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THE

ZOOLOGY

OF THE

VOYAGE OF H.M.S. SAMARANG;

UNDER THE COMMAND OF

CAPTAIN SIR EDWARD BELCHER, C.B., F.R.A.S., F.G.S.

DURING THE YEARS 1843–1846.

(Published under the Authority of the Lords Commissioners of the Admiralty.)

EDITED BY

ARTHUR ADAMS, R.N., F.L.S.

FISHES,

BY

SIR JOHN RICHARDSON, M.D., F.R.S.

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FISHES;

BY

SIR JOHN RICHARDSON, M.D., F.R.S.

APISTES TRACHINOIDES, *Cuv.*

Apistes *trachinoides,* Cuv. et Val. Hist. des Poiss. vol. iv. p. 401. pl. 92. f. 1.

Radii.—B. 6; D. 15|4; A. 3|4; C. $9\frac{3}{3}$; P. 13; V. 1|4.

Plate III. Fig. 3–5.

Our specimens agree exactly with the description and plate above quoted, except that there are only four soft rays in the ventrals, instead of five as quoted in the *Histoire des Poissons.* The small scales are very deeply imbedded in the skin, and are ranged on the sides in vertical lines not tiled. I have not been able to detect them in the space between the lateral line and fore part of the dorsal, but the whole of the shoulder for some distance below the lateral line is rough with prominent pores, as are also the sides of the head. On the limbs of the lower jaw, and the membrane connecting them, these pores render the surface villous.

The jaws, chevron of the vomer, and a narrow plate on the palatine bones are armed with fine short villiform teeth. Length, $2\frac{3}{4}$ inches.

Hab. Sea of China.

APISTES DEPRESSIFRONS, *Richardson.*

Radii.—B. 5; D 13|7; A. 3|5; C. $10\frac{3}{3}$; P. 10; V. 1|5.

Plate III. Fig. 1–2.

This *Apistes* agrees with *trachinoides* and *dracæna* in the three anterior dorsal rays being stouter, approximated to one another and somewhat remote from the following ones.

Indeed it possesses so many of the characters ascribed to *dracæna* in the *Histoire des Poissons*, that we should have referred it to that species were it not that the preorbitar and preopercular spines of the latter are said to be very large, while in our fish they are rather shorter than is usual in the genus. The anterior spinule of the preorbitar is, however, larger than common, being half as long as the chief spine and, like it, slightly curved and directed backwards. The species differs from *A. belengeri* in the more posterior origin of the dorsal, and in having only two bony points or ridges on the operculum. *A. rubripinnis* of the *Fauna Japonica* has no scales above the lateral line.

The body is highest about the fifth and sixth dorsal spines, the height there being equal to one fourth of the total length, and the thickness to about half the height. The head is considerably depressed, the profile rising at an angle of only twenty-five degrees to the beginning of the dorsal. When the mouth is closed the under jaw forms the extremity of the head, and the cleft of the mouth descends almost vertically. There is a small knob beneath the symphysis of the mandible. The mandible can be depressed to the horizontal line, the upper jaw remaining nearly vertical. The length of the head is contained thrice and one third in the total length. When viewed in front, the interorbital space is seen to be traversed by two smooth ridges which are approximated to the mesial line; the edges of the orbits themselves are also prominent. The breadth of this space is less than the diameter of the orbit. The principal preorbitar spine reaches to the anterior third of the orbit. The preopercular spine, which is of the same size, is straight, and there are three obtuse corners beneath it. The two opercular ridges are visible, but their points are scarcely pungent. The supra-scapular, however, has an acute point at the upper corner of the gill opening. The scales of the body are very small and remote from each other, are much sunk in the skin, and, being dark, look like little pits rather than scales on a cursory view.

The dorsal commences over the upper limb of the preoperculum. Its first three spines are a little stouter than the rest, are approximated to each other at the base and a little removed from the following one, to which the third one is connected by membrane. The second spine is a little taller than the first or third; the following ones are somewhat shorter and nearly all of one height, except the last, which, though more slender than the second one, is even taller. The anterior soft rays rather overtop the tallest of the spines: the last one is short and is bound to the back its whole length by membrane, which does not reach to the base of the caudal. The anal rays are fully taller than the soft dorsal ones; its spines, which are graduated, are shorter.

The teeth are in close-shaven, villiform bands on the jaws, prominent chevron of the vomer, and palatine bones. On the latter they form an elliptical patch.

The general colour of the specimen, which has been long in spirits, is brownish grey, the fins seem darker, and there are many obscure frecklings on the dorsal fin and back. Length, $2\frac{3}{4}$ inches. This specimen had a surmullet in his œsophagus.

Hab. Sea of Japan.

APISTES MULTICOLOR, *Richardson.*

Radii.—B. 6; D. 15|6; A. 3|4; C. $10\frac{3}{3}$; P. 11; V. 1|4.

PLATE IV. Fig. 3–4.

In this *Apistes* the profile of the face is steep with an abrupt curve over the eye to join the dorsal line, which descends gradually from its summit at the temple to the tail. The height of the body is equal to one quarter of the total length of the fish, and its thickness is equal to the sixth of the same length. The head forms a third of the whole length, the mouth is at its extremity, the jaws being equal, and the gape, which is small, is nearly horizontal. The ventral line is more horizontal than the dorsal one, being even with the lower jaw as far as the anus, from whence it ascends to the base of the caudal, whose height is about one third of the height of the head. The edges of the orbits and two smooth ridges between them are equally prominent and equidistant. The interorbitar space is one third narrower than the diameter of the eye. The jaws, prominent chevron of the vomer and palatine bones are set with close-shaven, villiform teeth.

The slender, acute preorbitar spine reaches back to the posterior part of the eye, and there is a spinule at its base in front standing forwards and outwards. The axilla of the spine is filled by a small slip of membrane. The opercular spine, though conspicuous, is not so long as the preorbitar one. There are four obtuse points beneath it. The operculum has two bony ridges whose points do not penetrate the skin. The scales of the body are small and the lateral line is formed of oblique tubes whose points are elevated. The last three dorsal spines are grooved at their tips so as to appear forked, and the same is the case with the anal spines. The spines are tipped by short skinny filaments, and the membrane is deeply notched between them. The last soft ray of the dorsal is attached to the back by membrane for nearly its whole length, and is divided to the base. The lowest ray of the pectoral is unbranched, the rest are forked. The ventral contains only four slender soft rays, the last of which is bound to the belly by a rather wide membrane.

The two specimens in the collection retain several lively colours, chiefly different shades of brown, red, and white; but there is considerable difference in the mode in which these tints are combined in the two individuals. Each of them has three conspicuous, lateral, white marks; viz., one on the fore part of the dorsal near its base, which descends from the third spine to the shoulder, another on the back under the last spine, and the third forming a bar which extends from the soft dorsal to the anal. The head is marbled like the back. The dorsal and anal are edged with aurora-red, and are dotted posteriorly with oblique rows of small white specks having broken black borders. On the fore part of the spinous dorsal the black, separating from the white centres, forms short oblique lines. Specks of the same kind are ranged in transverse lines on the caudal and pectorals. The ventrals are minutely freckled with brown and black, and are marked also by two or three white spots. Length, three or four inches.

HAB. Sea of China.

APISTES COTTOIDES, *Linn.* (*Perca.*)

Perca *cottoides,* Lin. Mus. Ad. Fr. vol. xi. p. 84.

Apistes *cottoides,* Cuv. et Val. Hist. des Poiss. vol. iv. p. 413.

Radii.—B. 6; D. 14|6; A. 3|8; C. 11½; P. 6 et viii.; V. 1|4.

Plate III. Fig. 6–7.

Our specimens agree with the Linnæan account of *Perca cottoides* in all respects, except that they have only six gill rays instead of eight, which latter number I consider to be a mistake; and in the rows of spots on the fins being more numerous than two. This also may be accounted for by a partial effacement of the markings, and I have therefore considered the specimens as examples of the species described by Linnæus.

The head is thick and large, with a considerably arched profile. It forms more than one third of the total length, while the height of the body scarcely exceeds the fourth. The thickness is a little more than half the height. The diameter of the eye is equal to one quarter of the length of the head. The principal preorbitar spine reaches to beneath its centre, and is thrice as long as the smaller spine, which lies parallel to it, and is quite straight. The second-suborbitar ridge is visible only when the integuments are suffered to dry. It is flat, quite unarmed, and runs close to the orbit. The preoperculum is armed by four small spines, the upper one being the largest but not equalling the preorbitar spine; there is also an obtuse corner under the lowest spine. This bone is better described by the passage "*opercula branchiarum spinoso-serrata*" in this species than in any other *Apistes* that we have seen. The two ribs of the bony operculum can scarcely be detected, and present no pungent points. Neither are there any acute points on the suprascapular. The jaws and the acute prominent chevron of the vomer are armed by villiform teeth, rather coarser than in the other *Apistes* we have figured, and this species differs from them in the palatine bones being entirely toothless. The scales of the body, though small, are visible to the naked eye, and are more crowded or tiled than in some others of the genus. They are wanting above the lateral line as far back as the fifth or sixth dorsal spine, and a narrower smooth space extends along the base of the dorsal its whole length. The head is also quite destitute of scales. The lateral line, formed of a series of short tubes, is straight, and about one third of the height distant from the summit of the back.

The first dorsal spine stands between the anterior corners of the orbit. The third is the tallest, being equal to four fifths of the height of the body, and is almost twice as high as the first one. The membrane is notched between the spines. The soft dorsal is rounded, lower than the last spine, and ends opposite to the anal at some distance from the caudal. The membrane which connects the last rays to the tail is smaller than in most *Apistes*. The pectorals are rather oblique, and their eight lower rays have simple, thick, and prominent tips, the others being forked at the ends. The ventrals have only four rays. The caudal is even at the end.

The ground colour on the back is chestnut brown, distributed in five or six clouds or bars, the sides are very pale, and the belly quite white. The head and whole of the body down to the middle of the sides is thickly covered with small round dark brown dots, having paler disks. There are also some diluted spots on the lower lip. These dots are numerous on the base of the dorsal, and form rings on the spines. On the pectorals, anal and caudal, the markings assume the form of five or six freckled cross-bars, and there are also a few specks on the ventrals. Length, $3\frac{1}{2}$ inches.

Hab. Seas of Borneo and China.

APISTES TÆNIANOTUS, *Cuv.*

Apistes tænianotus, C. et V. Hist. des Poiss. iv. p. 404; Lacépède, t. iv. pl. 3. f. 2. exclus. descript.

Radii.—D. 17|7; A. 3|5; C. $13\frac{2}{1}$; P. 12; V. 1|5.

Plate IV. Fig. 1–2.

We have two examples of this *Apistes* before us, one measuring three inches and three quarters from Japan, and the other four inches and a half long from the Philippines. Both correspond well with the detailed description of the species contained in the *Histoire des Poissons*, but they differ from one another in colour. The Japanese specimen is of a pale, clear, wood-brown, with a dark brown spot on the dorsal between the fifth and sixth spinous rays, and two or three faint indications of spots on the body, besides a row of points crossing the middle of the caudal rays. The specimen from the Philippines is of a much darker colour generally, being deep liver-brown, and wants the dorsal spot above mentioned, though it has some smaller and less distinct ones in other parts of the fin and several on the body. There are two rows of points on the caudal rays. The greatest difference between the species is in the fin membranes, those of the specimen from the Philippines being much thicker and more spongy and opaque. The scales in both are small, roundish, and in contact with each other, but not tiled. When the skin is allowed to dry, they become concave.

In reckoning the soft rays of the dorsal and anal, we have enumerated one fewer than the number quoted in the *Histoire des Poissons*, by considering the posterior one of each fin to be divided to its base, the two branches or rays springing from the same point.

Hab. Malay Archipelago; Seas of China and Japan.

APISTES LEUCOGASTER, *Richardson.*

Radii.—Br. 7; D. 13|8; A. 3|7; C. $11\frac{1}{1}$; P. 15; V. 1|5.

Plate V. Fig. 1–2.

The preceding *Apistes* are more or less completely scaly, the following one is entirely destitute of scales. It has a thick bluff head, from whence the moderately compressed body

tapers to the narrow base of the caudal, whose height is only about one quarter of that of the nape. The curves of the back and belly correspond, being but slightly arched. The profile of the head, from the mouth to the beginning of the dorsal, forms the sextant of a circle, and the lower jaw and throat form a smaller arc below. The total length is equal to thrice the height at the shoulder and one half, and the head makes one third of this length, while the thickness is two thirds of the height. The eye is situated high up, the margin of the orbit intruding slightly on the profile; the space between the eyes is equal to a diameter of the orbit and is concave; but the whole of the bones of the head are so covered with loose integument, that their forms are but very imperfectly distinguishable until the skin is suffered to dry. The mouth is terminal, and its moderately large gape descends obliquely till it comes under the middle of the eye. The jaws, chevron of the vomer, and palate bones are furnished with microscopical, close-shaven, villiform teeth. The preorbitar spine is straight, and scarcely exceeds half the diameter of the orbit in length. There is no small spine at its base, but a blunt projection of the bone stands forwards in its usual site. The disk of the preorbitar is flattish and its outline uneven. The second suborbitar forms an acute uneven ridge without spinous points. The preopercular spine is stouter but not longer than the preorbitar one, and has four obtuse corners beneath it, but none above it. Two ribs cross the operculum, the upper one being considerably curved with a perceptible point; the under one is straight. The soft flexible point of the suboperculum curves up behind the bony operculum, and forms the upper tip of the gill-cover. The gill-opening curves forward beneath, as far as the hinder part of the eye. The crests of the temples and supra-scapulars are very uneven and indistinct. The dorsal commences between the posterior quarters of the orbits, and its posterior spines are rather taller than the soft rays. The last of the latter is bound to the back its whole length, but the membrane does not quite reach the base of the caudal, while the membrane of the anal attains that fin. The caudal is moderately rounded at the end. The pectoral is very oblique, its rays gradually diminishing as they descend; their tips are mostly curved and project beyond the membrane; but, except one or two of the lowermost, they are all more or less forked, the upper ones being most so. The ventral spine stands immediately in the axilla of the lowest pectoral ray, the last soft ray is bound to the belly by loose skin. The ventrals are small, the pectorals comparatively large.

