# ENERAL ZOOLOGY MATIC NATURAL HISTORY br -GEORGE SHAW, M.D.F.R.S&c. WITH PLATES com the first Authorities and most select specimens Engraved principally by TIONAL LIBRARY M. HEATH. VOL.IV. Part 15 1118 PISCE ondon Printed for G. Kearsley Fleet Street.

## GENERAL ZOOLOGY.

VOLUME IV.—PART I.

PISCES.



#### LONDON.

PRINTED FOR GEORGE KEARSLEY, FLEET-STREET;
BY THOM 3 ... VISON, WHITE-FRIARS.

1803.





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#### ERRATA.-VOL. IV. PART L.

P. 22, 1. 13, for cauda read corpore.
P. 23, 1. 9, for M. Ophis read M. Serpens, and for conspidata read acuta.

\*\*\* The fifth volume of this work, which will conclude the Natural History of Fishes, will be published early in the year 1804.

# XIII.f.12

PISCES.

THE general description both of the external and internal parts of Fishes, considered as a distinct tribe of animals, cannot be better detailed than in the works of the ingenious Dr. Monro, who observes that these animals have neither anterior nor posterior extremities, as quadrupeds and birds, their progression being performed in a different method. For this purpose they are provided with machines, properly consisting of a great number of elastic beams, connected to one another by firm membranes, and with a tail of similar texture. Their spine is moveable towards the posterior part, and the strongest muscles of their body are inserted Their tails are so framed as to contract to a there. narrow space when drawn together to either side, and to expand again when drawn to a strait line with their bodies; so that, by the assistance of the broad tail and the fins on the sides, the animals make their progression in the water in much the same way as a boat with oars at its sides, and a rudder at its stern: the perpendicular fins situated V. IV. P. I.

on the superior part of the body keep them in equilibrio, hindering the belly from turning upwards, which it would otherwise easily do, the air-bag in the abdomen rendering that part specifically lighter than the back: but by the resistance which these fins meet with when inclined to either side, the animals are kept with the back uppermost. A more ample explanation of this particular may be found in Borelli's work de motu animalium.

Fishes have nothing which can properly be called a neck, since they seek their food in an horizontal direction, and can move their bodies either upwards or downwards, as they have occasion, by the contraction or dilatation of the air-bag. A long neck, as it would hinder their progression, would be very disadvantageous in the element in which they are destined to reside.

The teeth differ in the different tribes, but the generality of Fishes are unprovided with strong teeth, or such as are calculated for breaking and grinding the food, which usually consists of small fishes or other animals that need no trituration in the mouth, but spontaneously dissolve into a liquid chyle; their teeth rather serving to grasp their prey, and hinder it from escaping. For the same purpose the internal cartilaginous basis of the bronchi and the two round bodies situated in the posterior part of the jaws have a great number of tenter-hooks fixed into them, in such a manner as to permit any thing easily to get down, but to be prevented from returning; the superfluous water, which is necessarily received along with the food, passing between the

interstices of the bronchi and the flap which covers them. The compression of the water on the bronchi is of considerable use to the creature, as will afterwards appear.

The œsophagus or gullet is very short, and scarce to be distinguished from the stomach, since the food is retained almost equally in both. The stomach is of an oblong figure, and from the prey contained in it, which commonly preserves its natural form, though reduced to a gelatinous softness, it may be concluded that digestion is performed in it entirely by the dissolvent power of some peculiar menstruum, and not by any trituration.

The intestines are, in general, very short, making only three turns, the last of which terminates in a common outlet or vent, placed towards the middle of the lower part of the body. The appendicular or secondary intestines (coeca) are in these animals extremely numerous, composing a large groupe of worm-like processes, all ultimately terminating in two larger canals opening into the first intestine, into which they discharge their peculiar fluid.

The liver in Fishes is remarkably large, and commonly lies almost wholly on the left side: it contains a great proportion of oil or fat.

The spleen is placed near the back-bone, and at a place where it is subject to an alternate constriction and dilatation from the pressure of the air-bag which is situated in its neighbourhood.

The ova, in the females, are disposed into two large oblong bodies, one on each side of the abdo-

men; and the milt or soft roe, in the male, appears in a similar form in the same part.

The swimming or air-bladder is an oblong, white membranous bag, in which is contained a large quantity of elastic air: this organ lies close to the back bone near a red glandular substance, and has a strong muscular coat, by virtue of which it can occasionally contract itself, and, by condensing the contained air, cause the body to be specifically heavier than the water, so as to descend, or, by being again dilated, enable it to ascend by becoming specifically lighter, by which means the animal is enabled to swim in any height of water at pleasure\*. Some fishes, as the Flounder, and the whole tribe of flat-fish, are observed to be unprovided with this curious organ, and are in consequence obliged to remain always at the bottom of the waters they inhabit. From the anterior part of the bag pass out two processes or appendices, which, according to the anatomists of the French academy, terminate in the fauces: in some fishes the air-bag communicates with the œsophagus, and in others with the stomach.

The peritonæum, or membrane investing the contents of the abdomen, is thin, and of a blackish colour.

The heart is of a triangular form, with the base downwards, and the apex upwards: it consists of one auricle and one ventricle. The aorta sends out

<sup>\*</sup> The complete theory of the operation of the air-bladder in fishes does not seem to have been yet explained by any physiologist.

numberless branches to the branchiæ or gills, on which it is distributed into subdivisions so small as to escape the eye, unless assisted by a glass. The blood is red, and the red particles are not round, as in the Mammalia, but oval as in the Amphibia.

The gills or branchiæ are seated beneath two large slits or openings on each side the head, and are analogous to the lungs in other animals. Their general form is semicircular, and they commonly consist of four double rows of fringed vascular fibrils attached to four bony arches. The gills are perpetually subject to alternate motion and pressure from the water: they are guarded externally by the gill-covers or opercula, constituting a pair of strong flaps on each side, and which are furnished with a lateral membrane, dilatable at pleasure by a certain number of bony radii or arches, in such a manner as to enable the animal either to open or close the gillcovers. The blood, after being thrown by the heart into the ramifications of the gills, is collected again by a vast number of small veins, somewhat in the same manner as in the Mammalia, but instead of returning to the heart again, these vessels unite and form a descending agrta without the intervention of an auricle and ventricle.

The absorbent system in Fishes is thus elaborately described by Dr. Monro, who gives the Haddock as a general example.

On the middle of the belly, immediately below the outer skin, a lymphatic vessel runs upwards from the vent, and receives branches from the sides of the belly and the fin below the vent: near the

head this lymphatic passes between the two pectoral fins, and having got above them, receives their lymphatics: it then goes under the juncture of the. two bones which form the thorax, where it opens into a net-work of very large lymphatics which lie close to the pericardium, and almost surrounds the heart: this net-work, besides that part of it behind the heart, has a large lymphatic on each side, which receives others from the kidney, runs upon the bone of the thorax backwards, and when it has got as far as the middle of that bone, sends off a large branch from its inside to join the thoracic duct: after detaching this branch it is joined by the lymphatics of the thoracic fins, and soon after by a lymphatic which runs upon the side of the fish: it is formed of branches, which give it a beautiful penniform appearance. Besides these branches, there is another set lying deeper, which accompanies the ribs. after the large lymphatic has been joined by the abovementioned vessels, it receives others from the gills, orbit, nose, and mouth: a little below the orbit another net-work appears, consisting in part of the vessels above described, and of the thoracic duct: this net-work is very complete, some of its vessels lying on each side the muscles of the gills, and from its internal part a trunk is sent out which terminates in the jugular vein.

