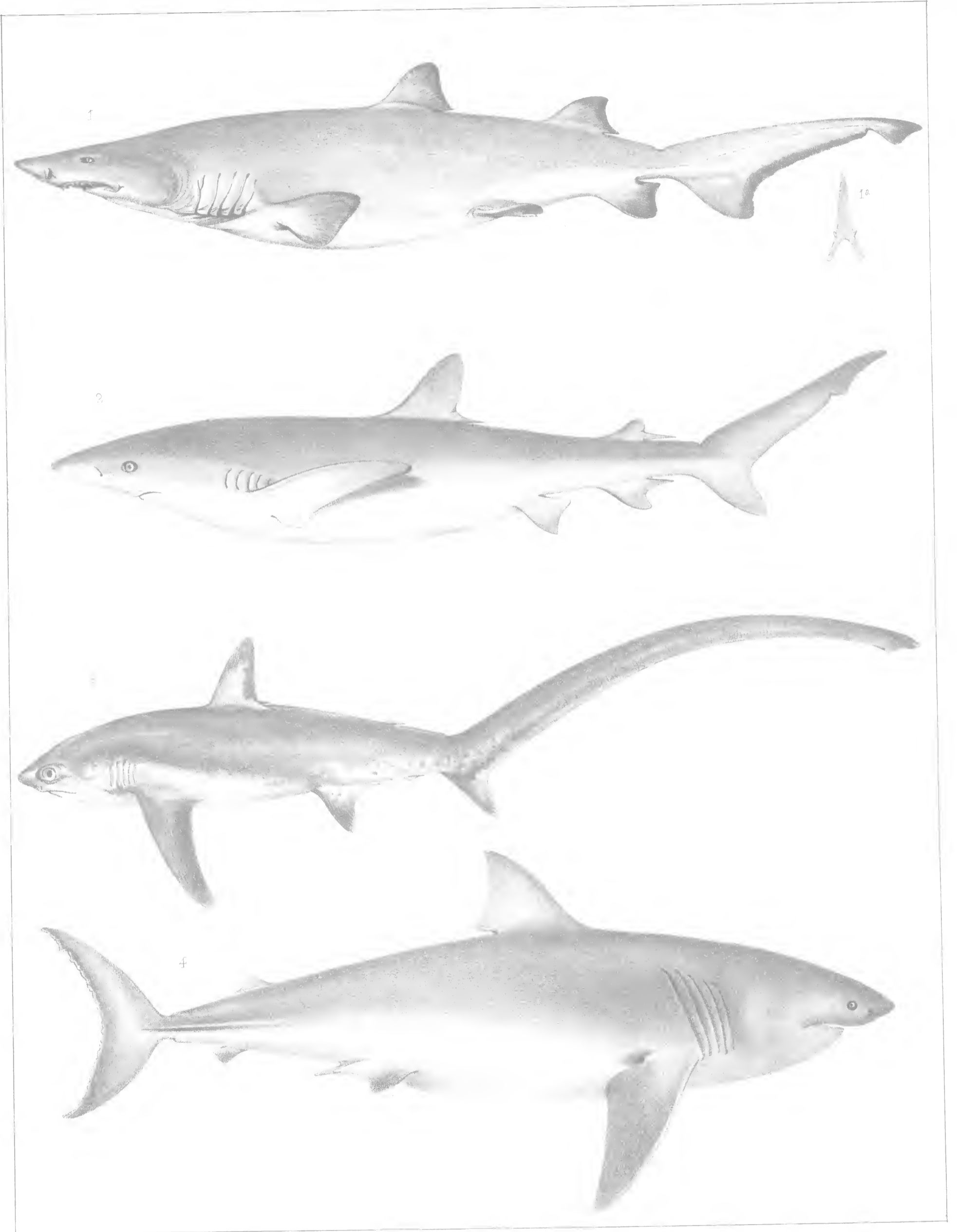
1. TETRAODON LAEVIGATUS Linn. — 2. ORTHAGORISCUS MOLA Schneider
3. MONACANTHUS AURANTIACUS Mitch. — 4. M. MASSACHUSETTENSIS Storer.



Tappan & Sonrel.

Printed at J. H. Bufford's.