The skin is perfectly smooth and scaleless. Two minute, simple, tapering barbels spring from the upper border of each eye. The lateral line is marked by a series of soft elevations which are rendered more prominent by drawing the finger backwards over them. The ground tint of the upper parts is purplish-brown, with one large patch over the pectorals, formed by a close marbling of liver-brown, and another under the soft dorsal. The head is more finely mottled with liver-brown. The whole under surface, including the lower part of the pectorals, is pure white. The lateral dark patches extend to the membrane of that fin. The rays are white, finely ringed with brown. The upper half of the pectorals, the end of the caudal, the anal, and tips of the ventrals, are freckled and minutely dotted with blackish brown. Length, $2\frac{1}{2}$ inches.

The only *Apistes* noticed in the *Histoire des Poissons*, to which this fish bears a resemblance, is *niger*; but it would appear from the description there given, that *niger* has stronger spines, and the perfectly white ventral surface of *leucogaster* would ill accord with the specific name of *niger*.

Hab. Sea of China.

MINOUS ADAMSII, *Richardson*.

Radii.—B. 7; D. 10|10 vel 11; A. 10 vel 11; C. $10\frac{3}{3}$; P. 11, I.; V. 1|5.

Plate II. Fig. 4, 5.

This species agrees neither with the *M. woora* nor *M. monodactylus* of the *Histoire des Poissons* in the number of its rays, and it further disagrees with the latter in wanting the three trenchant teeth of the second suborbitar. As to the former, we have no specimen wherewith to compare ours; but Russell's figure, 159 A, has but a very imperfect resemblance to it in the head. We have therefore given it a distinct specific appellation, and, in doing so, embraced the opportunity of paying a tribute to the zeal and ability displayed by Mr. Adams in making the collection of fish on this voyage, and to his artistic skill evinced by the drawings of many which he executed at the time of their capture. The *M. pusillus* of the *Fauna Japonica* is evidently a distinct species.

The space between the eyes is concave, and is a little broader than the diameter of the orbit. It is traversed by two low acute ridges, which diverge a little as they run backwards. The anterior frontal is also marked by five prominent lines, which spread from an anterior point like the sticks of a fan, and form teeth on the fore edge of the orbit. The rest of the upper margin of the orbit is still more roughly crenated or toothed. A transverse furrow separates the frontals from the conical and ridged bones which lie between the nostrils and cover the maxillary pedicles. Behind the frontals there is another and a larger depression, which is traversed by the very uneven lateral ridges. These ridges have each three triangular, rough points, the terminal one being the largest. The temporal ridges are composed of two rough prominences, immediately behind which is the acute point of the suprascapular, at the commencement of the lateral line. The preorbitar has five short crenulated crests diverging from its centre, one of them running out anteriorly into a short triangular point, which is directed forwards; behind it springs the slightly curved spine, which reaches back to the middle of the eye. The great suborbitar has a central, thin, crenated crest, from which there radiates one thin crest forwards, a short one obliquely forwards and downwards, two backwards to the base of the preopercular spine, five short ones to the upper limb of the preoperculum, and a very low one directly upwards to the orbit. There is also a rugged conical point on this bone below the anterior ridge. All these lines are granulated and crenated, and the cheek of this fish is better protected by bone than in most of the family. The preoperculum has a somewhat concave disk, with both borders unequally prominent. The

spine of this bone is rather longer than the preorbitar one, is compressed, grooved, quite straight, and very acute. There is one acute corner on the edge of the bone above it and five below, the latter ones being very conspicuous, and the one immediately below it acute enough to be named as a short triangular spine. The operculum is strengthened by two ridges which diverge greatly. The lower ridge and its point can be discovered only when the integuments are suffered to dry; but the point of the upper ridge projects immediately behind the soft tip of the gill-cover, which is formed of the flexible cartilaginous extremity of the suboperculum; when the gill-opening is closed beneath, there is a round orifice above this tip, which is seemingly kept open by the direction then taken by the upper ridge and spine of the operculum. The dorsal commences in the occipital notch over the posterior margin of the preoperculum, and its second ray stands even with the acute terminations of the lateral cranial crests. The last pair of soft rays of the dorsal and anal fins approximate at their bases, and may prove on dissection to be only one deeply divided ray, so that only ten soft rays ought in that case to be reckoned to each. If an anal spine exists, it cannot be seen through the integuments. The teeth are microscopical, in villiform bands, those on the prominent chevron of the vomer being with difficulty distinguishable even with the aid of a lens. A small white barbel hangs from each limb of the lower jaw, a little behind its middle.

The colours of the specimen in spirits are nearly the same with those attributed to *M. monodactylus* in the *Histoire des Poissons*. The ground tint is a pale brown with two darker diffused stripes on the back. The fins are clouded with black and white, and the caudal has two white bars alternating with three blackish ones. Length, $2\frac{1}{2}$ inches.

Hab. Sea of China.

CHORIDACTYLUS MULTIBARBUS, *Richardson*.

Radii.—B. 5; D. 13|9; A. 2|8; C. $11\frac{2}{2}$; P. 10, III.; V. 1|5.

Plate II. Fig. 1–3.

This fish has characters in common with several of the Cottoid genera. In union with the preorbitar spines of *Apistes*, or *Minous*, it exhibits the hollow cheeks, prominent orbits, tall slender dorsal spines, the filaments of the fins, free pectoral rays, and ventrals adnate to the belly of *Pelors*. It has not, however, the elongated body, depressed head, and horizontally protruding muzzle, nor the vomerine teeth of this genus, and the membrane of its dorsal is complete, thick, and spongy, instead of being deficient between the posterior spines. In the lax skin, shape of the head, and general form, it comes nearer to some of the *Synanceiæ*, from which it is readily distinguished however by its free, curved, pectoral rays. The generic appellation is derived from χωρισμος, *sejunctio*, and δακτυλος, *digitus*.

The face of this fish is vertical, as high as the very prominent orbits, behind which there is a deep notch. The height of the shoulder is contained thrice and nearly one half in the total length, and the thickness is equal to three fourths of the height. The back is consi-

derably arched, the ventral line horizontal to the anus, whence it slopes upwards to the slender base of the caudal. The thickness is greatest at the gill-covers. The length, height, and thickness of the head are equal to one another, and to rather less than one fourth of the total length. Its shortness is owing to the vertical direction of the face, the front of the orbit being nearly as far advanced as the lips. The eyes are lateral, the upper bony margins of the orbits very prominent and uneven, presenting three irregular, angular corners. The anterior and posterior frontal bones, which form the upper part of the orbit, have each their diverging ribs. There is also a short longitudinal ridge on each elevated wall of the smooth mesial, inter-orbital furrow. The whole space between the edges of the orbits is equal to a diameter of the eye. The orbits are connected posteriorly by a slightly curved ridge, behind which there is a deep transverse depression, that is bounded behind by the first dorsal spine, flanked on each side by the conical eminences of the par-occipitals and temporal ridges. There is a very small depressed cheek beneath the eye. The comparatively small preorbitar has an elevated, ridged centre, from which a short three cornered point descends anteriorly, and a slightly curved spine projects posteriorly. This spine reaches back to the middle of the eye. The great suborbitar forms a conspicuous, prominent, very uneven ridge, which is not armed with spinous points. The preopercular spine equals the preorbitar one in size; immediately beneath it, there is an acute angular point, and at some distance below a smaller point, the under limb of the bone having but a slight inclination forwards. The small operculum is situated almost wholly over the preopercular spine, and is furnished with two ridges, the point of the upper one alone penetrating the skin. The gill-cover is attached by membrane to the shoulder, but the curved gill-opening is ample, and runs forward beneath as far as the fore end of the preoperculum and middle of the eye. The mouth is small, terminal, with a slightly descending cleft, so that when the lower jaw is depressed it reaches rather farther forward than the upper one. The rounded margins of the jaws are covered with microscopical, densely crowded, close-shaven, villiform teeth. The vomer is prominent and apparently tooth-less, and there are no teeth on the palate bones. The tongue is thick but pretty free.

The skin is quite scaleless, and lax, and rather spongy. The lateral line runs in the upper quarter of the height, and is formed of a series of short tubes. There are two conspicuous fringed barbels attached to each limb of the lower jaw. There is also one attached to the upper part of the eye springing from within the orbit, several skinny prominences on the bony points of the head, and a row of round tufts on the second preorbitar; numerous short filaments are crowded at the tips of the dorsal spines, and a row at the base of the spinous part of the fin is continued across the middle of the soft rays. There are also minute filaments on the pectoral rays. The dorsal commences in the occipital notch. It is more arched than the curve of the back. Its spines are tall and slender. The pectoral has three detached rays beneath, which curve downwards. The ventral spine is slender and shorter than the soft rays which are all forked: the last one is attached by membrane to the belly for its whole length. Only two anal spines could be detected without dissection, but there may be another small one hidden under the skin.

The colour of the specimen, as preserved in spirits, is chocolate-brown, more or less diluted on various parts of the body, and fading into white on the belly. A white band, proceeding from the third and fourth dorsal spines, passes down the sides; another crosses the basal half of the tail. The ventrals and the sides between them and the pectorals are covered with milk-white dots on a ground colour of blackish-brown. The pectorals are a little less dark, and the vertical fins are dark brown towards their edges and extremities. The extreme parts of the dorsal at the tips of the rays are white. Length, 3 inches.

Hab. Sea of China.

STHENOPUS MOLLIS, *Richardson*.

Radii.—B. 6; D. 3–$\frac{9}{8}$; A. 1|9; C. 11$\frac{2}{2}$; P. 15; V. 1|2.

Plate II. Fig. 6–7.

In profile, the outline of the face being very little elevated is a prolongation of the moderately arched curve of the back, and the ventral line is nearly similar. When the mouth is closed, the nearly vertical lower jaw forms the obtuse fore end of the head, but the body tapers considerably posteriorly, the height of the base of the caudal being only one third of the height at the nape. The total length, caudal included, is equal to three times and three quarters the height, and to six times and a half the thickness. The head is large in proportion to the size of the fish, forming a third of the total length, and is high and compressed with flat sides. The eye is small and high up, but does not interfere with the profile. The space between the eyes equals the diameter of the orbit, and is occupied by three anterior detached rays of the dorsal. The shaggy skin conceals all the bones of the head. A transverse furrow is visible between the orbits and nostrils. The mouth descends almost vertically from nearly the level of the eye. The maxillary, covered with loose shaggy skin, shews a rather broad disk behind the premaxillary, which is in no way concealed when the mouth is closed. The preorbitar is entirely hidden by the integuments, and on dissection is found to be a small subulate bone with a soft tip, proceeding forward from the suborbitar chain, which is very narrow and forms the under margin of the orbit. A narrow plate of bone descends from the chain under the posterior part of the eye to the curve of the preoperculum, which is also concealed by the skin. The curve of the preoperculum is the segment of an oval, the upper limb being very short, and its whole edge perfectly entire. The operculum on dissection is seen to be thin and weak, with two inconspicuous ribs which end in feeble points not at all pungent, and it has a concave edge between them. The narrow suboperculum curves up behind the operculum, and furnishes to the gill-cover a small elastic tip, which points upwards, nearly on a level with the summit of the back, and encloses a small round portion of the gill-opening when the gill-flap is closed. There are no pungent points whatever on the head. The gill-opening is very large, and extends in the segment of a circle from high on the shoulder down, and forwards to beneath the nostrils. The branchiostegous

membrane is supported by six curved cylindrical rays. The four small branchial arches lie deep in the cavity covered by the ample gill-flap. They are furnished with sessile knobs on their borders. The teeth on the jaws are microscopical, and set in close-shaven, villiform bands. They are even smaller on the chevron of the vomer and in a narrower transverse band. The palatines are toothless.

The integuments are soft, lax, scaleless, and almost everywhere furnished with small slender filaments, either simple or bifid. These are numerous on the jaws and most parts of the head, and are most conspicuous on the spinous dorsal fins and lateral line. They are small, but numerous on the lower half of the pectoral, and exist on the soft dorsal anal and caudal. The lateral line runs parallel to the back in the upper quarter of the height, and is furnished with bifid filaments.

The anterior dorsal consists of three approximated rays which stand between the eyes: the middle ray is the tallest, and is connected to the other by membrane as high as the tips. The next dorsal ray is over the preoperculum, and is connected to the following ones by low membrane, but stands at a greater distance from them than they do from each other. The membrane is deeply notched between them, but they are all clothed with thick skin studded with filaments. The soft rays are higher than the spines, and the last one is connected to the caudal by low membrane. The existence of an anal spine was not clearly made out. The pectorals are obliquely rounded, but not connected to the sides after the manner of *Synanceia*. All the rays are jointed, unbranched, and have prominent curved tips, the lower ones being thicker. The ventrals are exactly under the base of the pectorals, are small, and are composed of a short spine and two soft rays. The generic name is derived from their comparatively diminutive size. The caudal is rounded at the end with the tips of the rays projecting.

The colour of the specimen, after immersion in spirits, is blackish-gray, passing on the under surface into pale purplish-brown and white. There is a row of pale spots on the lateral line, and there are some pale dots scattered over the head, flanks, and fins. The fin membranes, particularly the borders of the pectorals, are dark. Length, 3 inches.

Hab. Sea of China.

PODABRUS CENTROPOMUS, *Richardson*.

Radii.—B. 6; D. 10|–20; A. 18; C. $11\frac{3}{3}$; P. 17; V. 1|2.

Plate I. Fig. 7–11.