The lacteals run on each side the mesenteric arteries, anastomosing frequently across those vessels: the receptacle into which they enter is very large in proportion to them, and consists at its lower part of two branches, one of which lies between the

duodenum and stomach, and runs a little way upon the pancreas, receiving the lymphatics of the liver. pancreas, lower part of the stomach, and the lacteals from the greatest part of the small intestines: the other branch of the receptacle receives the lymphatics from the rest of the alimentary canal. The receptacle formed by these two branches lies on the right side of the upper part of the stomach, and is joined by some lymphatics in that part, and also by some from the sound and gall-bladder, which in this fish adheres to the receptacle: the thoracic duct takes its rise from the receptacle, and lies on the right side of the œsophagus, receiving lymphatics from that part; and running up about half an inch, divides into two ducts, one of which passes over the œsophagus to the left side, and the other goes strait upon the right side, passing by the upper part of the kidney, from which it receives some small branches, and soon afterwards is joined by a branch from the large lymphatic that lies above the bone of the thorax, as formerly mentioned: near this part it likewise sends off a branch to join the duct of the opposite side; and then, a little higher, is joined by those large lymphatics from the upper part of the gills and from the fauces.

The thoracic duct, after being joined by these vessels, communicates with the net-work near the orbit, where its lymph is mixed with that of the lymphatics from the posterior part of the gills, and from the superior fins, belly, &c. and then from this net-work a vessel goes into the jugular vein just below the orbit. This last vessel, which may be

called the termination of the whole system, is very small in proportion to the net-work from which it rises; and indeed the lymphatics of the part are so large as to exceed by far the size of the sanguiferous vessels.

The thoracic duct from the left side, having passed under the esophagus from the right, runs on the inside of the vena cava of the left side, receives a branch from its fellow of the opposite side, and joins the large lymphatics which lie on the left side of the pericardium, and a part of those which lie behind the heart, and afterwards makes, together with the lymphatics from the gills, upper fins, and side of the fish, a net-work, from which a vessel passes into the jugular vein of this side: in a word, the lymphatics of the left side agree exactly with those of the right. Another part of the system is more deeply seated, lying between the roots of the spinal processes of the back-bone. This part consists of a large trunk that begins from the lower part of the fish, and as it ascends receives branches from the dorsal fins and adjacent parts of the body: it goes up near the head, and sends a branch to each thoracic duct near its origin.

The brain in fishes is formed pretty much in the same way as in fowls; only we may observe that the posterior lobes bear a greater proportion to the anterior.

The organ of smelling is large, and the animals have a power of contracting and dilating the entry to it as they have occasion: it seems to be mostly by their acute smell that they discover their food,

for their tongue seems not to have been designed for a very nice sensation, being of a pretty firm cartilaginous substance; and common experience evinces that their sight is not of so much use to them as their smell in searching for their nourishment. If you throw a fresh worm into the water, a fish shall distinguish it at a considerable distance; and that this is not done by the eye is plain from observing that after the same worm has been a considerable time in the water, and lost its smell, no fishes will come near it; but if you take out the bait, and make several little incisions into it, so as to let out more of the odoriferous effluvia, it shall have the same effect as formerly. Now it is certain that had the animals discovered this bait with their eyes, they would have come equally to it in both cases. In consequence of their smell being the principal means they have of discovering their food, we may frequently observe them allowing themselves to be carried down with the stream, that they may ascend again leisurely against the current of the water: thus the odoriferous particles swimming in that medium, being applied more forcibly to their organs of smell, produce a stronger sensation.

The optic nerves in Fishes are not confounded with one another in their middle progress betwixt their origin and the orbit, but the one passes over the other without any communication; so that the nerve which comes from the left side of the brain goes distinctly to the right eye, and vice versa. Indeed it should seem not to be necessary for the optic nerves of fishes to have the same kind of con-

nection with each other as those of man have; for their eyes are not placed in the fore-part, but in the sides of the head; and consequently cannot look so conveniently at any object with both eyes at the same time.

The crystalline lens in Fishes is a complete sphere, and more dense than in terrestrial animals, that the rays of light coming from the water might be sufficiently refracted.

As Fishes are continually exposed to injuries in the uncertain element in which they reside, and as they are in perpetual danger of becoming a prey to the larger ones, it was necessary that their eyes should never be shut; and as the cornea is sufficiently washed by the element they live in, they are not provided with palpebræ: but, as in the current itself the eye must be exposed to several injuries, there was a necessity that it should be sufficiently defended; which, in effect, it is, by a firm, pellucid membrane, seeming to be a continuation of the cuticula stretched over it: the epidermis is very proper for this purpose, as being insensible, and destitute of vessels, and consequently not liable to obstructions, and thus becoming opake. In the eye of the skate tribe there is a digitated curtain which hangs over the pupil, and which may shut out the light when the animal rests, being somewhat similar to the tunica adnata of other animals.

Although it was formerly much doubted whether' Fishes possessed the sense of hearing, yet there can be little doubt of it now; since it is found that they bave a complete organ of hearing as well as other animals, and likewise that the water in which they live is proved to be a good medium. Fishes, particularly of the skate kind, have a bag at some distance behind the eyes, which contains a fluid, and a soft cretaceous substance, and supplies the place of the vestibule and cochlea: there is a nerve distributed upon it, similar to the portio mollis in man: they have semicircular canals, which are filled with a fluid, and communicate with the bag: they have likewise a meatus externus, which leads to the internal ear. The cod-fish and others of the same shape, have an organ of hearing somewhat similar to the former, but instead of a soft substance contained in the bag, there is a hard cretaceous stone.

The cuticle in Fishes is strong and thick, and is defended by an armature of scales, closely laid over each other: the generality of Fishes have a particular line or series of small ducts running along each side of the body, and discharging a soft mucus or slimy substance, serving to lubricate the surface of the body.

The fins of Fishes are named from their situation on the animal, viz. dorsal or back-fin, pectoral or breast-fins, ventral or belly-fins, anal or vent-fin, and caudal or tail-fin.

The ventral fins are considered by Linnæus as analogous to the feet in quadrupeds, and it is from the situation, presence, or absence of these fins that the Linnæan orders of Fishes are instituted.

Such as are entirely destitute of ventral fins are termed *Pisces apodes*, being, as it were, apodal or footless Fishes. Those which have the ventral fins

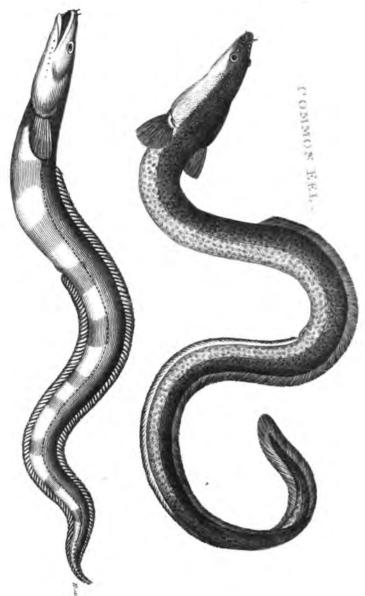
placed more forward than the pectoral or breast-fins are termed Jugulares or Jugular Fishes. Those which have the ventral fins situated immediately under the pectoral ones are termed Pisces thoracici, or thoracic Fishes; while those which have the ventral fins situated behind or beyond the pectoral fins are termed Pisces abdominates or abdominal Fishes.