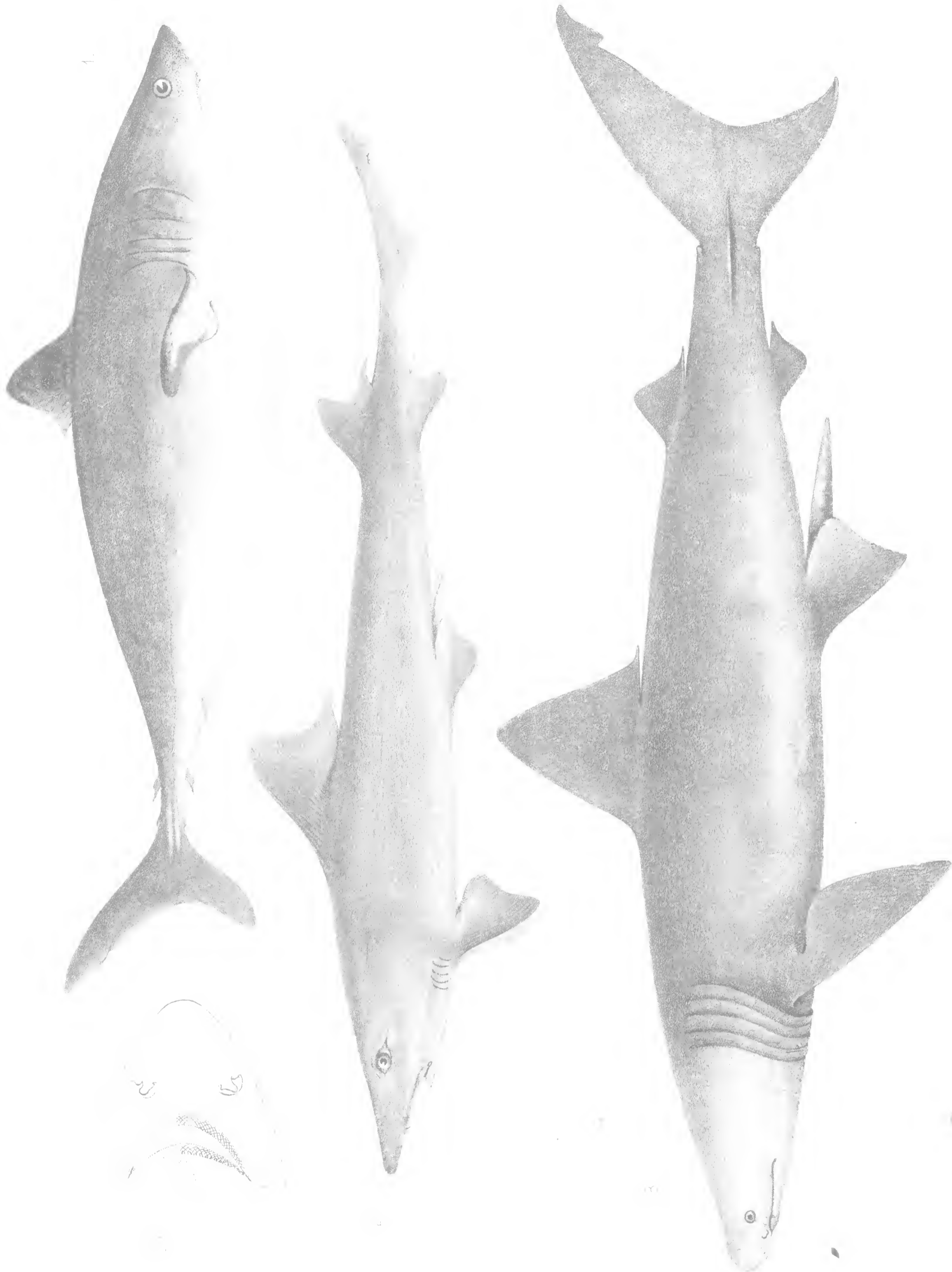
1. MONACANTHUS SIGNIFER Storer. — 2. ALUTERES CUSPIDATA Dek.
 3. LACTOPHRYS YALEI Dek. — 4. ACIPENSER OXYRINCHUS Mitch.



1. *Carcharias griseus* Aves.
1^a. tooth.

2. *Carcharias obscurus* Lesueur.
3. *Carcharias vulpes* Cuv.

4. *Carcharias wordi* Steyer.