This fish is much compressed, the height, which is greatest under the spinous dorsal, being more than twice the thickness. The profile approaches a semi-ellipse, the line of the belly being nearly horizontal with a slight convexity, while the back is elevated. The mouth is horizontal and low down, and the ascent from it to the dorsal is at an angle of 45°, nearly in a straight line; while the posterior part of the back is a little more arched than the under outline, both meeting in the very slender short trunk of the tail.

The head forms one third of the length of the fish, caudal excluded, or less than a fourth, including that fin. Its length exceeds the greatest depth of the body, and is twice its own height at the occiput. The eye is moderately large, forming a fourth part of the length of the head. It is placed one diameter of the orbit from the tip of the snout, two diameters from the apex of the gill-flap, and encroaches slightly on the upper profile. The nostrils are minute orifices without cirrhi before the eye, the anterior one being near to the end of the snout, and the posterior one more removed from the orbit. The space between the eyes is equal to almost two thirds of the diameter of the orbit, is covered with smooth skin, and is flattish. The preorbitar has a smooth under edge, curved in the segment of an ellipse; the rest of the suborbitar chain is concealed by the integuments; but a smooth, moderately wide process crosses the cheek from under the eye to the hollow of the preoperculum. This latter bone is curved, and its narrow disk, whose under edge is somewhat uneven, is also covered by the integuments continued from the cheek, so as not to be apparent in the recent fish: a little above the curve, there is a small, narrow, flat, obtuse spine or process, projecting from the upper limb of the bone. The interoperculum is rather narrow, flexible, and smooth. The operculum, of a triangular form, ends in an obtuse, thin point, which is not at all pungent, and is wholly concealed by the flexible, narrow, prolonged end of the suboperculum, that forms a conspicuous tip to the gill-cover. The gill-opening is pretty large, although it is restricted above by a membrane which runs from the tip of the suboperculum, and binds the gill-cover to the nape. The gill-membrane is also united to its fellow beneath and plays free over the isthmus, to which it is connected only at the root of the tongue. It is sustained by six pretty long, slender, curved rays on each side, and, when fully expanded, is convex externally. The mouth is horizontal, with a pretty large gape, though it does not extend so far back as the orbit. The under jaw is rather the longest. The margin of the mouth is formed by the premaxillaries and the mandible, and both are armed by villiform bands of teeth, which are broadest at the symphyses, where there are four or five teeth in the breadth of the bands; the individual teeth, when examined by the aid of a lens, appear to be subulate and acute. The projecting chevron of the vomer is similarly armed, and there are more minute ones covering the narrow edges of the palatine bones. The tongue is hemispherical and smooth. There are four branchial leaves and a small single one attached to the gill-plate. Each arch is armed interiorly by two rows of small, obtuse, sessile processes; and the posterior branchial leaf is bound to the shoulder by membrane, leaving only four openings from the gullet. The maxillary bone is closely bound by integument to the pre-maxillary its whole length, and glides partly under the edge of the preorbitar: its lower end is wider and truncated.

The skin is smooth and scaleless, and the lateral line, which is composed of a series of short tubes, is much arched over the pectoral, and quite straight for the remainder of its course to the caudal fin.

The first dorsal is arched, the fourth and fifth rays being the tallest, and the last one

very short. All the rays are slender and flexible. The rays of the second dorsal are all unbranched and finely jointed. The anal is similarly constructed. The membrane of these and of the other fins is extremely delicate and easily torn, and as it has suffered some damage in the specimen, we cannot determine whether the two dorsals were connected by a low membrane or not, or whether the last rays of the dorsal and anal were bound to the tail. There is a deep furrow on the upper surface of the short trunk of the tail and a similar one below, in which the last rays of the dorsal and anal recline. The caudal is truncated at the end with a slight projection of the angles, and the membrane is notched between the tips of the rays, which are forked. The pectoral appears to have been pointed, but its rays being brittle have been mutilated. The ventrals are very small and are attached beneath, or rather behind, the attachment of the pectorals. The first ray is flexible without apparent joints, the other two, which are not separated from each other by membrane, are longer and distinctly jointed. Colour in spirits uniform and brownish. Mr. Adams has noted that the body and fore part of the dorsal are chestnut brown, the throat and belly orange. There are oblong, silvery spots on the sides, one of them extending from the eye to the gill-opening, another being in the axilla of the pectoral, and the third under the end of that fin, just where the lateral line begins to take a straight course. The eye is orange and golden. Length, $4\frac{1}{2}$ inches.

Hab. The sea off the Island of Quelpart.

PODABRUS COTTOIDES, *Richardson*.

Radii.—B. 6; D. 10|–19; A. 18; C. $11\frac{5}{5}$; P. 15; V. 1|2.

Plate I. Fig. 1–6.

This fish is much less high and compressed in the body than *P. centropomus* and has a very different aspect, though it posesses the same generic characters. It has some resemblance to a *Cottus* or *Apistes*, but is distinguished from the former by its palatine teeth, and from the latter by its unarmed preorbitar. It is moderately compressed, the height at the shoulder being twice the width; the dorsal line is continued from the eye to the caudal with a very slight convexity, and the descent of the snout is small; the ventral line is similar, both profiles meeting in the rather slender tail, which has scarcely a third of the height of the body at the pectoral. The belly is tumid. The head forms one third of the length of the fish, excluding the caudal, which is shorter than the head. The eye touches the profile, and its diameter is equal to about one fourth of the length of the head, and scarcely equal to the breadth of the cheek between the orbit and preopercular disk. The space between the eyes is less than the diameter of the orbit, whose upper margin is rather raised, and the interval in the skull is furrowed, but the inequalities are concealed by the integument. The jaws are equal; very little of the maxillary is concealed by the preorbitar, and its truncated end falls back as far

as the middle of the orbit when the mouth is closed. The premaxillary does not reach quite to the corner of the mouth, which is membranous. The jaws are armed by bands of acicular teeth, standing about four deep at the symphyses, and narrowing to a single row towards the corner of the mouth. The edges of the palatine bones, the prominent chevron of the vomer, and the hemispherical pharyngeals are set with similar teeth. There is no tongue. The preorbitar is not much broader than the rest of the suborbitar chain, and its under edge is curved in the segment of an ellipse, and is slightly uneven. The process which crosses the cheek from the second suborbitar to the preoperculum can be felt rather than seen. The preoperculum is curved with a narrow disk and no prominent angle, but is armed by a small acute spine, directed a little upwards, and springing from its upper limb above the apex of the curve. The triangular bony operculum is unarmed, and the gill-flap ends in a narrow strap-shaped tip, formed by the flexible extremity of the subopercular. The upper edge of the gill-plate is connected to the shoulder by membrane, but the gill-opening is ample, and the thin gill membranes, supported on each side by six, slender, curved rays, are united beneath and play freely over the isthmus. The ventral is composed of two simple jointed rays, and a short spine. The lateral line, formed of a series of short tubes, is somewhat undulated and moderately curved over the pectoral, after passing which it runs straight to the caudal. The general tint is brownish, with some silvery tints towards the belly. The back is darker, and the sides are crossed by about six vertical brown bars of a deeper tint. The tubes of the lateral line are silvery, and are strongly relieved by a series of small brown spots. The head and lips are also spotted with brown, and the vertical fins are barred transversely, each by about four brown lines. The pectoral is likewise marked with brown.

Several shrimps were contained in the œsophagus of this fish. Length, $3\frac{1}{2}$ inches.

Hab. Sea of China.

BATRACHUS QUADRISPINIS, *Cuv. et Valenc.*

Batrachus *quadrispinis*, Cuv. et Valenc., Hist. des Poissons, vol. xii. p. 487.

Radii.—Br. 6; D. 3|–17; A. 16; C. $15\frac{3}{3}$; P. 21; V. 1|2.

Plate I. Fig. 12–16.

Our specimen agrees with the description in the *Histoire des Poissons*, in the opercular and subopercular spines, and with the other particulars noticed in the brief description, except that the dark points or dots on the back and belly cannot be traced, but in place thereof the belly is pale without dots, and the back is clouded in a somewhat banded manner.

The head forms one third of the total length of the fish, including the caudal, and its height and thickness at the occiput are equal. The cleft of the mouth reaches to under the middle of the eye. The premaxillary teeth are in two rows and are acute, though short;

they are represented by mistake in figure 15 as uniserial. The vomerine and palatine teeth form a continued series of short teeth with rounded cusps, the vomerine teeth being somewhat larger and more prominent than the palatine ones. The mandibular ones resemble the latter, and stand in two rows at the end of the jaw. The first dorsal is connected to the second by membrane, and the pectoral and caudal are ovate. The ventrals are furnished with a spine and two unbranched jointed rays, the second soft ray being closely applied to the first and so slender as to be detected with difficulty. The dorsal and anal are connected to the base of the caudal by low membrane, and there are similar cutaneous folds in the axillary of the ventrals. Length, $3\frac{1}{2}$ inches.

Hab. China Sea.

TETRODON ATRATUS, *Richardson*.

Radii.—B. 5; D. 9; A. 8; C $8\frac{1}{1}$; P. 17.

Plate VII. Fig. 1–3.

This *Tetrodon* belongs to the group which have short heads, a generally hispid body, and pale spots. The spines are small, scarcely protrude even on the belly through the integument, and are but very little pungent to the finger, as they sink beneath the skin when pressed. They are most conspicuous on the belly, but become visible on the back when the skin is inflated. They can be traced over all the back, nearly to the base of the dorsal, and down the sides over the styloid bone, till they meet the spinous skin of the belly. Some very delicate ones are detected with difficulty on the lateral line, where it traverses the trunk of the tail, and a few also at the posterior part of the base of the dorsal. The top of the head is also set with minute spines, but the snout anterior to the nostrils, the chin, cheeks, the pectoral axillæ, the flanks posterior to the point of the styloid bone, and the whole of the tail, except the lateral lines, are smooth. The lateral line can be traced from near the nostril in a curve, under the eye, over the shoulder and pectoral fin with some slight undulations, and then straight through the tail, above the middle height. Porous lines can also be traced over the eye, and one line runs from the caudal fin through the lower third of the tail. The skin along this line is minutely granulated, as if spinous, but the spines are neither visible by aid of a single lens, nor sensible to the touch. The rest of the integument above and below is quite smooth.

The obtuse chin projects beyond the mouth, which is thus turned obliquely upwards. The profile is slightly concave at the nostrils, and convex at the eye, from whence it runs nearly horizontally to the dorsal. The belly is tumid, and is capable of considerable distention. The head, measured to the gill-opening, forms one-fourth of the total length of the fish, caudal included; its breadth at the gill-openings is equal to its length, and its height, when the skin is flaccid, is nearly equal to its breadth. The nostrils are two small contiguous

openings, situated before and above the level of the eye, the tips of the anterior opening being tumid. The distance between the eyes is nearly half the length of the head, and the mouth is small, with the loose tips granulated or fringed interiorly. The anus is lax, and is fully a quarter of an inch before the anal fin.

By dissection, the preoperculum is found to have a broad flat disk with numerous furrows towards its border. Its under limb is one-third longer than the upper one, which is vertical. They meet at a right angle, and the corner is very slightly rounded. The under edge is straight and horizontal, and lies in contact with, and partly conceals, the gill-rays. The body of the operculum is triangular, with a prominent ridge or crest near its articulation, and a narrow, flat process descending from its anterior edge, over a thin plate, formed by the interoperculum and subopercular, which lie wholly behind the preoperculum, and are closely joined by membrane to one another. The hyoid bone gives attachment to five slender, curved branchiostegous rays, and the point of the uppermost can be felt through the integuments at the margin of the gill-opening, where it projects. Beneath the rays there is a broad thin plate, undulated so as to give lodgment to several large muscles, and articulated to the body of the hyoid bone. It looks like a greatly developed gill-ray, or rather like several (four) confluent rays, being traversed by three lines, indicating the points of union. The anal and dorsal are rather high, and the latter is the narrowest. The two fins terminate opposite to each other, but the dorsal commences a little farther forward. The caudal is even at the end, and the pectoral is much rounded.

The upper half of the fish is deep black, but there are some scattered round marks on the back of greyish-black, in general not much paler than the ground colour. In one specimen, however, these spots look whitish, as if the pigment were partially worn off. The under surface is white, and there are some orange tints on the flanks. The black and white meet in an irregular, clouded manner. The anal is white. The other fins are more or less clouded or mottled with black. Length, $5\frac{1}{2}$ inches.

Hab. China Sea.

Of the species named in the *Règne Animal*, p. 368, as belonging to the division 1° D., *T. testudineus*, Bl. 139, differs in its colour and markings, as well as in the general diffusion of the spines on the chin, flanks, and tail, as well as on the belly and back. Lacépède would appear to have confounded more than one species under the name of *hispidus*, as he states it to be an inhabitant both of the embouchure of the Nile, and of the Indian Ocean. His figure is copied from one of Commerson's designs, and is studded on the back with round, well-defined, white dots, in which as well as in the band-like processes of the dark ground colour, which run from the back into the white of the belly, the species differs from *atratus*. The *T. hispidus* of Bloch, pl. 142, has similar lateral descending bars of the dark colour without the superior white dots. *T. patoca* of Buchanan Hamilton, pl. 18. f, 2, differs from *atratus* in its more arched back, more prominent upper jaw, and in the numerous yellow angular spots on the back. Of the many handsome species figured in the *Fauna Japonica* by M. Schlegel,

the only ones which require to be compared with *atratus*, are *rubripes*, pl. CXXIII. f. 1., and *firmamentum*, pl. CXXVI. f. 1. Both differ from *atratus* in the mouth being at the extremity of the head, and not the chin, and *rubripes* has the eye much more remote from the profile, and large black marks on the flanks, while *firmamentum*, with a more arched back, has the spines more generally diffused, and many pale oval or round spots equably placed on the head, back, belly, and basal half of the caudal fin. None of the species named under Cuvier's fourth division of the genus, characterized by smooth flanks, without tubercles, have any resemblance to *atratus*.