There still remains a particular tribe called Cartilaginous Fishes, *Pisces Cartilaginei*. This tribe was by Linnæus separated from the rest, and placed in the class Amphibia, where it constituted the order *Nantes*.

This particular distribution of the cartilaginous Fishes was made on a supposition of their being furnished both with lungs and gills; an idea which seemed confirmed by the observations of Dr. Garden of South Carolina, who, at the request of Linnæus, examined the organs of the genus *Diodon*, and found, as he conceived, both external branchiæ or gills, and internal lungs\*. This idea however has

<sup>\*</sup> Branchiæ horum (Nantium) pectinatæ ut Piscium, sed adnatæ vasi arcuato cylindrico tubuloso, absque radio osseo, nec piscium similes, nisi externa figura; Branchiostegorum piscium propria structura, eorum larvæ singulares, foetus fere extra ovum, defectus pinnarum ventralium mihi persuasere literis, a D. D. Garden iu America habitante, petere, vellet dissecare Diodontis respirationis organa et inquirere numne pulmones haberent: stupefactus ipse dissecuit pisces, reperitque et branchias externas, et pulmones internos, quos descriptos et conservatos remisit, unde constitit eos annumerandos Nantibus.—Lin. Syst. Nat. p. 348.

been shewn by later physiologists to have been not strictly correct; the supposed lungs being in reality only a peculiar modification of gills. The cartilaginous fishes, as their name imports, differ from others in having a cartilaginous instead of a bony skeleton.



CONGRE ENT.

### FISHES.

ORDER

APODES.

#### ANGUILLA. EEL.

Generic Character.

Caput læve.

Nares tubulosæ.

Oculi cute communi tecti.

Membrana branchiostegaradiis decem.

Corpus teretiusculum, lubricum.

Pinna caudæ coadunata dorsali analique.

Spiracula pone caput vel pinnas pectorales.

Head smooth.

Nostrils tubular.

Eyes covered by the com-

Gill-Membrane ten-rayed.

Body roundish, smooth, mu-

Dorsal, caudal, and anal fins united.

Spiracles behind the head or pectoral fins.

#### COMMON EEL.

Anguilla Vulgaris. A. olivaceo-fusca subtus subargentea, maxilla inferiore longiore.

Olive-brown Eel, subargenteous beneath, with the lower jaw longer than the upper.

Muræna Anguilla. M. maxilla inferiore longiore, corpore uricolore. Lin. Syst. Nat. p. 426.

Muræna corpore immaculato, maxilla inferiore sublongiore.

Bloch.

The common Eel.

HE Eel, which, in a natural arrangement of the animal world, may be considered as in some degree connecting the fish and serpent tribes, is a native of almost all the waters of the ancient continent, frequenting not only rivers but stagnant waters, and occasionally salt marshes and lakes: it is even found in the spring season in the Baltic and other seas. As a species it is distinguished by its uniform colours, but more particularly by the peculiar elongation of the lower jaw, which advances to some distance beyond the upper: the head is small, and pointed; the nostrils small and cylindric; and at a very small distance from each eye are a kind of additional pair, of a lengthened shape, but not cylindric: the eyes are small, round, and covered by a transparent skin united with the common integument of the body: the opening of the mouth is small, and both jaws and palate are beset with several ranges of small sharp teeth: on each side both of the upper and under jaw are observed several minute pores, through which exsudes a viscid mucus: the orifices of the gills are very small, of a lunated shape, and are seated close to the pectoral fins, which are small and of an ovate shape: the

back-fin commences at some distance beyond the head, and is continued into the tail-fin, which is also united with the vent-fin; the latter being continued as far as the vent, which is situated near the middle of the belly. The general colour of the Eel is olive-brown on the back, and silvery on the sides and beneath: the fins are slightly tinged with violet, and sometimes margined with pale red: the Eel is however occasionally seen of a very dark colour, with scarce any silvery tinge, and sometimes yellowish, or greenish: those are observed to be most beautiful which inhabit the clearest waters. The skin of the Eel is proverbially slippery, being furnished with a large proportion of mucus: it is also furnished with small, deeply-imbedded scales, which are not easily visible in the living animal, but are very conspicuous in the dried skin: their form is a long oval, their colour white, and their texture finely reticular: these scales appear to have been first observed, or at least described, by the celebrated Leewenhoek, who has figured them with great accuracy and elegance. The Eel is extremely tenacious of life. and may be kept many hours, or even days, out of water, provided it be placed in a cool situation: it is even affirmed that it voluntarily leaves the water at certain periods, and wanders about meadows and moist grounds in quest of particular food, as snails &c. it is also said to be fond of new-sown peas, which it has been observed to root out of the ground and devour during the night. If we may credit Albertus magnus, it has been known, during very severe frosts, to take refuge in adjoining hay-ricks:

yeral having been discovered coiled together in such situations. The usual food of the Eel consists of water insects, worms, and the spawn or eggs of other fishes: it will also devour almost any decayed animal substance which it happens occasionally to find in its native waters. The Eel is viviparous; producing its numerous young during the decline of summer: these at their first exclusion are very small. The errors of the ancients on this subject, and even of some modern writers, are too absurd to be seriously mentioned in the present enlightened period of science: it appears however that both eggs and ready-formed young are occasionally observed in the same individuals, as is known to be the case also with several other animals. It is pretended by several authors that the Eel cannot bear the water of the Danube, and is therefore never found in that river; but Dr. Bloch assures us that this is not strictly true; though it is but rarely found either in that river or the Volga.

During the day the Eel commonly lies concealed in its hole, which it forms pretty deep beneath the banks, and which is furnished with two outlets, in order to facilitate its escape if disturbed. During the winter it chiefly conceals itself beneath the mud, and in spring-time commences its excursions into rivers, &c. In some parts of Europe the Eel-fishery is of surprising magnitude. We are informed by Dr. Bloch that in some places near the mouths of the Baltic so great a quantity are taken that they cannot be used fresh, but are smoked and salted for sale, and conveyed by waggon-loads into Saxony,

Silesia, &c. In Jutland it is said that 2000 have been taken at a single sweep of the net. In the Garonne 60,000 are said to have been taken in one day by a single net. As a food the Eel is by the general run of medical writers rather condemned than recommended: it appears however to be highly nutritious, and is probably only hurtful when taken to excess\*.

The general size of the Eel is from two to three feet, but it is sometimes said, though very rarely, to attain to the length of six feet and to the weight of twenty pounds. It is a fish of slow growth, and is supposed to live to a very considerable age,

- \* That well-known old Manual the Schola Saleraitana declares the eating of eels to be hurtful to the throat.
  - † Faucibus anguilla pravæ sunt si comedantur: Qui physicam non ignorant hoc testificantur.

Which, (to reduce the translation to the same standard with the original), might be thus rendered.

> Eating of eels is hurtful to the throat: So say physicians of no common note.

> > of In many editions vocibus.

Anguilla Conger. A. fusca, subtus subargentea, linea laterali albo-punctata.

Brown Eel, silvery beneath, with the lateral line speckled with white.

Muræna Anguilla. M. maxilla inferiore longiore, corpore unicolore. Lin. Syst. Nat. p. 426.

M. rostro tentaculis duobus, linea laterali ex punctis albida. Lin. Syst. Nat. Gmel. p. 1135.

Conger. Will. ichth. p. 111. t. G. 6.