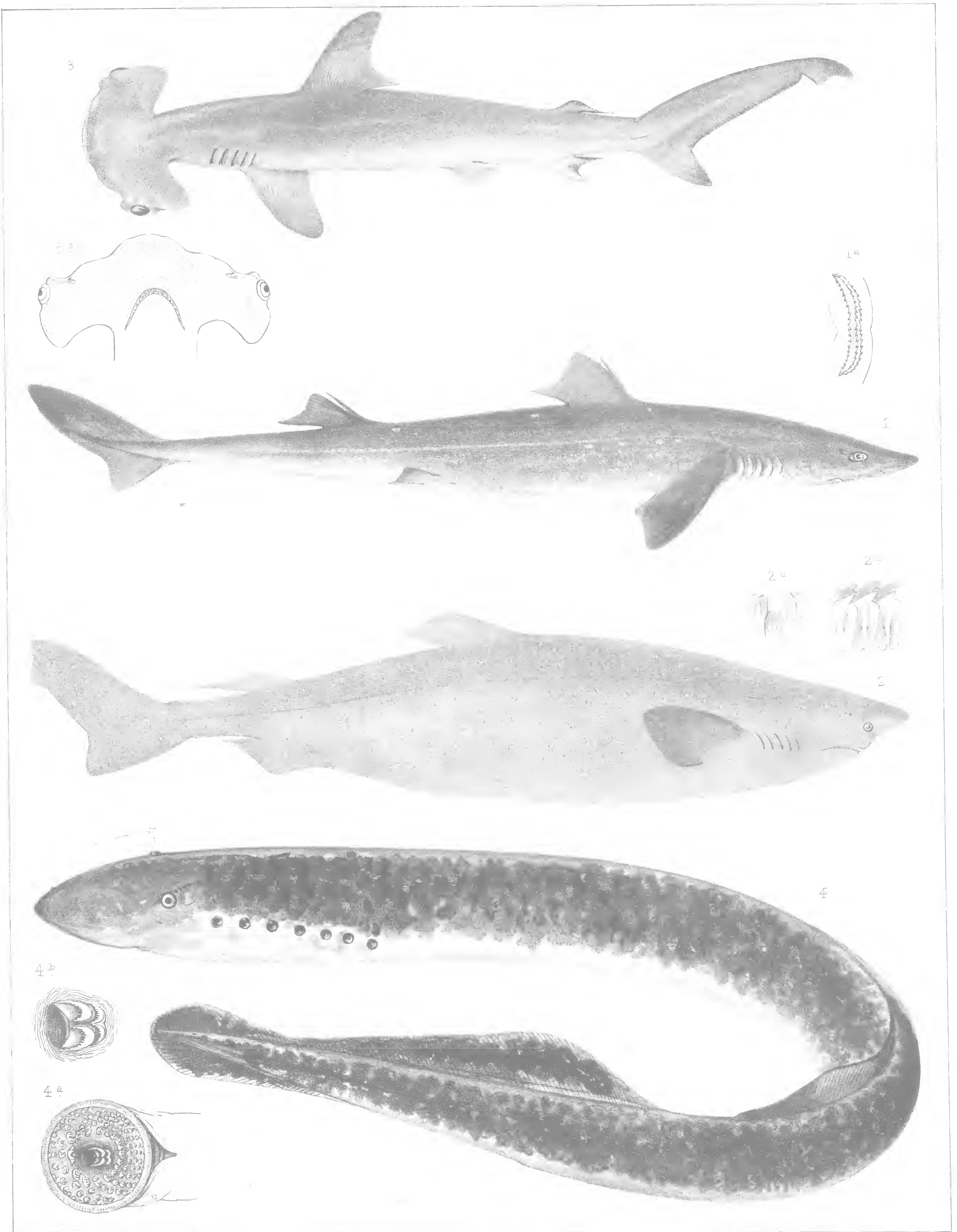
J. H. Bufford's Lith. Boston.

1. *Lamna punctata*. Storer.

2. *Mustelus canis*. Dekey

2^a: head, beneath.