TETRODON HISPIDUS, *Lacépède.*

Le Tetrodon hérissé, Lacép. vol. i. p. 487. pl. 24. f. 1.?

Radii.—D. 10; A.; C. $9\frac{1}{1}$; P. 17.

Plate IX. Fig. 3–4.

I refer this species, though not without doubt, to the *Tetrodon hispidus* figured by Lacépède, from a drawing of Commerson's, but it seems to be distinct from the *hispidus* of *Bloch*, which wants the white spots on the back. In retaining the specific name of *hispidus*, I have followed the *Règne Animal*, though without expressing an opinion as to the identity of Commerson's fish with the *hispidus* of the Nile and Mediterranean, which I have not seen.

This *Tetrodon* has a short thick snout, which in profile ascends to the prominent eyes. The back is moderately arched, and the belly can be distended to a semi-globular form. When the fish is fully blown up, the pectorals, dorsal and anal, are much concealed, as well as a considerable portion of the caudal. The space between the eyes is equal to two diameters of the orbits, and is slightly concave owing to the prominence of the upper borders of the orbits. The nostrils are pierced in two short barbels, which are connected at the base. The pectorals have an even or slightly crescentic edge, with rounded corners. The caudal is even, and the dorsal is placed, nearly its own breadth, before the anal. The lips are papillated. A ring round the mouth, the upper part of the snout, as far back as the nostrils, the narrow borders of the eyes, a ring round all the fins, the fins themselves, and the tail, posterior to the anal fin, are smooth. The rest of the integuments are spiny. The spines of the sides, belly, and cheeks, are closely set and rigid, and though small, are conspicuous enough. Those of the back are very short, scarcely penetrating the skin, and are not so numerous. They extend backwards behind the dorsal, and terminate over the fore-part of the anal.

The specimen, which has been long in spirits, has a grayish-brown colour above, and a white belly. The upper parts are regularly spotted with white, the dots being round on the snout, tail, and base of the caudal fin, and oval on the back. They coalesce into circular lines round the eyes and bases of the pectorals and dorsal fins; the bases, themselves, being dark. The end of the caudal is blackish brown, and there are some dark tints on the dorsal.

There is also a series of four deep black marks, or bars, on the sides, viz., one under the eye, another before the gill-opening, the third and largest under the pectoral, and the fourth rather before the dorsal. The ground colour of the back deepens slightly over these marks, as if in the recent fish they had formed the extremities of transverse dorsal bands; but they cannot be said to be mere prolongations of the ground colour into the white of the sides, such as the lateral bars of the *hispidus* of Bloch are described to be. When the skin is examined with a lens, it is seen to be composed of tessellated minute plates, having various forms in different parts. On the smooth skin of the tail they are round or polygonal. They are oblong, but very unequal on the back, and smaller, granulated, and irregular on the belly.

Hab. Eastern Atlantic.

TETRODON NARITUS, *Richardson.*

Radii.—D. 33; A. 28; C. 10; P. 17.

Plate VIII. Fig. 1–3.

The usual number of rays in the dorsal fin of a *Tetrodon* is nine or ten. One species, the *nigro-punctatus*, is noted by Schneider as having only seven rays in that fin, in others the numbers amount to twelve or thirteen; but out of twenty-four species characterized by the author just named, only one is said to have as many as fifteen dorsal rays.[1] The species described below has more than twice that number of rays in the dorsal, and its anal is also proportionably great. It differs also from any other fish we have seen in its nostril, which is single and has an orifice equal in extent to the length and breadth of the cavity.

The length of the head, measured to the gill-opening, is one fourth of the whole length of the fish, caudal included; the breadth of the head is less, being contained five times and a half in the whole length. The eye is placed above the level of the mouth, and mid-way between the end of the snout and gill-opening. The nostril is before, and rather higher than the eye, and is a single, wide opening, with a smooth bottom, and a plaited, loose margin, which forms two small, narrow, obtuse lobes anteriorly, the border being deficient between the lobes, so as to form a small channel or notch on the anterior rim of the opening. The mouth is rather small, the lips granulated or papillated on the edges; and within close to the teeth, there is a narrow, prominent, more densely papillated ridge. The mouth is terminal, and the profile is gibbous over the eye. The belly is capable of considerable distention, so as to assume a semi-globular form. The tail, between the three vertical fins, has a peculiar shape, arising from an osseous enlargement of the upper and under interspinous bones, each about the size of a kidney bean. The dorsal and anal fins have a different shape from those of any other Tetrodon which we have seen, being longer than high, and considerably arched.

The skin is smooth on the back, and of a pale brownish-purple tint, with various reflexions, when taken from the spirits. The recent colours were not noted. The skin is

[1] This is the Chinese *ocellatus*, which has usually only fourteen rays in the dorsal.

traversed by various fine furrows, or depressed lines, whose course will be better understood by referring to the plates than by description. The spines are stronger than usual in the genus, and are each composed of a longitudinal base, imbedded in the integument, and a central subulate, acute stem rising from it through the skin at a right angle. These spines cover the belly, from the chin to the anus, leaving the cheek naked, but rising before the gill-opening to the temples and supra-scapular region. There are also five spines on the shoulder, behind and above the pectoral fin, the spiny surface there being bounded above by the undulating lateral line, and meeting beneath with the spiny ventral surface. The rest of the skin of the snout, top of the head, cheeks, and body, is smooth and polished, the axillæ of the pectorals alone being finely and softly granular. Length, 8 inches.

Hab. River Saräwak, Borneo.

Tetrodon meleagris, *Solander.* (Rich. Ichth. of Voy. of Sulph. p. 122. p. lvii. f. 1–3.) We take this opportunity of adding a short extract form Solander's Manuscripts, relating to this species. "*Caro venenata. Totus e purpurascenti nigricans undique adspersis maculis, parvis, numerosis, albidis etiam in pinnis. Spinulæ breves rigidæ, vix spinosæ, subcartilagineæ sunt in vel sub cute totius animalis, exceptis pinnis, spursæ, numerosæ, in caudâ raræ; has vivus retrahere et exserere potest, unde nunc uno nunc altero loco hispidus.*"—Sol. MS. p. 79.

TETRODON SOLANDRI.

Tetrodon Solandri, Richardson, Zool. Voy. of Sulph. Fish, p. 125.
Tetrodon punctatus, Solander, MS.

Since the figure and short description of this species were published in the work above quoted, I have had an opportunity of again consulting Solander's manuscripts and Parkinson's drawings, and find that I was in error in quoting *T. cinctus* of Solander, as a synonym of the species, the error having arisen from the figures of *punctatus* and *cinctus* being on the same leaf of Parkinson's volume, and being referred to by the same number. The following is Solander's account of the species.

"Tetrodon punctatus, D. 10; A. 9; C. 10; P. 17. "Tæte." *Totus piscis (excluso abdomine) rufo-ferrugineus, punctis numerosis in corpore e viridi flavis, ubique circumcinctis, et inter oculos strigæ numerosæ cæruleæ, in dorso etiam puncta oblonga evadunt ut potius strigæ appellanda. T. dixit, piscis intoxicat illos qui illum edunt. Iris e viridi flava, annulo extero aureo. Pupilla nigra, annulo aureo. P. dorsi e glauco pellucida, basi carnoso nigricante, sub qua linea cærulea. P. pectoris glauco-pellucidæ. P. ani viridis, lineis duabus sordidè flavis. P. caudæ a basi ultra medium pallidè olivacea punctis ut in corpore, posticè e rubro lutea, strigis transversis interruptis seu potius maculis oblongis, cæruleis, ipso apice cæruleo. Abdomen setis brevibus hispidum, flaccidum e viridi flavum; carina abdominis mollis, cærulea, limitibus luteis; lineæ ad latera carinæ, obsoletæ, glaucæ. Gula dilutè crocea.*"—Sol. MS.

Parkinson's figure is nearly of the same size with that published in the Ichthyology of the Voyage of the Sulphur, which coincides with specimen, and measures four inches and a half in length. Parkinson has made a memorandum under the drawing, stating that "every spot is bordered with a dark line, which turns paler as the ground colour does." The specific name of *punctatus* having been given in Schneider's edition of Bloch to a Brazilian *Tetrodon*, cannot be retained for Solander's fish.

Tetrodon cinctus, which is also figured on the sixty-sixth folio of Parkinson's drawings, has a short head, obtuse snout, and a nearly globular form, when the belly is distended. It is also studded with small round dots on the upper surface, and on the caudal fin, but is characterized by two oblique black bars, which embrace the fore-part of the belly, whence its specific name. The intervals between the bars are light yellow, and there are several bars in outline on the remainder of the belly, but their colours are not specified. I have not found any reference to this species in Solander's Manuscripts. Like the preceding species, it was discovered at Otaheite, or, as Parkinson writes the name of the island, Taitaí. Supposing all the bars on the belly to be black, the species will closely resemble the *lineatus* of the *Fauna Japonica*.

TETRODON INSIGNITUS, *Richardson*.

Radii.—D. 9; A. 8; C. $9\frac{1}{1}$; P. 16.

Plate IX. Fig. 1–2.

This *Tetrodon* belongs to the third division of the genus, characterised by a keeled back, and of which only two species are named in the *Règne Animal*, viz., *T. rostratus*, Bl. 146, 2, to which *T. electricus*, Paterson, Phil. Trans. p. 76. pl. 3, is referred; and *T. Gronovii*, Cuv. Our fish resembles *T. grammatocephalus* of the *Fauna Japonica* (pl. cxxvi. f. 3.) so much, that I have great doubt as to its being really distinct; but M. Schlegel's figure does not show the striking ocellated mark at the base of the dorsal, nor the stripes on the back, and spots on the sides, and as the letter-press referring to this plate has not yet reached us, we do not know the condition of the specimen, or whether the colours had perished or not. *T. ocellatus* of Bennett, (Fishes of Ceylon, pl. 21,) has some resemblance to *insignitus*, but the eyed spot surrounds the base of the dorsal in the same way as it does in the *ocellatus* of Bl. p. 145, and the dorsal bands and streaks do not correspond with those of our fish. Nothing is said, in Mr. Bennett's text, of spines, nor are any represented in his figure.

In *insignitus* the belly and back are studded with minute spines, which roughen also the top, and entire sides of the head. There is a narrow ring of smooth integument round the base of the lips, the eyes, and gill-openings. The spines of the belly rise as high as the under ray of the pectoral, and backwards to the anus, while those of the back extend to the dorsal, and as low as the level of the centre of the eye. The axilla of the pectoral, the sides, and tail, are smooth, including the bases of the dorsal and anal fins.

The head forms one-third of the entire length of the fish; the snout is conical, and the profile in rising becomes a little gibbous at the eyes, and attains its summit in a prominent point, directly over the gill-opening, from whence it is horizontal to the dorsal fin. The belly is round and prominent, but apparently not capable of much distention. Posterior to the anus, the compression of the tail is considerable. The space between the eyes is rather concave transversely, and equals in breadth a diameter and a half of the orbit. This space narrows to a point posteriorly, the summit of the dorsal line, which is an acute point of bone covered by integument, forming, when viewed in front, the apex of a flat triangle. From thence the back to the dorsal is ridged, but not very acutely. The snout, before the eyes, is rounded, and tapers to the mouth. There is a low cutaneous seam on the mesial line of the belly. The nostril is a small round opening before the eye, which is so closed by a flat operculum, that when the skin is allowed to dry, it can with difficulty be discovered. The dorsal is a little before the anal, and the caudal is even at the end, with the tips of the rays projecting.

The specimen in spirits has a brown colour above, and is pale or whitish beneath. The snout and cheeks are marked with numerous round, blue-eyed spots, with darker borders, which fade under the pectorals, into an indistinct marbling, and entirely disappear farther back. The upper parts are marked with blue lines having dark borders. Two of these cross the upper surface of the snout before the nostrils, one crosses the nostrils and extends from eye to eye, four others cross the inter-orbital space, and five radiate from the posterior part of the orbit backwards; there is also one beneath the eye. Many short ones undulate longitudinally in the back and upper parts of the sides, and there are a few on the upper surface of the tail behind the dorsal. All these will be better known by consulting the figures than by description. They have much resemblance to the lines of *Tetrodon mappa* of Lesson. On each side of the base of the dorsal, there is a somewhat triangular black spot, with a pale blue border. These spots do not touch each other in front of the dorsal, and there is a still broader space between them behind. The fins are pale and transparent. Length, $2\frac{1}{2}$ inches.

Hab. Sea of China.

BALISTES RINGENS, *Bloch.*

Balistes *ringens*, Bloch, pl. 152. f. 2. Bl. Schn. p. 472. Lacép. vol. i. p. 370. pl. 18. f. 1. (*B. sillonné.*)
Balistes *niger*, Osbeck. Voy. Bl. Schn. p. 471.
Balistes *radula*, Solander, MS.

Radii.—D. 3|–31; A. 28; C. $10\frac{1}{1}$; P. 16.

Plate 6. Fig. 1–4.

The reference to Bloch's plate 152. f. 2, is made on the authority of the *Règne Animal*, for the figure is so bad a representation of our fish, that without the opportunity of verifying it by consulting Bloch's specimens, enjoyed by Cuvier, we could not have quoted it with confidence.