THE Conger is so nearly allied in general appearance to the common eel that it might at first view be considered as the same species: it is however in general of a darker colour on the upper part, and of a brighter or more silvery tinge beneath; the whiteness on the sides being sometimes disposed into a kind of large beds or patches: the upper jaw is rather longer than the lower, and the lateral line is broad and whitish; being marked by a row of small white specks: the size of the Conger is also, when full grown, far superior to that of the common eel. This fish is an inhabitant of the Mediterranean and the Northern seas, as well as of those surrounding some of the American islands. It seems however to arrive at a larger size in the Mediterranean than elesewhere; specimens being sometimes taken of the length of ten feet, and of the weight of more than 100 pounds.

The Conger is only an occasional visitant of fresh waters, residing generally in the sea. In the winter

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राष्ट्रीय उलाकालय, कोलकाला
National Library, Kolkata

It is supposed to imbed itself under the soft mud, and to lie in an inactive state; but on the approach of spring it emerges from its concealment and visits the mouths of rivers. In the mouth of the Severn incredible quantities of young Congers are annually taken during the month of April under the name of Elvers: these are taken in a kind of sieve made of hair-cloth and fixed to the end of a long pole: the fisherman standing on the edge of the water during the tide puts in his net as far as he can reach, and drawing it out again takes multitudes at every sweep, and will take as many during one tide as will fill a bushel: they are dressed and reckoned very delicate.

The Conger in its full-grown state is also considered as a useful article of food in many parts of Europe, where it forms an article of commerce. Great numbers are taken on the coast of Cornwall, and are exported into Spain and Portugal, particularly to Barcelona: some are taken by a single hook and line, but because that method is tedious, and does not answer the expence of time and labour, they are chiefly caught by bulters, which are strong lines, five hundred feet long, with about sixty hooks, each eight feet asunder, baited with pilchards or mackrel: the bulters are sunk to the ground by a stone fastened to them, and sometimes such a number of these are tied together as to reach a mile: the fishermen are said to be very fearful of a large Conger, lest it should endanger their legs by clinging round them: they therefore kill them as soon as possible, which is said to be best done by striking

them on the belly: they are then slit and hung on a frame to dry in order to drain away the oil or fat which is extremely plentiful, insomuch that a Conger of a hundred weight is said to waste to twenty pounds during the process.

The Conger is a very voracious animal, preying on the smaller fishes, as well as on various kinds of crustacea, and particularly on the smaller kind of crabs during their soft state after having cast their shell.

#### SPOTTED EEL.

Anguilla Ophis. A. alba, fusco maculata, cauda aptera.

White Eel, spotted with brown, with finless tail.

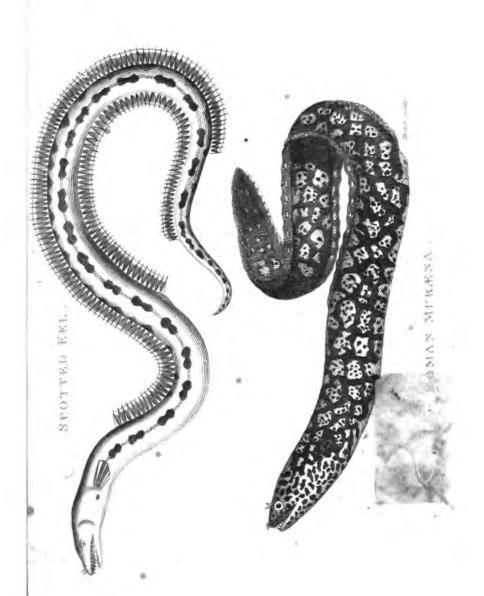
Muræna Ophis. M. cauda aptera cuspidata, cauda tereti. Lin.

Syst. Nat. p. 425.

Muræna maculata cauda aptera. Bloch. 5. p. 31. t. 164.

Serpens marinus maculosus, Will. append. p. 19. t. G. 9.

This species is readily distinguished from both the preceding by its remarkable colours, as well as by the more slender form of the body in proportion to its length: the fins are also much wider, and the tail is naked towards the tip; both dorsal and caudal fins terminating at some distance from that part: the whole body is of a silvery white colour, marked on the back and sides by a triple row of large dark-brown oblong spots or patches: the head is rather slender; the eyes of moderate size; the mouth wide, the teeth strong and slightly curved, and the pectoral



fins small and white. This fish is chiefly found in the Indian seas, but is said to have been occasionally met with in the Mediterranean, &c. It is of the same predacious nature with the rest of this genus, and is said to arrive at a very considerable size, though the specimens usually brought into Europe seldom exceed two or three feet in length.

#### SNAKE EEL.

Anguilla Serpens. A. albida rostro elongato, cauda aptera acuta, corpore tereti.

Whitish Eel, with lengthened snout, finless sharp-pointed tail, and round body.

M. Ophis. M. cauda aptera cuspidata, corpore tereti. Lin. Syst. Nat. p. 425.

Serpens marinus. Salvian? Gesn? Aldr? Will? t. G. 4.

thern seas, where it often arrives at able size, and is commonly known ea-serpent or snake: the head is and the gape very wide: the size, the size in the front of the mouth being longer than those on the sides: the general colour of the animal is a very pale yellowish brown above, and bluish white beneath: the dorsal and anal fins are shallow, tinged with black toward the edges, and terminate at some little distance before the tip of the tail, which is not of a compressed

form, but round and sharp-pointed: the pectoral fins are small, oval, and furnished with sixteen rays. The habits of this species resemble those of the preceding, and it is said to swim with great vigour and activity. It seems to have given rise to the fabulous narratives recorded by some authors of the vast sea-serpents supposed to be sometimes seen in various parts of the northern ocean.

#### RONDELETIAN EEL.

Anguilla Myrus. A. nigricans, rostro elongato.

Dusky Eel, with elongated snout.

Muræna Myrus. M. pinna ambiente alba, margine nigro. Lin. Syt. Nat. p. 427.

M. rostro acuto lituris albis vario, margine pinnæ dorsalis nigro. Arted. gen. 24. syn. 40.

Myrus Rondeletii. ? Gesn, Aldr. Will. p. 109.

If the Muræna Myrus of Linnæus be the Myrus of Rondeletius, it is thus described by that author. It bears a greater general resemblance to a serpent than to an eel; having a long sharp snout, at thin, round, blackish body, without either spots or scales: it has one branchial orifice on each side, and is furnished with two shallow fins of a skinny substance; one running from the neck to the tail, and the other from the vent to the same part; the border of both being black, as in the Conger: the sides, from the beginning of the neck, are marked with certain yellow specks, more apparent in the

living than in the dead animal: the flesh is tender, and has few or no spines. Linnaeus observes that the head is attenuated in front, and that there are two short tentacula on the upper lip. This animal is a native of the Mediterranean, and a supposed variety, entirely of an ash-colour, is mentioned by Forskal as a native of the Red Sea.

#### MURÆNA. MURÆNA.

#### Generic Character.

Corpus anguilliforme.

Pinnæ pectorales nullæ.

Spiraculum utrinque ad latera colli.

Body eel-shaped.

Pectoral fins none.

Spiracle on each side the neck.

#### ROMAN MURÆNA.

Muræna Romana. M. olivaceo-fusca, flavo variata.

Olive-brown Muræna with yellow variegations.

Muræna Helena. M. pinnis pectoralibus nullis. Lin. Syst.

Nat. p. 425.

Gymnothorax Muræna. Bloch. ichth. 12. p. 67. & Muræna

Helena. 5. p. 28. t. 153.