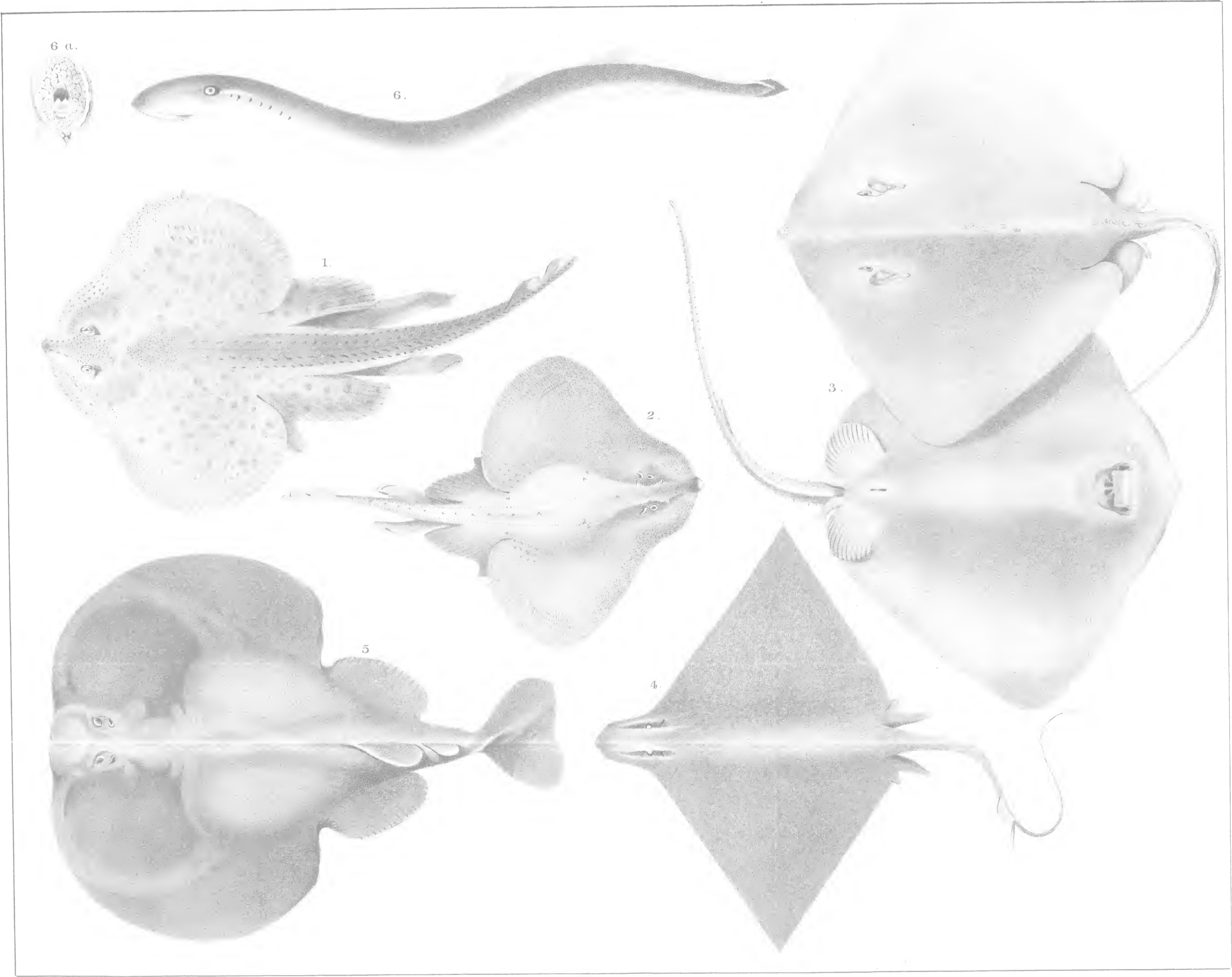
3. *Selachus maximus*. Cur.



J. H. Bufford's Lith. Boston.

1 *Acanthias Americanus*. Storer.
 1^a teeth.
 2 *Scymnus brevipinna*. Dekay.
 2^a teeth in both jaws.

3 *Zygaena malleus*. Val.
 3^a head, beneath.
 4 *Petromyzon Americanus*. Lesueur.
 4^a mouth. 4^b central teeth.



Benjamin & Co. Lith. 34 Cornhill St. Boston

1. *Raja erinacea* (Walt.)
2. *Pseudisoma maculatum* (Walt.)

3. *Myliobatis californica* (Walt.)
4. *Myliobatis californica* (Walt.)

5. *Pseudisoma maculatum* (Walt.)
6. *Myliobatis californica* (Walt.)