It is incorrect in the general profile of the fish, and in the vertical fins. Lacépède's figure is better. The species enters the group, which is characterized in the *Règne Animal* by six or seven rows of spines on the tail. Schneider attributes *seven* rows to *niger*, and *eight* to *ringens*. Solander, again, mentions nine rows as existing on the tail of his fish. There are in our specimen nine rows, four of which attain the base of the caudal, but the uppermost three and the lowermost two are shorter. The upper rows begin opposite to the anterior third of the dorsal fin, and the lower ones above the same part of the anal. These lines can scarcely be said to be spinous: they are rather low ridges, formed by a narrow, rough elevation of the transverse or short diameter of each scale. (fig. 3.) The scales, generally, are regular rhombs, having their surfaces densely, but equably scabrous, and are separated from each other by smooth lines. The rhombs are mostly vertical, and are higher and proportionally narrower on the tail than elsewhere. They are shorter, without losing their width near the pectoral fin, are more oblique on the belly, and make an approach in form to hexagons on the cheek. Behind the gill-opening there are a few scales, rather wider than the others, but not much longer. The dorsal spine is stout, cylindrical, obtuse, and slightly curved. It is not serrated in front, like the spine of Bloch's figure of *ringens*, nor does it taper so much. Its front is, in fact, villous, appearing so to the eye, but feeling smooth to the touch; and it is made rough on the sides by fine and crowded, hard granulations. The second ray of the first dorsal is short and slender, and the third one is far back, and so short, that it does not rise above the level of the furrow, which receives the fin when depressed. The dorsal and anal are arched in front, and lower and more even posteriorly. The exterior rays of the caudal are stout, with rough surfaces, which project beyond the intermediate straight, or slightly convex border, forming falcate points, equal in length to about one-third of the length of the fin. The ventral spine is short and truncated, and is raised only by force from a depression into which it fits. There is no thin membrane, nor appearance of rays behind it, the belly remaining roundish between it and the anus; but the narrow rows of scales which converge towards that part, are rough on the rim, or mesial line of the belly, making a low ridge. The length of the head is contained four times and one-third, in the total length, caudal included. The mouth is small, the eye quite round and high up, and the upper and under profiles of the fish are alike. The height of the body equals two-fifths of the whole length.

The colour of the specimen in spirits is dark brown, with a blacker face and chin. Some pale lines cross the nape and forehead, and there are darker lines on the body and tail corresponding to the centres of the rows of scales. The lines of skin, which appear between the scales, are pale and bluish, though they have been represented necessarily by the artist as dark. A milk-white line runs along the bases of the dorsal and anal rays, and there is a dark crescentic line, edged with a pale tint, within the border of the caudal.

The following is Solander's description, taken from his manuscript *Animalia Oceani Pacifici*.

"Balistes radula. *Totus piscis e fusco nigricans, cute cæruleâ quæ in inferiore capite,*

pectore et precipuè abdomine sæpe inter squamas apparet, quod pulchrum reddit piscem. Pinnæ magis fuliginosæ. Ad basin pinnæ dorsi posterioris et pinnæ ani strigæ pulcherrimè glaucæ seu e cæruleo albæ. Pupilla olivacea. Iris nigra. Ordines novem spinarum carinatarum in posteriore parte piscis æquales; sex ad basin pinnæ caudali extenduntur. Pinna dorsi anterior bi-radiata.

"Squamæ in inferiore parte piscis sub-olivaceæ quod inter cutem cæruleum strigas obliquas olivaceas efficit. Pinna caudalis posticè lunulato fasciâ nigricante ornata, limite posteriori sordidè glaucescente. Aelhi pahah or Aelhe pahahah." Solander, MS. An. Oc. Pacif. p. 86.

BALISTES SENTICOSUS, *Richardson.*

Radii.—D. 3|–25; A. 22; C. 12; P. 15.

PLATE IX. Fig. 5–8.

This *Balistes* belongs to that division of the genus which has no peculiar armature on the tail, for though the scales there are spiny, they are more or less so over the whole fish. When newly removed from the spirits in which the specimens are kept, the form of the scales cannot be well perceived, but as the skin is allowed to dry, it is seen to be covered with small, roundish, or obscurely tetragonal, or hexagonal scales, which have an elevated point in the centre, from whence lines radiate to the edges. On the scales of the head and breast, the elevation of the central point is less, and it does not appear much more conspicuous than several other rough points which stud the disk. On the back, sides, and tail, however, the central point becomes a true, small, acute spine, and the disk of the scale is more elevated, with radiating lines, but the other points are comparatively smaller. There are nine rows of scales on the trunk of the tail, laterally, and the scales on the narrow upper and under surfaces of that, have also spines, though not so large. On the under surface and point of the pelvic bone, the central spines and other points on the scales are larger and more acute, and on the edge of the dew-lap, between the pelvic bone and anus, the scales are ranged in pairs, and their central spines are bifid. The front of the dorsal spine is roughened by four rows of spinules, and the rays of all the other fins, pectorals included, are also rough, except the upper and under ray of the caudal, which are smooth. The scales behind the gill-opening are no larger than elsewhere, but on the immediate border of the opening the points on the scales are smaller, and more equable in size, and numerous.

The shape of this fish is much like that of *B. capriscus*. Its height is equal to half its length, caudal included. It is much compressed, the greatest thickness being at the temples. The space between the eyes is convex, and almost ridged in the specimen we have figured; but in younger individuals, from the greater prominence of the orbits, it appears concave. The length of the head is contained thrice and nearly one-half in the total length of the fish. The pectoral fin is small, the dorsal and anal high and rounded. The front spine of the first

dorsal is stout, and the third is as tall as the second, and rises considerably above the edge of the furrow which receives the fin. The dew-lap is not greatly distensible, and presents no resemblance of rays.

Our specimens are streaked and dotted with black, in the directions of the centres of the scales, but the pigment seems to be perishable, and the specimens are not in a perfect state, so that the proper colours cannot be described. Length, from one to six inches.

Hab. Sea of China.

Sir Edward Belcher's collection contains several other *Balistes*, such as

BALISTES ACULEATUS, *Lin.* Bl. pl. 149.

Balistes ornatus, Solander, MS., An. Oceani Pacifici, p. 93. Parkins. Icon. pl. 59, Mus. Banks.

This species has an extensive range, and appears to be abundant in most places where it is found. Sir Edward Belcher's collection contains several specimens. The following is Solander's account of it.

"Balistes ornatus, (*B. aculeatus*, L. Syst. 406–6, *secundam*, Sebam.) "Aer'h. Aelhitea."

"*Piscis supra medium anticè pallidè olivaceus, posticè fuliginosus infra medium albicans. Maxillæ sordidè lutescentes. Fascia intensè cærulea supra maxillam superiorem, unde ritta utrinque ad latera capitis, paulo ponè basin pinnæ pectoralium extensa lutea. Inter oculos fasciæ quatuor cæruleæ. Infra oculos ad basin pinnarum pectoralium fasciæ tres angustæ cæruleæ. Infra medium corpus fasciæ quatuor obliquæ. Prima incipiens paulo ponè pinnas pectoris ad anum extenditur: Secunda angustissima pinnæ parallela: Tertia primæ similis: Quarta infernè flavescens. In caudá quatuor ordines spinarum nigrarum.* P. D. 1 *ma. cærulescenti-pallida: 2da. pellucida. Anus intensè cæruleus. Iris lutescens. Pupilla nigra. Cauda intra aculeos glaucescens. Pinnæ pectoris pellucidæ immaculatæ.*"

Hab. Polynesia, Australia, Malay Peninsula, Seas of Borneo and China.

BALISTES VERRUCOSUS, *Linn.* (Cuv. *Règn. An.*)

Balistes pralin, Lacép. vol. i. p. 365.

Hab. Sea of China, Polynesia.

BALISTES RECTANGULUS, *Bl. Schn.*

Balistes angulatus, Solander, MS. *Anim. Oceani Pacif.* p. 57. Park. Icon. Bibl. Banks, no. 58.

Solander's description is as follows:—

"Balistes angulatus. "Aedhi, Oedi, or Oehli."

"*Supernè sc. caput supernè et superna pars corporis ex olivaceo castaneæ. Gula, pectus, abdomen ad anum usque alba. Labia cinerea. Arcus cæruleus supra labium superius. Striga*

nigricans ab anteriori parte orbitæ ad basin pinnæ pectoralis. Ab oculis obliquè descendit supra pinnam pectoris per latera ad pinnam caudalem, area magna latissima, nigra, prope oculos angustior, pone pinnas pectoris maximam partem lateris occupans. Prope basin posticam pinnæ ani, et dorsi posterioris strigæ duæ e viridi flavæ, antrorsum obliquè exeunt, angulos acutos a latere formantes: primus angulus ad medium latus extenditur, alter dimidio brevior. Cauda nigra, quæ nigredo in angulum acutum antrorsum intra angulos lutescentes extenditur. P. caudalis basis tecta corio olivaceo castaneo, striga transversa lutea inter hanc et nigredinem caudæ. Pinna pectoris e glauco pellucida, prope basin striga transversa miniata. Aculei recumbentes plurimi in cauda: ordines tres intermedii plurimi (9–10) *aculeis compositi: laterales ab unico tantummodo vel altero.*"—Solander, l. c.

Parkinson's figure represents the colour as buff orange, with an oblique black stripe crossing the pectoral region, and extending from the eye to the tail. The acute, black chevron on the tail has green borders and lines, and the caudal is green.

Hab. Polynesia. Sea of Borneo and China.

NEMICHTHYS SCOLOPACEA, *Richardson.*

Plate X. Fig. 1–3.

Of this apparently novel form I can give but an imperfect account. There is only a single specimen which I am unwilling to mutilate by dissection, and from its shape, it cannot be examined otherwise by a microscope, while its parts are too minute to be readily seen by the aid of a common eye-glass.

Its general form is thread-like, more slender near the head, swelling out by degrees in the anterior quarter of the body, and again tapering imperceptibly into the caudal extremity, which is as fine as a hair. The eye is large, and is very conspicuous from its dark purplish blue colour. The jaws are long and slender, and the cleft of the mouth extends back to the posterior part of the eye. The length of the upper jaw seems to depend on the prolongation of the premaxillaries, and the slender maxillaries lie more exteriorly at the angle of the mouth, which they form, their lower ends slightly overlapping the limbs of the mandible. The interior surfaces of both jaws are convex, and are entirely covered like a file with short triangular or semi-lanceolate teeth, having their points inclined backwards. There appear to be about six rows of these teeth on each premaxillary, and the dental surface narrows off to a mesial point at the entrance of the gullet. The maxillaries are armed with three rows of similar teeth. The limbs of the mandibles recede towards the angles of the mouth, so as to receive the mesial dental plate of the upper jaw between them, the maxillaries lying exterior to both. There is no visible tongue. Nine or ten gill-rays, as slender as a fine hair, and curved like the gill-rays of a *Muræna*, support the branchiostegous membrane. A narrow space beneath divides the gill-openings, which reach upwards to about half the height of the head. The anus is placed between the middles of the small pectorals, and is with great difficulty detected.

The very tender, pointed pectorals, are sustained by about eleven rays. Between them the belly bulges a little. The back is furnished with a numerous series of short, subulate, acute rays, each having a short membrane in its axilla, and being destitute of joints, but shrivelling as they dry, and without pungency. They can be traced from the occipital crescent of the cranium to within an inch of the hair-like point of the tail, but as this has been injured by handling, their exact termination could not be determined. The tip of the tail under a high magnifying power showed no vestige of caudal rays, but its surface being somewhat abraded, the absence or presence of dorsal or anal rays on it could not be determined. The anal rays commence at the verge of the anus, and are considerably larger and more numerous than the dorsal ones. They are also unjointed, but one or two of them in the middle of the series, where they are longest, are split at the tips. A low continuous membrane connects their bases, and probably originally extended to their tips, but if so, it has, from its delicacy, been in great part destroyed. A fine groove running along the middle height of the body represents the lateral line. Mr. Adams has noted the colours of the recent fish as being dull white, with dark brown spots, and the head as having a pink tint. The spots are small, and mostly confined to the ventral surface, very few rising above the lateral line. Under the lens their borders appear radiated. The skin is quite scaleless. Length, 14 inches.

Hab. Southern Atlantic.

CIRRHITES ARCATA, *Cuv. et Val. Hist. des Poiss.*

Perca ? areata, Solander, MSS. A. 64.

Radii.—Br. 5; D. 10|11; A. 3|6; C. $15\frac{6}{6}$; P. 8 et VI.; V. 1|5.

Plate V. Fig. 3–5.

This fish is described in the *Histoire des Poissons* by the specific name which we have adopted, though the preferable orthography is *arquata* or *arcuata*. In Solander's MSS. the word appears to be *areata*, and the following is his account of the species:—

"Perca areata ("Pahulhu-t'aeo"). *Piscis glaucus, area lata a medio pisce ad caudam per lineam lateralem e rubicundo aurantiaca. Ponè oculum arcus oblongus aurantiacus, limitibus rubris, inferiore in laminâ postremâ operculorum lituræ tres luteæ. Margo infimus laminæ operculorum branchiarum aurantiacus, carina juguli nigricans. Apex labii inferioris flavus. Striga flava, supra mandibulam superiorem. Pinnæ ventrales ponè pinnas pectorales. Narium apertura antica tubulosa, saturatissimè aurantiaca. Iris argentea. Pupilla oblonga nigra. Pinnæ sordidè lutescentes, exceptâ pinnâ caudali quæ in medio glauca. Squamæ majusculæ. In multis similis* Percæ mundæ."—Solander, l. c.

The various-coloured lines mentioned by Solander can still be distinctly traced on our specimens. The length of the head is contained thrice and one-third in the total length of

the fish, caudal included. The thickness of the body scarcely exceeds one-third of its height, and this again is more exactly one-third of the length. The upper margins of the orbits are prominent but obtuse, rendering the space between them concave. The width of this is rather less than a diameter of the orbit. The line of the closed mouth descends with a moderate curvature, and does not extend backwards beyond the front of the eye. The teeth on both jaws are disposed in dense villiform bands, with an exterior row of stouter subulate ones, not rising much above the general surface, nor very regular. There is a stout conico-subulate canine on the front of each premaxillary at some distance from the symphyses, and a somewhat more slender one on the anterior third of the mandible. Between these and the symphyses, above and below, there are several smaller subulate teeth in the exterior row. The prominent chevron of the vomer is covered with fine, short, villiform teeth; the palate-bones and tongue are toothless. The height of the preorbitar does not quite equal the diameter of the orbit, its disk is uneven, and its edge entire. The rest of the suborbitar chain is narrow. The large cheek is covered by six oblique rows of scales, intermixed with numerous much smaller scales. It is bounded posteriorly by the curved preoperculum, which is entire on its lower third, and finely and equally toothed on the edge above. The opercular scales are larger, but are also mixed with minute ones. The bony operculum ends in an obtuse corner, beneath which the bone is rounded off. Very small, densely crowded scales cover the interoperculum, limbs of the mandible, temples, and interorbital space, but there are none on the maxillary. Forty-six rows of scales exist between the upper angle of the gill-opening and base of the caudal. The lateral line runs parallel to the back, bounding the upper third of the height, and is traced by a series of small, short tubes, as well as by the rows of scales beneath it being more oblique than the upper rows. Length, 5 inches.