Muræna omnium autorum. Will, ichth. p. 103. t. G. 1.

THIS fish, the celebrated favourite of the ancient Romans, who considered it as one of the most luxurious articles of the table, is found in considered able plenty about several of the Mediterranean coasts, where it arrives at a size at least equal, if not superior, to that of an eel. Its colour is a dusky greenish brown, pretty thickly variegated on all parts with dull yellow subangular marks or patches, which are disposed in a somewhat different manner in different individuals, and are generally scattered over with smaller specklings of brown; the whole

forming a kind of obscurely reticular pattern, as expressed in the annexed engraving: the head is rather small; the mouth moderately wide, and the teeth sharp: the dorsal and caudal fins, which are shallow, and covered by the common skin, are united, in the same manner as in the cel, and are of a dusky colour with whitish spots. The Muræna is capable of living with equal facility both in fresh and salt water, though principally found at sea. In its manners it much resembles the eel and the conger, being extremely voracious, and preving on a variety of smaller animals. The ancients, who kept it in reservoirs appropriated for the purpose, are said to have sometimes tamed it to such a degree as to come at the signal of its master in order to receive its food. Pliny records a most disgusting and barbarous instance of tyranny practised by one Vedius Pollio, who was in the habit of causing his offending slaves to be thrown into the reservoirs in which he kept his Murænæ; expressing a savage delight in thus being able to taste in an improved state their altered remains. The emperor Augustus, according to Seneca, honoured this man with his presence at one of his entertainments; when a slave happening to break a valuable chrystal vase, was immediately ordered to be thrown to the Murænæ; but the poor boy, flying to the feet of Augustus, requested rather to die any death than thus to be made the food of fishes. The emperor, being informed of this extraordinary mode of punishment, immediately ordered all the chrystal vessels in the house to be broken before his face, and the

ponds of the barbarous owner to be completely filled up; at the same time giving the slave his freedom, and sparing the life of the offender in consideration of former friendship.

#### SPOTTED MURÆNA.

Murzena Guttata. M. glauca, guttis nigris, macula majori utrinque prope caput. Forsk. F. Arab. p. 22. No. 1. Lin. Syst. Nat. Gmel. p. 1135.

Glaucous Muræna, bedropped with black; with a larger spot on each side near the head.

Observed by Forskal: native of the Red Sea: has a rising callus between the eyes, gold-coloured irides, upper lip shorter than the lower, and the dorsal and anal fins united at the tail.

#### CHAIN-STRIPED MURÆNA.

Muræna Catenata. M. fusca maculis catenatis albis transvefsim fusciata.

Brown Muræna, transversely fasciated with white chainshaped spots.

Gymnothorax catenatus. Bloch. 12, p. 69. t. 415. f. 1. Muræna seu Conger Brasiliensis. Seb. mus. 2. t. 69, f. 4.

This species, of which the individuals hithertodescribed appear to be of the size of a smallish eel, is of a brown colour, crossed by large chain-like



white bands, somewhat irregular in their form on different parts of the animal, and marked by numerous brown spots and freckles: the head and orifice of the mouth are small, and the jaws armed with numerous close-set small and sharp teeth: the tongue connate with the palate: the eyes small and blue: the nostrils small, simple, and placed very near the eyes: the snout furnished at the tip with two very small setaceous cirri or beards: the branchial orifices are very small: the lateral line scarce perceptible: the dorsal fin commences at a considerable distance from the head, and is continued round the tail where it meets the anal fin. This fish is a native of Surinam.

### RETICULATED MURÆNA.

Muræna Reticulata. M. albida, fasciis transversis fuscis, lateribus corporis fusco reticulatis, pinna dorsali longitudine trunci.

Whitish Muræna, with transverse brown bands; the sides of the body reticulated with brown, and the dorsal fin as long as the body.

Gymnothorax reticularis. Bloch. 12. p. 71. t. 416.

In size and general form this resembles the preceding species, but differs in colours and in the disposition of the dorsal fin, which commences immediately at the back of the head, and is continued round the tail where it unites with the vent-fin: the head and mouth are small; the eyes rather large, and situated very near the upper lip: the jaws are edged with sharp, distant teeth, of which those in front are longer than the rest: the colour of the animal is white, with a slight tinge of yellow, and marked throughout by transverse brown bands, continued across the fins: on the sides of the body the appearance of the bands is indistinct, on account of the numerous reticularly disposed variegations of light brown with which those parts are covered. Native of the Indian seas.

### AFRICAN MURÆNA.

Muræna Africana. M. fusca, albido marmorata, pinna dorsali longitudine trunci.

Brown Muræna marbled with whitish variegations; the dorsal fin the length of the body.

Gymnothorax afer. Bloch. 12. p. 73. t. 417.

The colour of this species is brown, irregularly marbled with pale or whitish variegations in such a manner as to bear some resemblance to those of the common or Roman Muræna; these variegations are continued on the fins which are moderately broad in proportion to the body: the dorsal fin begins immediately behind the head, and is continued round the tail where it meets the vent-fin, as in others of this genus: the head is of moderate size; the eyes large; the mouth very wide, and armed with sharp, distant teeth, those in front exceeding the rest in size: in the palate are also situated three or four large teeth in a longitudinal

direction. This species is a native of the African seas, being found near the coasts of Guinea, where, though known to be a good food, it is not eaten by the negroes, who consider it as a kind of sea snake.

# ZEBRA MURÆNA.

Muræna Zebra. M. atro-fusca, fasciis transversis linearibus distantibus albis, subtus irregulariter concurrentibus.

Blackish-brown finless Muræna, with transverse, linear, distant, white bands, meeting irregularly beneath.

Zebra Gymnothorax. Naturalist's Miscellany. pl. 322.

Serpens marina Surinamensis fœmina Murænis valde affinis. Seb. 3. t. 70. f. 3.

This species, which grows to the length of two or three feet, is a native of the American seas, and is readily distinguished by the strongly marked distribution of its colours; the rich brown, which constitutes the ground-colour, being surrounded, at considerable distance, by narrow, white bands, which on the lower part of the sides and under the abdomen unite or anastomose here and there, so as to form subtriangular markings in some parts and rounded or occllated ones in others: the head is rather large or tumid, and the mouth and eyes small: there is no distinct appearance either of dorsal or caudal fins. This animal seems to have been first described by Seba. A beautiful specimen occurs in the Museum of Mr. John Hunter.

### SOUTHERN MURÆNA.

Muræna Echidna. M. fusca, nigro variegata, capite depresso, collo turgidissimo.

Brown Muræna, with black variegations, depressed head, and very turgid neck.

Muræna Echidna. M. pinnis pectoralibus nullis, capite depresso, corpore fusco nigroque vario, statim pone caput turgidissimo. Lin. Syst. Nat. Gmel. p. 1135.

NATIVE of the Southern ocean: grows to a large size, measuring from four to five feet in length and being of a very considerable thickness: the head is small and depressed, but the neck immediately beyond the occiput swells into a very large size, and again diminishes at the commencement of the body: the eyes are small; the mouth wide, and furnished with numerous sharp teeth. The flesh is said to be excellent, but the animal has a peculiarly forbidding appearance on account of its colours and form.

### SPECKLED MURÆNA.

Muræna Meleagris. M. nigricans, maculis creberrimis albis irroratu.

Blackish Muræna, very thickly speckled with white. Muræna Meleagris. Speckled Ecl. Nat. Miscell. pl. 220.