Hab. Otaheite. Mauritius. Cape of Good Hope.

Solander mentions a variety in the following terms:—

"Pahulhu toco, A. 167, no. 6. Perca areata *varietas absque areâ laterali. Piscis e purpureo-cinereus. Corpus immaculatum. Caput naresque omnino uti in antecedente. Iris ex argenteo extus rubicundo, intus lutea. Pinna dorsalis anticè e pallidè-miniato, viridi-nebulosâ; posticè basi rubescens; medio glauca, apice flavescens. Pinnæ pectoralis corpore concolores immaculatæ. Pinnæ ventrales et ani fuscescentes. Pinna caudalis radiis luteis. Piscis idem cum antecedente eodem die captus.*"

APERIOPTUS PICTORIUS, *Richardson.*

Radii.—D. 13; A. 11; C. $18\frac{13}{13}$; P. 11; V. 9.

Plate X. Fig. 4–5.

Of this fish I can give no details. There were two specimens which I unfortunately placed in the hands of the artist before I had examined them, except very cursorily. While he was employed in sketching, he put them into a plateful of water for the purpose of ex-

panding their fins more perfectly, and forgetting that he had not returned them into the spirits, they were thrown out and lost. The general aspect of the fish is that of a slender *Galaxias*, but there are no teeth on the jaws. The orifice of the mouth is a narrow vertical oval, which is restricted on the sides by membranous processes. The figure is of the natural size.

Hab. Borneo.

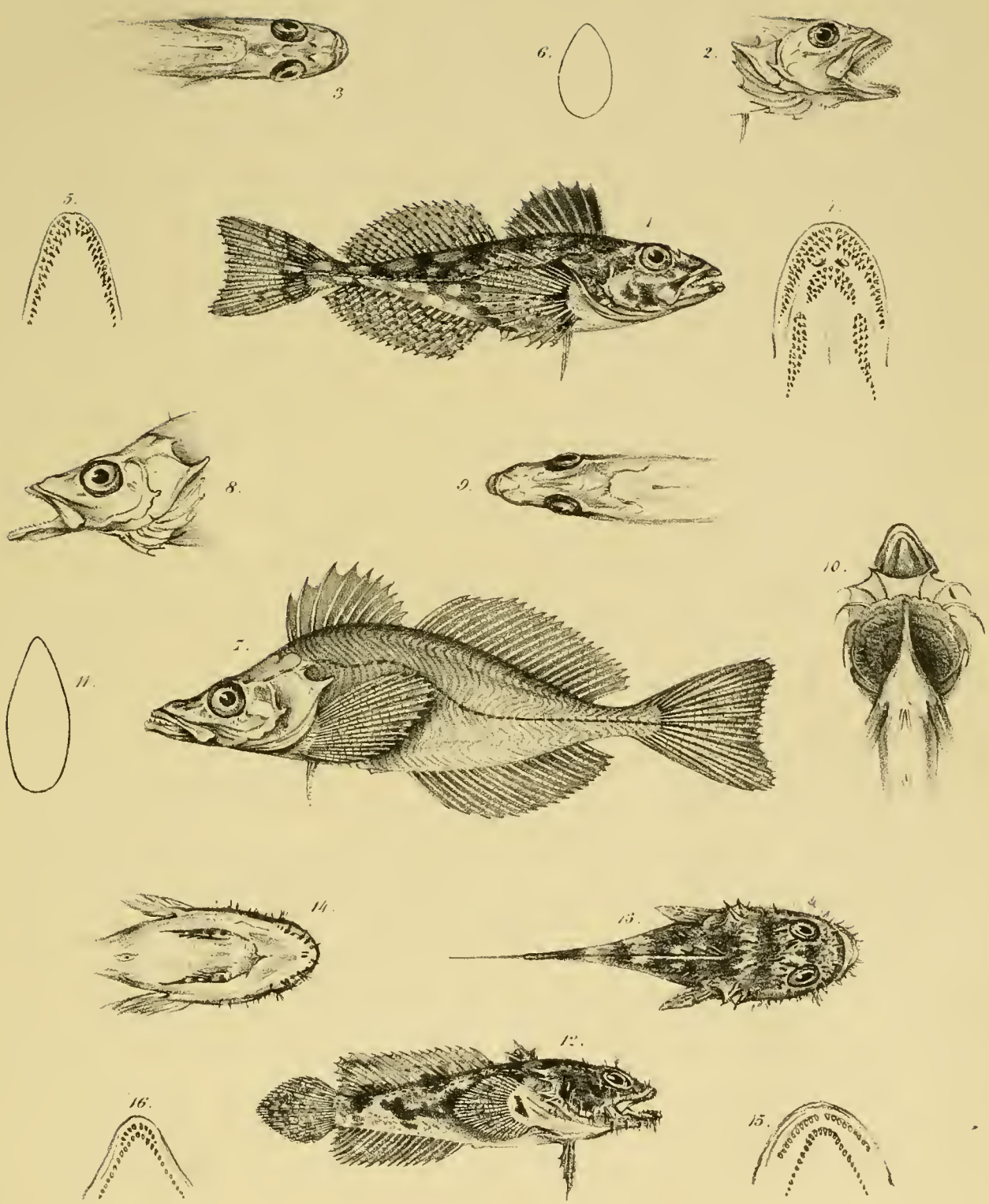
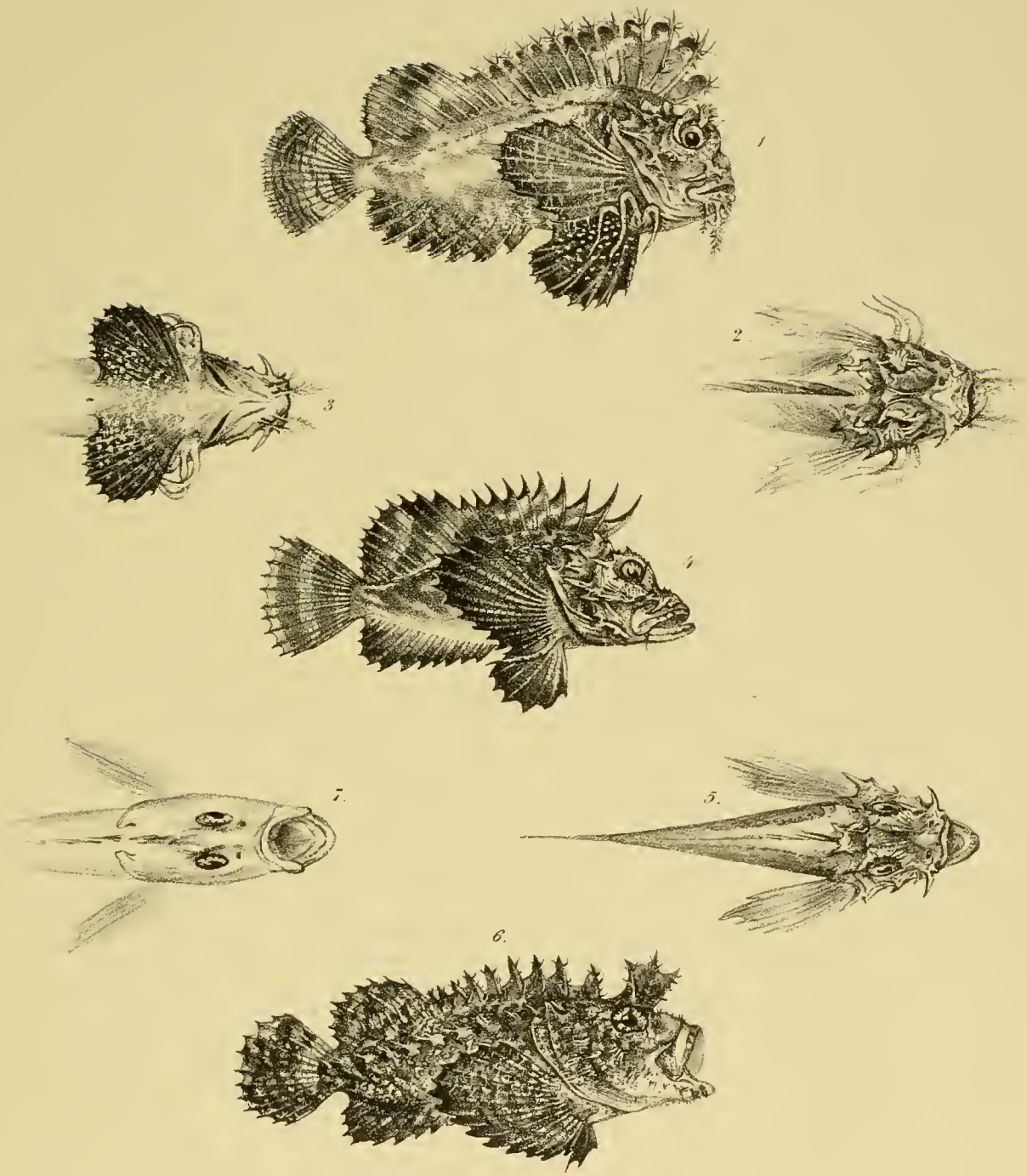


FIG. 1—6. PODABRUS COTTOIDES. FIG. 7—11 PODABRUS DENTRICULUS

FIG. 12—16 BATRACHUS QUADRISPINIS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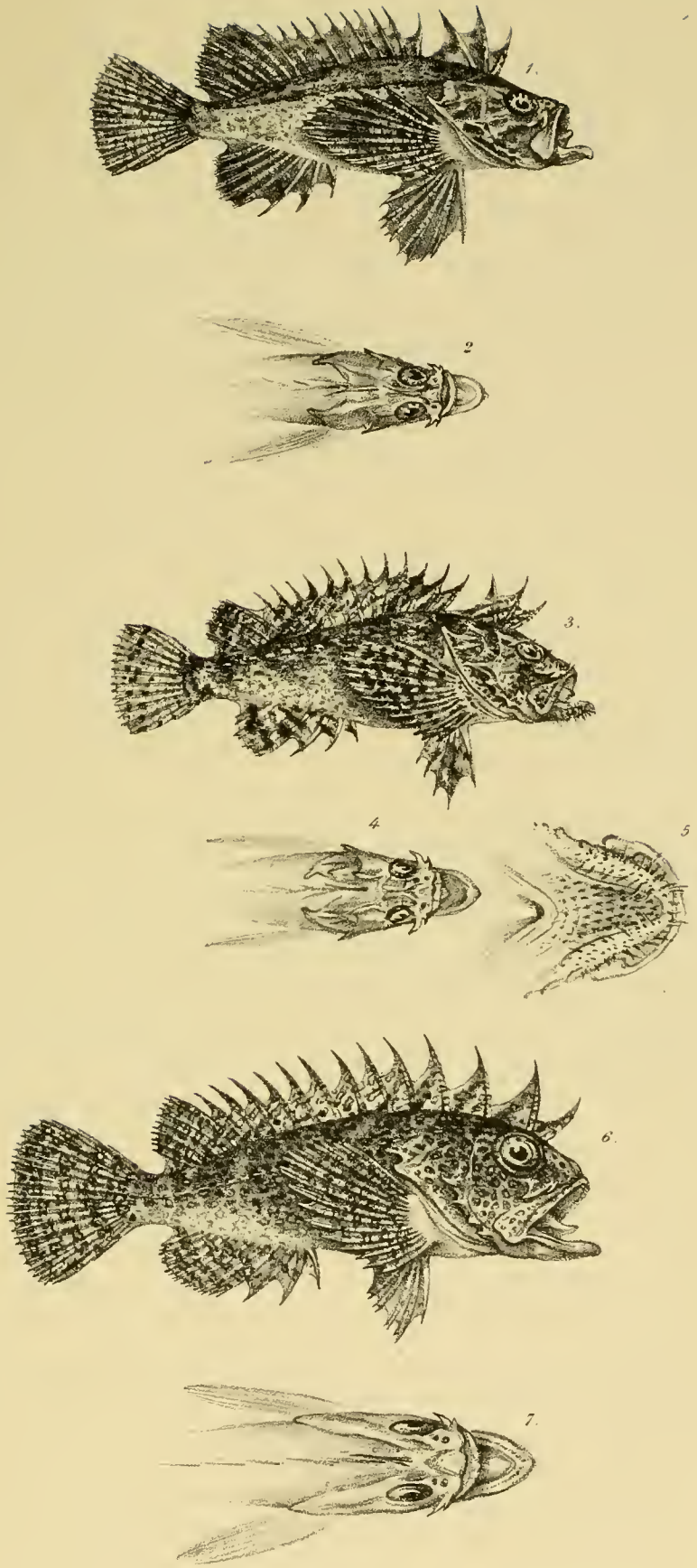