DESCRIBED from a specimen in the British Museum. Length about two feet: colour deep-brown,

very thickly beset on all parts with innumerable small round white spots, which are somewhat less regular or more confluent on the head and breast than elsewhere: eyes small; mouth wide; tech sharp and numerous. Native of the Southern ocean.

### COLUBRINE MURÆNA.

Muræna Colubrina. M. corpore fasciis annulatis alternatim flavis nigrisque variegato.

Muræna with the body variegated by alternate yellow and black bands.

Muræna Colubrina. Lin. Syst. Nat. Gmel. p. 1133.

Length about two feet: habit long and slender: colour pale, or yellowish-white: marked throughout by numerous equidistant widish bands of black or brown, passing through the fins: body said to be covered with very small scales: snout sharp-pointed; eyes very small. Native of the Indian seas.

### GREEN MURÆNA.

Muræna Viridis. M. viridis, maculis creberrimis rufo-fuscis.
Grass-green Muræna, with very numerous rufous-brown spots.
Serpens Marinus Americanus, &c. Seb. 3. t. 70. f. 2.

This, which is sufficiently described as to its general appearance by the specific character annexed, is considered by Seba as a kind of merine snake, and is represented with a bifid or serpentine tongue; but this is probably an error of the engraver; the whole habit shewing it to be either of this genus or the following one.



# SYNBRANCHUS. SYNBRANCHUS.

# Generic Character.

Corpus anguilliforme.

Pinnæ pectorales nullæ.

Spiraculum unicumsub collo.

Body eel-shaped.
Pectoral fins none.
Spiracle single, beneath the neck.

THIS genus differs from the preceding merely in the circumstance of the spiracle or branchial orifice being single, and situated beneath the throat.

### MARBLED SYNBRANCHUS.

Synbranchus Marmoratus. S. olivaceo-fuscus, maculis nigricantibus variatus, corpore subtus flavescente.

Olive-brown Synbranchus, marbled with blackish spots; the body yellowish beneath.

Synbranchus marmoratus. Bloch. 12. p. 75. t. 418.

The general appearance of the animal is that of a Muræna: its length about two feet and a half: head large, short, and thick: mouth moderately wide, and furnished with several rows of small conical teeth: tongue connate: lips fleshy: nostrils simple, seated near the eyes, which are blue: the skin of the body is thick and loose: the back is of a deep olive-colour with dusky spots: the belly and sides are of a yellowish cast, and the spots on those parts have a tinge of violet: the dorsal, or rather caudal fin, is extremely remote from the head, and surrounding the tail unites with the vent-fin; the vent being situated at the distance of some inches from the end of the tail, which terminates acutely. Native of the fresh waters of Surinam.

### PLAIN SYNBRANCHUS.

Synbranchus Immaculatus. S. fuscus immaculatus.
Synbranchus of a plain unvariegated brown colour.
Synbranchus immaculatus. Bloch. 12. p. 77. t. 419. f. 1.

This is much allied in general form to the preceding, but is considerably smaller, and very different in colour, being nearly of an uniform brown throughout, with the exception of a few very obscure subtransverse dusky shades across the body, and a few whitish marblings on the fins: like the former species it is a native of Surinam.



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# SPHAGEBRANCHUS. SPHAGEBRANCHUS.

# Generic Character.

Corpus anguilliforme, Pinnæ pectorales nullæ. Spiracula duo sub collo. Body eel-shaped.

Pectoral fins none.

Spiracles two, beneath the neck.

### ROSTRATED SPHAGEBRANCHUS.

Sphagebranchus rostratus. S. capite rostrato. Bloch. 12. p. 79. t. 419. f. 2.

Sphagebranchus with the upper lip produced into a snout.

Muræna cœca. M. apterygia, rostro acutiusculo. Lin. Syst.

Nat. p. 426.

THIS genus, which resembles the preceding, except in the circumstance of a double instead of a single branchial aperture beneath the neck, consists at present of a single species only. The specimen mentioned by Dr. Bloch, who appears to have been its first describer, measured about nine inches, and was supposed to be still in a young state: it is represented in its natural size on the annexed plate, and was of a cylindric form, destitute both of fins and scales: the upper jaw was considerably longer than the lower, being produced into a sharpened snout: the eyes were small; the teeth numerous, and the two spiracles or branchial orifices were situated at

about the distance of an inch beyond the mouth, immediately beneath the neck or fore-part of the body: the colour of the whole animal was a pale brown. It was received from Tranquebar.

The Muræna coeca of Linnæus, from the slight description given in the Systema Naturæ, seems so nearly allied to the above animal, that there is some reason for supposing it to be in reality the same\*.

\* Corpus Anguillæ, absque-omni pinna: caput in medio 7, anterius 8, ad occiput 7 punctis perforatum: mandibulæ acuminatæ, dentibus acerosis: sub rostro nares tubulosæ: sub collo aperturæ branchiarum: anus propior capiti quam caudæ.

E. BRANDER. Lin. Syst. Nat. Gmel. p. 1135.

# MONOPTERUS. MONOPTERE.

# Generic Character.

Corpus anguilliforme.
Nares inter oculos.

Pinna caudalis.

Body anguilliform.

Nostrils placed between the eyes.

Fin caudal.

### JAVAN MONOPTERE.

Monopterus Javanicus. M. nigricans, cauda peracuta.

Monopterus with very sharp-pointed tail.

Le Monoptère Javanois. Cepede pisc. 2. p. 139.

THE Monopterus Javanicus, the only animal of this genus hitherto discovered, is thus described by the Count de la Cepede, from the manuscripts of Commerson, by whom it was considered as a species of Muræna. The body is serpentiform, viscous, and destitute of conspicuous scales: the head thick, compressed, enlarging towards the back part, and terminated in front by a rounded muzzle: the gape is rather wide; the upper jaw scarce projecting beyond the lower; both being furnished with short close teeth, like those of a file: a row of similar teeth is also situated in the inside of the mouth around the palate: the base of the tongue, which is

cartilaginous, and hollowed above into a channel, is furnished with two whitish tubercles: the openings of the nostrils are not tubular, nor are they situated, as in most fishes, before the eyes, but above them: the gill-covers are soft and flaccid, appearing like a duplicature of the skin: the gill-membrane has only three rays, and the branchize are only three in number on each side: the bony arches which support them are but little bowed, and have no denticulated appearance or asperity: the caudal fin has no perceptible rays, and the tail itself being very compressed, resembles the shape of a two-edged sword-blade: the lateral line, which is nearer the back than the belly, extends from the gills to the extremity of the tail, and is almost of a gold-colour: the back is of a livid brown or blackish, and the sides have a similar tinge, with small transverse ferruginous bands: the belly is also of this colour: the general length of the animal is about seven decimetres; the circumference, in the thickest part of the body, one decimetre; and the weight more than a hectogramme. This fish is a native of the Indian seas, and is very common about the coasts of Java, where it is considered as an excellent food.





# GYMNOTUS. GYMNOTE.

# Generic Character.

Caput operculis lateralibus. | Head with lateral opercula. Tentacula duo ad labium superius.

Oculi cute communi tecti.

Membrana branchiostega radiis quinque.

Corpus compressum, subtus pinna carinatum, dorso (plerisque) apterygio.

Tentacula two on the upper lip.

Eyes covered by the common skin.

Gill-membrane five-rayed.

Body compressed, without dorsal fin (in most species), but carinated by a fin beneath.

### ELECTRICAL GYMNOTE.

Gymnotus Electricus. Gymnotus anguilliformis fuscus, cauda obtusa.