FIG. 1 — 2. APISTES DEPRESSIFRONS

— 3 — 5 APISTES TRACHINOIDES

— 6 — 7. APISTES COTTOIDES

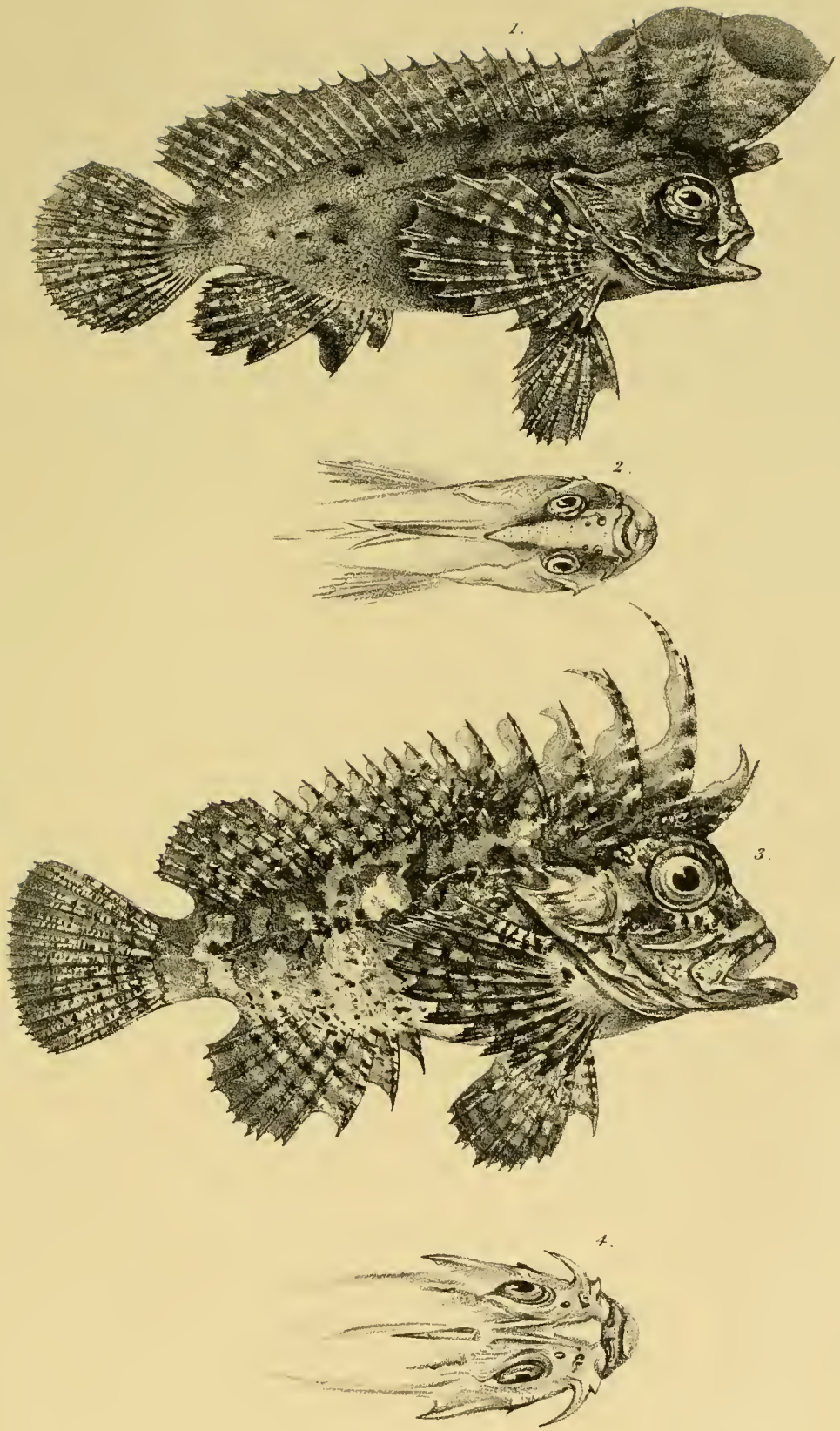

FIG 1, 2 APISTES TÆNIANOTUS

FIG 3, 4 APISTES MULTICOLOR

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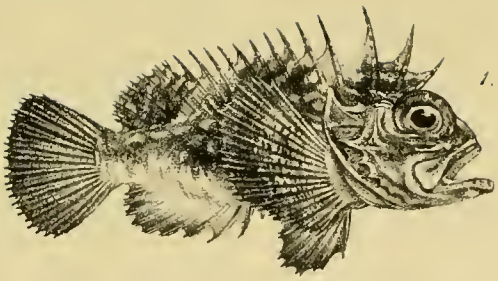
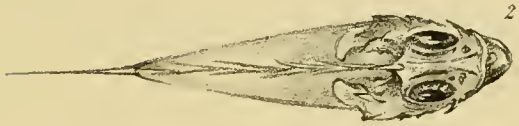




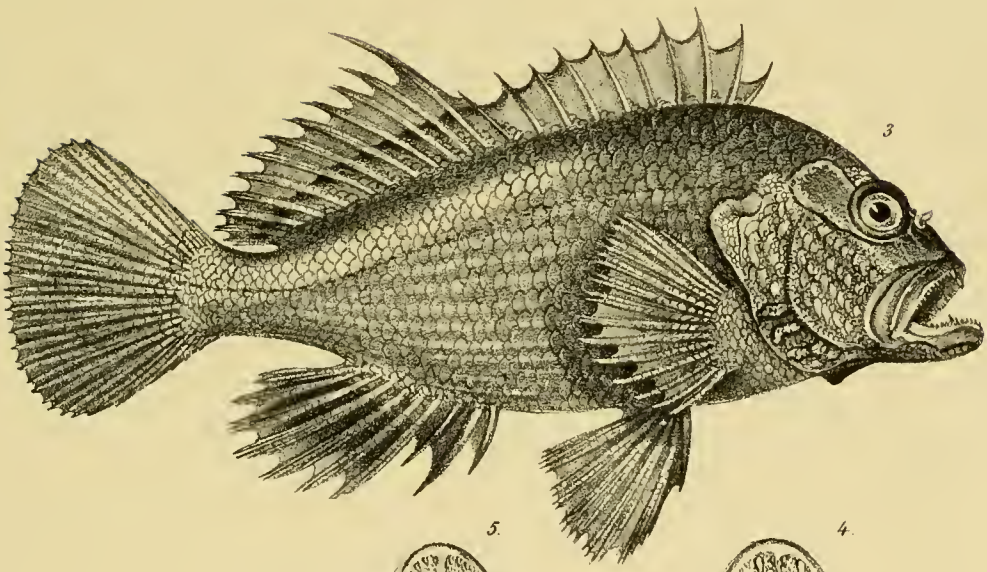
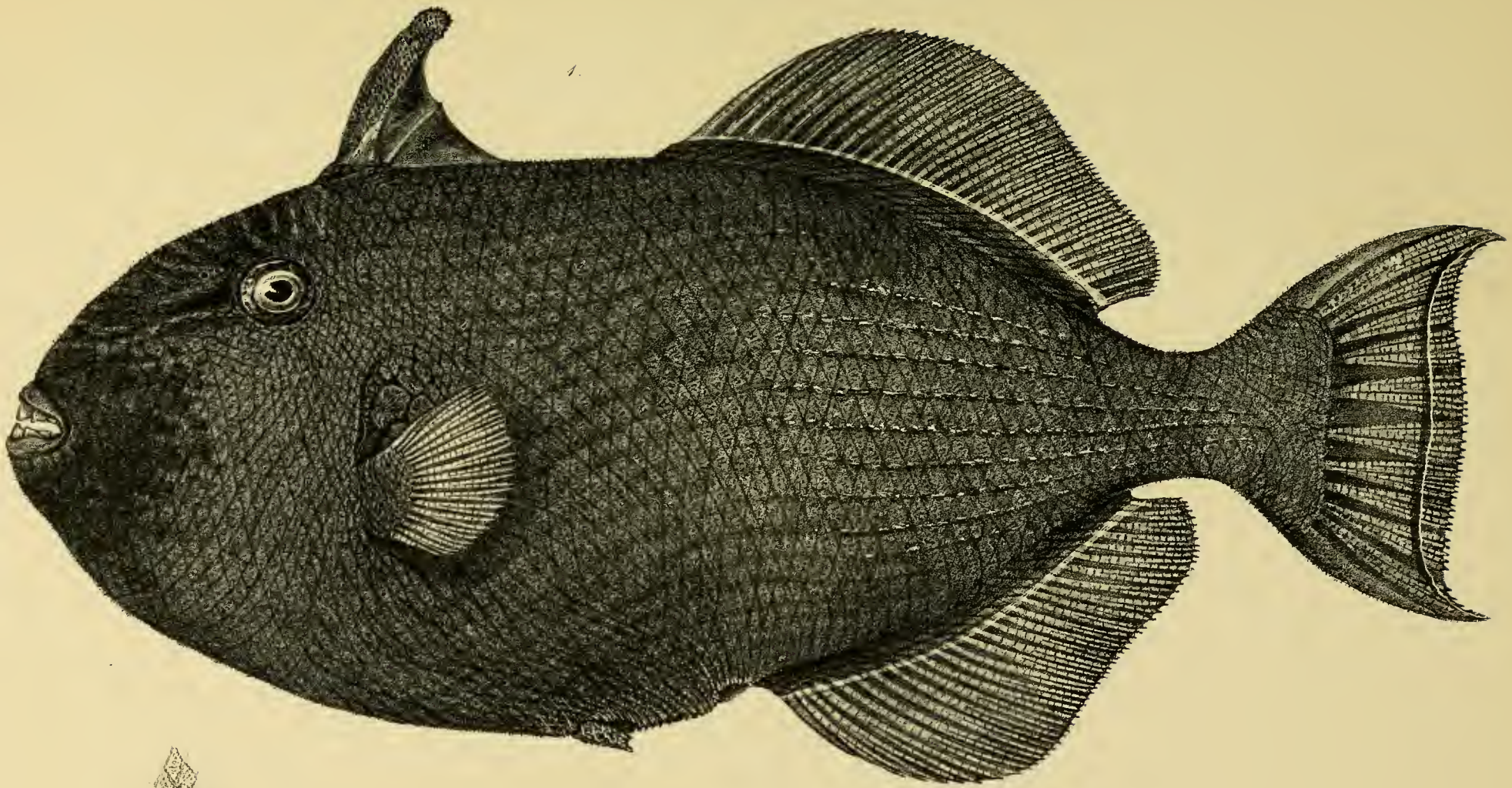
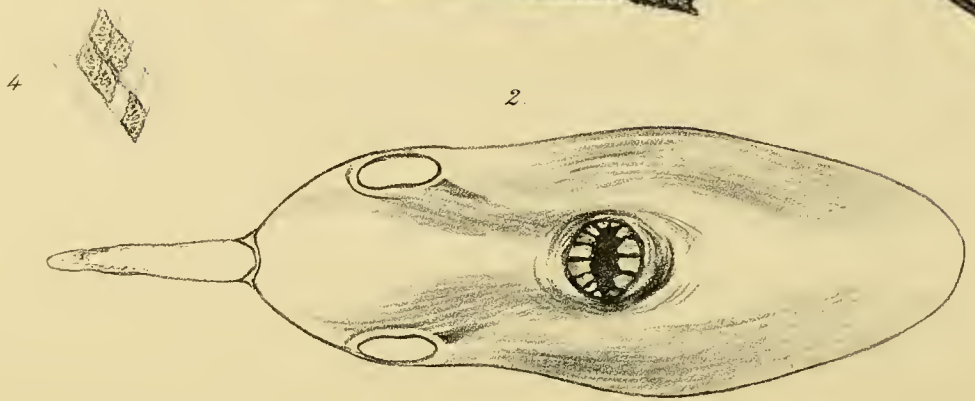


FIG. 1, 2. APISTUS LEUCOCASTER.

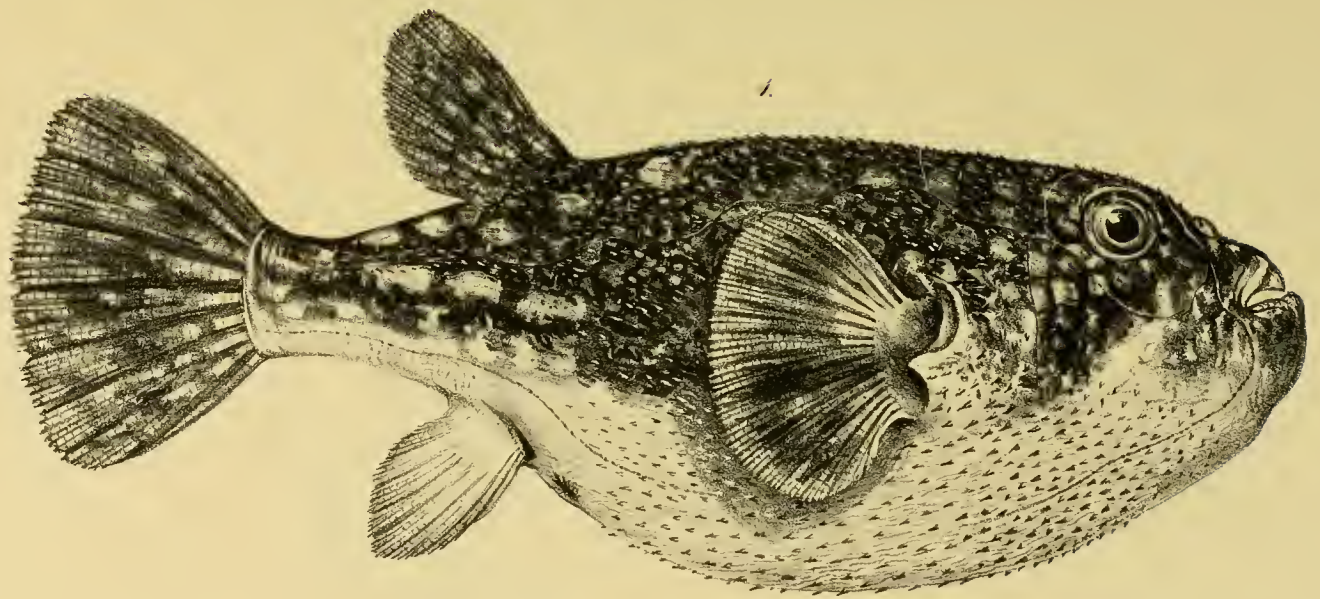
FIG. 3—5. CIRRHITES ARGATA.