Anguilliform brown Gymnote, with obtuse tail.

Gymnotus electricus. G. nudus dorso apterngio, pinna caudali obtusissima anali annexa. Lin. Syst. Nat. p. 427.

Gymnotus electricus. Bloch. ichth. 5. p. 38, t. 156.

HE peculiar species of electricity or Galvanism exerted at pleasure by this extraordinary animal is such as greatly to surpass that of the Torpedo, so long the subject of admiration both in ancient and modern times. The electric Gymnotus is a native of the warmer regions of Africa and America,

where it inhabits the larger rivers, and is particularly found in those of Surinam. In Africa it is said chiefly to occur in the branches of the river Senegal. It is a fish of a disagreeable appearance; bearing a general resemblance to a large eel, though somewhat thicker in proportion, and of a much darker colour, being commonly of an uniform blackish brown. It is usually seen of the length of three or four feet, but is said to arrive at a far larger size, specimens occasionally occurring of six, seven, or even ten feet in length. It was first made known to the philosophers of Europe about the year 1671, when its wonderful properties were an nounced to the French academy by Monsr. Richer, one of the gentlemen sent out by the academy to conduct some mathematical observations in Cayenne. This account however seems to have been received with a degree of cautious scepticism by the major part of European naturalists, and it was not till towards the middle of the late century that a full and general conviction appears to have taken place; the observations of Monsr. Condamine, Mr. Ingram, Mr. Gravesend, and others, then conspiring to prove that the power of this animal consists in a species of real electricity, being conducted by similar conducting substances, and intercepted by others of an opposite nature. Thus, on touching the fish with the fingers, the same sensation is perceived as on touching a charged vial; being sometimes felt as far as the elbows; and if touched by both hands, an electric shock is conveyed through the breast in the usual manner. Fermin, in par-

ticular, who, during his residence in Surinam, had frequent' opportunities of examining the animal, demonstrated by experiment that fourteen slaves. holding each other by the hands, received the shock at the same instant; the first touching the fish with a stick\*, and the last dipping his hand into the water in which it was kept. The experiments of Dr. Bancroft were equally satisfactory. After this, viz. about the year 1773, Mr. Williamson, in a letter from Philadelphia to Mr. Walsh, so celebrated for his observations relative to the electricity of the Torpedo, communicated his own highly satisfactory experiments on the Gymnotus. On touching the animal with one hand, in such a manner as to irritate it considerably, while the other was held at a small distance from it in the water, he experienced as strong a shock as from a charged Leyden vial. The shock was also readily communicated through a circle formed by eight or ten persons at once; the person at one extremity putting his hand in the water, near the fish, while the other touched the animal. It would be todious to recite all the various modifications of these experiments, and it is sufficient to add, that all conspired to prove the genuine voluntary electricity of the animal; though occasionally exhibiting some variations from the phenomena of common electricity. It is by this extraordinary faculty that the Gymnotus supports its existence: the smaller fishes and other animals which happen to approach it, being instantly

<sup>\*</sup> Probably a green or moist one.

stupified, and thus falling an easy prey to the electrical tyrant. So powerful is the shock which this fish, in its native waters, is capable of exerting, that it is said to deprive almost entirely of sense and motion those who are exposed to its approach, and is therefore much dreaded by those who bathe in the rivers it inhabits.

A very accurate description of the exterior form of the Gymnotus was drawn up by the late ingenious Dr. Garden of Charles Town in South Carolina, addressed to the celebrated Mr. Ellis; and an equally accurate description of its internal structure, and more particularly of its electric or Galvanic organs, is given by Mr. Hunter. Both these are printed in the 65th volume of the Philosophical Transactions.

"The largest of these fish," says Dr. Garden, was three feet eight inches in length, when extending itself most, and might have been from ten to fourteen inches in circumference about the thickest part of the body. The head is large, broad, flat. smooth, and impressed here and there with holes, as if perforated with a blunt needle, especially towards the sides, where they are more regularly ranged in a line on each side. The rostrum is obtuse and rounded. The upper and lower jaws are of an equal length, and the gape is large. The nostrils are two on each side; the first large and tubular, and elevated above the surface; the others small, and level with the skin, placed immediately behind the verge of the rostrum, at the distance of an inch asunder. The eyes are small, flattish, and

of a blueish colour, placed about three quarters of an inch behind the nostrils, and more towards the sides of the head. The whole head seems to be well supported; but whether with bones or cartilages I could not learn. The body is large, thick, and roundish, for a considerable distance from the head. and then gradually grows smaller, but at the same time deeper, or becomes of an acinaciform shape, to the point of the tail, which is rather blunt. There are many light-coloured spots on the back and sides of the body, placed at considerable distances in regular lines, but more numerous and distinct towards the tail. When the fish was swimming, it measured six inches in depth near the middle, from the upper part of the back to the lower edge of the fin, and it could not be more than two inches broad on the back at that place. The whole body, from about four inches below the head, seems to be clearly distinguished into four different longitudinal parts or divisions. The upper part or back is roundish, of a dark colour, and separated from the other parts on each side by the lateral lines; which, taking their rise at the base of the head, just above the pectoral fins, run down the sides, gradually converging, as the fish grows smaller, to the tail, and make so visible a depression or furrow in their course, as to distinguish this from the second part or division, which may be properly called the body, or at least, appears to be the strong muscular part of the fish. This second division is of a lighter and more clear blueish colour than the upper or back part, and seems to swell

out somewhat on each side, from the depression of the lateral lines; but towards the lower or under part, is again contracted, or sharpened into the third part or carina. This carina or keel is very distinguishable from the other two divisions, by its thinness, its apparent laxness, and by the reticulated skin of a more grey or light colour, with which it is covered. When the animal swims gently in pretty deep water, the rhomboidal reticulations of the skin of this carina are very discernible; but when the water is shallow, or the depth of the carina is contracted, these reticulations appear like many irregular longitudinal plicæ. The carina begins about six or seven inches below the base of the head, and gradually widening or deepening as it goes along, reaches down to the tail, where it is thinnest. It seems to be of a strong muscular nature. Where it first takes its rise from the body of the fish, it seems to be about one inch, or one inch and a half thick, and is gradually sharpened to a thin edge, where the fourth and last part is situated; viz. a long, deep, soft, wavy fin, which takes its rise about three or four inches at most below the head, and runs down along the sharp edge of the carina to the extremity of the tail. When it first rises it is not deep, but gradually deepens or widens as it approaches the tail. It is of a very pliable soft consistence, and seems rather longer than the body. The situation of the vent in this fish is very singular, being placed underneath, and being about an inch more forward than the pectoral fins, and consequently considerably nearer the rostrum.