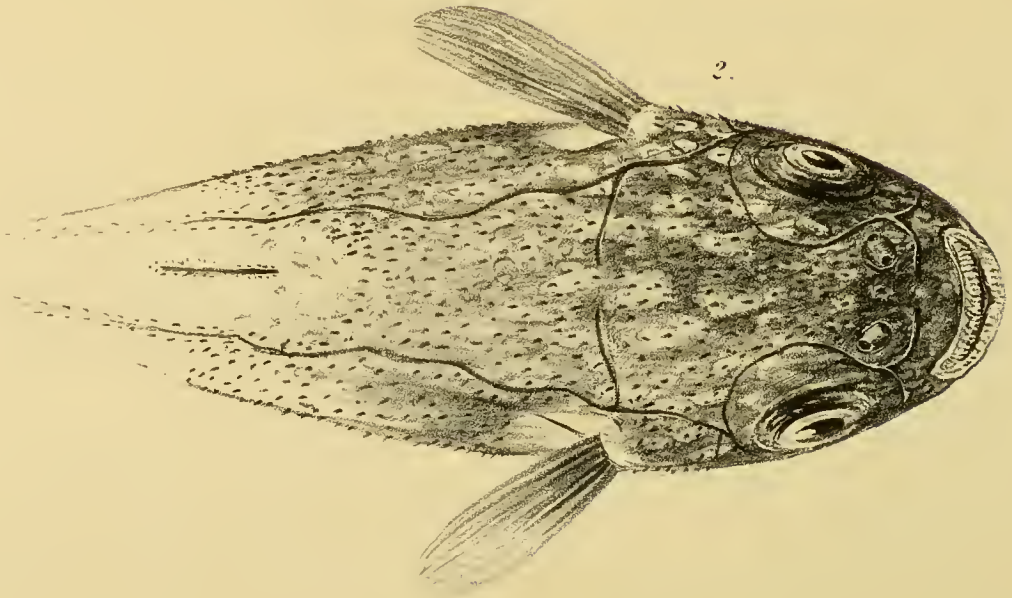
Reeve, Benham & Reeve imp.





BALISTES RINGENS.





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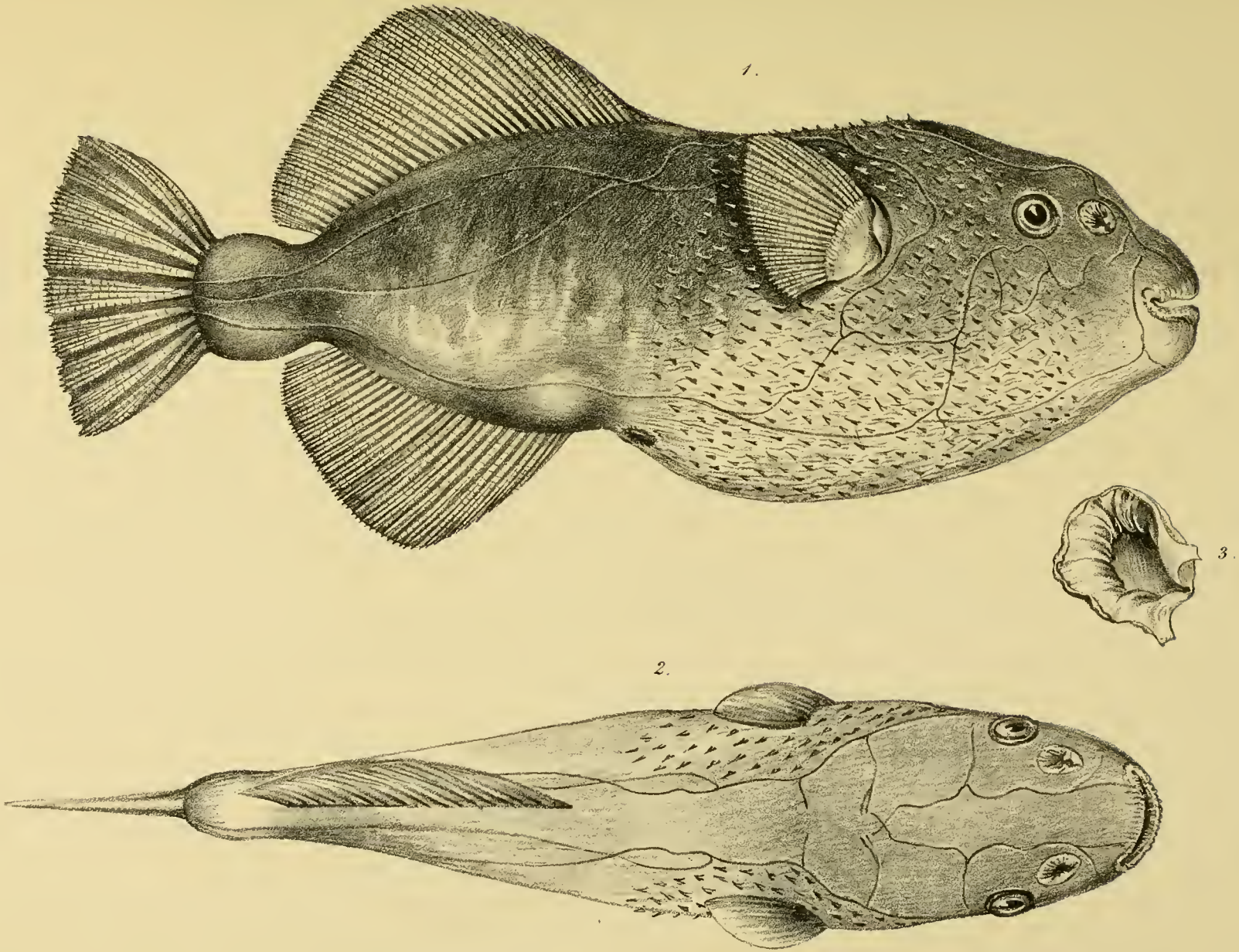
TETRODON ATRATUS



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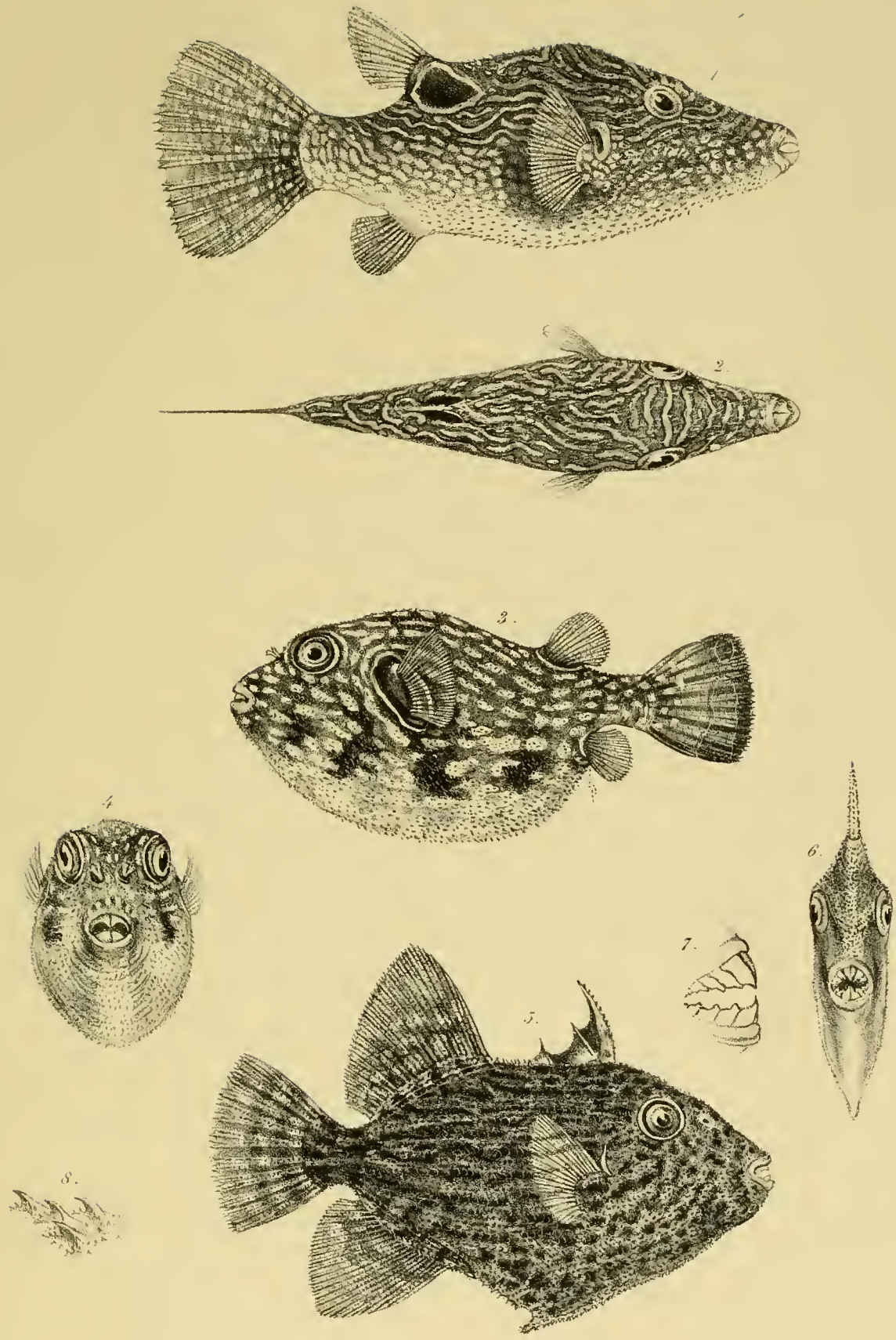
TETRODON NARITUS.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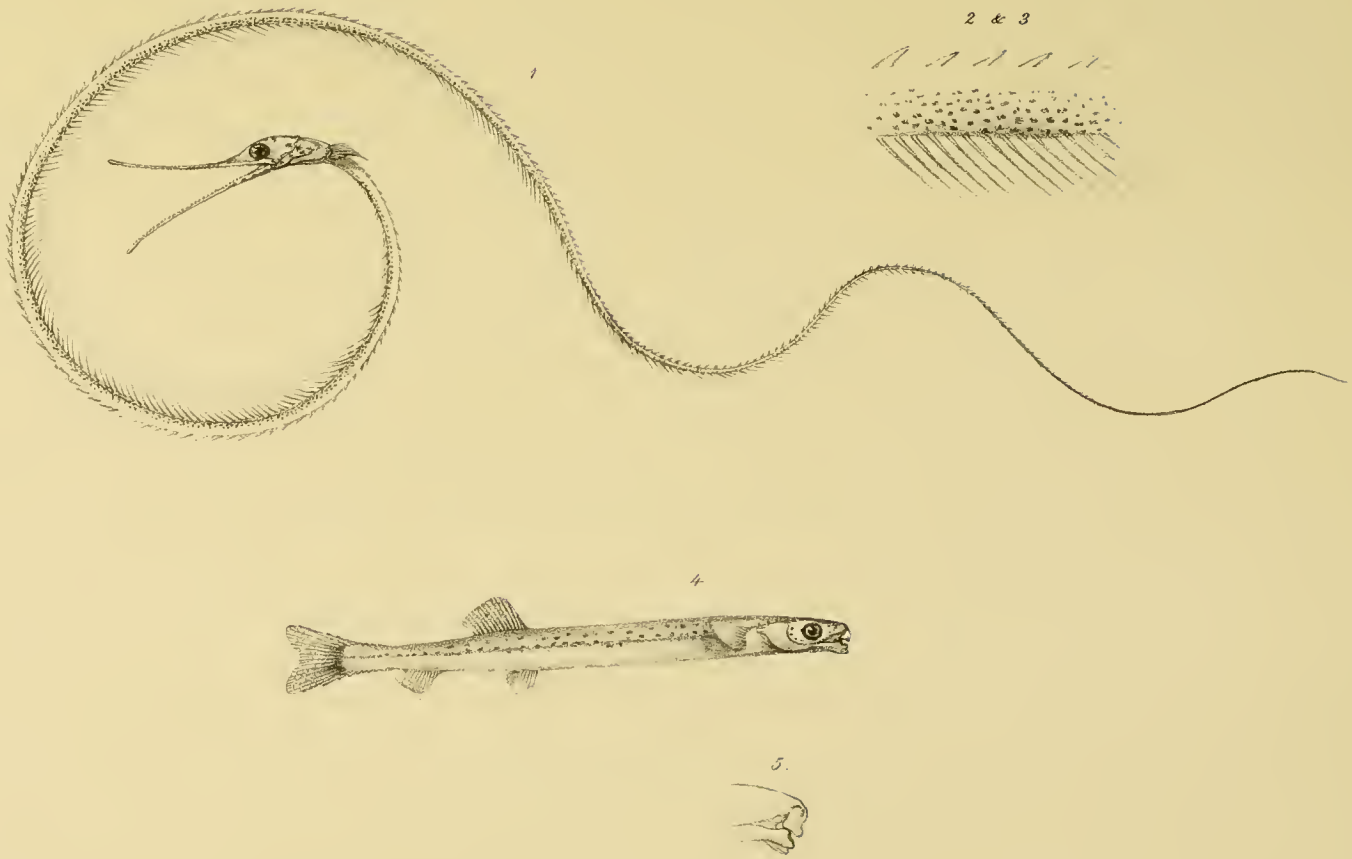

FIG. 1–3. NEMICHTHYS SCOLOPACEA. FIG. 4–5 APERIOPTUS PICTORIUS.

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MESSRS. REEVE, BENHAM, AND REEVE

have this day published

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