There are two pectoral (if I may call them so) fins, placed one on each side, just behind the head, over the foramina spiratoria, which are small, and generally covered with a lax skin, situated in the axillæ of these fins. These fins are small for the size of the fish, being scarcely an inch in length, and of a very thin, delicate consistence, and orbicular shape. They seem to be chiefly useful in supporting and raising the head of the fish when he wants to breathe, which he does every four or five minutes, by raising his mouth out of the water. This shews that he has lungs and is amphibious, and the foramina spiratoria seem to indicate his having branchiæ likewise\*; but this I only offer as a conjecture, not being certain of the fact. I must now mention the appearances of a number of small cross bands, annular divisions, or rather rugæ of the skin of the body. They reach across the body down to the base of the carina on each side; but those that cross the back seem to terminate at the lateral lines, where new rings take their rise, not exactly in the same line, and run down to the carina. This gives the fish somewhat of a worm-like appearance; and indeed it seems to have some of the properties of this tribe, for it has a power of lengthening or shortening its body to a certain degree, for its own conveniency, or agreeably to its own inclination. I have seen this specimen, which I have measured three feet eight inches, shorten himself to three feet two inches; but besides this power of lengthen-

<sup>\*</sup> This proved an erroneous idea,

ing or shortening his body, he can swim forwards or backwards with apparently equal ease to himself. which is another property of the vermicular tribe. When he swims forwards, the undulations or wavy motions of the fin and carina begin from the upper part, and move downwards; but when he swims backwards, and the tail goes foremost, the undulations of the fin begin at the extremity of the tail or fin, and proceed in succession from that backwards to the upper part of the body: in either case he swims equally swift. Every now and then the fish lays himself on one side, as it were, to rest himself, and then the four divisions of the body above mentioned are very distinctly seen, viz. the vermiform appearance of the two upper divisions; the retiform appearance of the carina, and the last or dark-coloured fin, whose rays seem to be exceedingly soft and flexible, and entirely at the command of the strong muscular carina. When he is taken out of the water and laid on his belly, the carina and fin lie on one side, in the same manner as the ventral fin of the Tetraodon does, when he creeps on the ground. I have been the longer and more particular in the description of the external structure of this animal's body, because I think, as it is of a most singular nature, and endowed with some amazing properties, even the most minute circumstance I was able to observe relating to it should be mentioned. The power it has of giving an electrical shock to any person, or to any number of persons who join hands together, the extreme person on each side touching the fish, is its most singular and

astonishing property. The five we have here are possessed of this power in a very great degree, and communicate the shock to one person, or to any number of persons, either by the immediate touch of the fish with the hand, or by the intervention of any metalline rod. The keeper says that when first caught, they could give a much stronger shock by a metalline conductor than they can do at present. The person who is to receive the shock must take the fish with both hands, at some considerable distance asunder, so as to form the communication: otherwise he will not receive it; at least I never saw any one shocked from taking hold of it with one hand only: though some have assured me that they were shocked by laying one hand on him. myself have taken hold of the largest with one hand often, without ever receiving a shock; but I never touched it with both hands, at a little distance asunder, without feeling a smart shock. I have often remarked, that when it is taken hold of with one hand, and the other hand is put into the water over its body, without touching it, the person received a smart shock; and I have observed the same effect follow, when a number joined hands, and the person at one extremity of the circle took hold of or touched the fish, and the person at the other extremity put his hand into the water, over the body of the fish. The shock was communicated through the whole circle as smartly as if both the extreme persons had touched the fish. In this it seems to differ widely from the Torpedo, or else we are much misinformed of the manner in which the benumbing

effect of that fish is communicated. The shock which our Surinam fish gives seems to be wholly electrical; and all the phænomena or properties of it exactly resemble those of the electric aura of our atmosphere when collected, as far as they are discoverable from the several trials made on this fish. This stroke is communicated by the same conductors, and intercepted by the interposition of the same original electrics or electrics per se, as they are called. The keeper of these fish informed me that he caught them in Surinam river, a great way up, beyond where the salt water reaches; and that they are a fresh water fish only. He says that they are eaten, and by some people esteemed a great delicacy. They live on fish, worms, or any animal food, if it is cut small, so that they can swallow it. When small live fishes are thrown into the water, they first give them a shock, which kills, or so stupifies them, that they can swallow them easily and without any trouble. If one of these small fishes, after it is shocked, and to all appearance dead, be taken out of the vessel where the electrical fish is, and put into fresh water, it will soon revive again. If a larger fish than they can swallow be thrown into the water, at a time that they are hungry, they give him some smart shocks, till he is apparently dead, and then endeavour to swallow or suck him in: but, after several attempts, finding he is too large, they quit him. Upon the most careful inspection of such fish, I could never see any mark of teeth, or the least wound or scratch upon them. When the electrical fish are hungry, they are pretty keen

after their food; but they are soon satisfied, not being able to contain much at a time. An electrical fish of three feet and upwards in length cannot swallow a small fish above three or at most three inches and a half long. I am told that the electrical fish is sometimes found in the river Surinam upwards of twenty feet in length, and that the stroke or shock proves instant death to the person who receives it."

Mr. Hunter's accurate description of the electric or Galvanic organs of this curious animal, is as follows:

" This fish, on the first view, appears very much like an eel, from which resemblance it has most probably got its name; but it has none of the specific properties of that fish. This animal may be considered, both anatomically and physiologically, as divided into two parts, viz. the common animal part, and a part which is superadded, viz. the peculiar organ. I shall at present consider it only with respect to the last; as the first explains nothing relating to the other, nor any thing relating to the animal economy of fish in general. The first, or common animal part, is so contrived as to exceed what was necessary for itself, in order to give situation, nourishment, and most probably the peculiar property to the second. The last part, or peculiar organ, has an immediate connexion with the first; the body affording it a situation; the heart nourishment; and the brain nerves, and probably its peculiar powers. For the first of these purposes the body is extended out in length,

being much longer than would be sufficient for what may be called its progressive motion. For the real body, or that part where the viscera lye, is situated, with respect to the head, as in other fish, and is extremely short; so that, according to the ordinary proportions, this should be a very short fish. Its great length, therefore, seems chiefly intended to afford a surface for the support of the peculiar organ: the tail-part, however, is likewise adapted to the progressive motion of the whole, and to preserve the specific gravity; for the spine, medulla spinalis, muscles, fin, and air-bladder, are continued through its whole length. Besides which parts, there is a membrane passing from the spine to that fin which runs along the belly or lower edge of the animal. This membrane is broad at the end next to the head, terminating in a point at the tail. It is a support for the abdominal fin, gives a greater surface of support for the organ, and makes a partition between the organs of the two opposite sides.

"The organs which produce the peculiar effect of this fish, constitute nearly one half of that part of the flesh in which they are placed, and perhaps make more than one third of the whole animal. There are two pair of these organs, a larger and a smaller; one being placed on each side. The large pair occupy the whole lower or anterior, and also the lateral part of the body, making the thickness of the fore or lower parts of the animal, and run almost through its whole length, viz. from the abdomen to near the end of the tail. It is broadest on the sides of the fish at the interior end, where

it incloses more of the lateral parts of the body. becomes narrower towards the end of the tail, occupying less and less of the sides of the animal, till at last it ends almost in a point. These two organs are separated from one another at the upper part by the muscles of the back, which keep their posterior or upper edges at a considerable distance from one another: below that, and towards the middle, they are separated by the air-bag; and at their lower parts they are separated by the middle partition. They begin forwards, by a pretty regular edge, almost at right angles with the longitudinal axis of the body, situated on the lower and lateral parts of the abdomen. Their upper edge is a pretty strait line, with small indentations made by the nerves and blood-vessels which pass round it to the skin. At the anterior end they go as far towards the back as the middle line of the animal; but in their approach towards the tail, they gradually leave that line, coming nearer to the lower surface of the animal. The general shape of the organ, on an exterior or side view, is broad at the end next to the head of the animal, becoming gradually narrower towards the tail, and ending there almost in a point. The other surfaces of the organ are fitted to the shape of the parts with which they come in contact: therefore on the upper and inner surface it is hollowed, to receive the muscles of the back. There 3 also a longitudinal depression on its lower edge, where a substance lies which divides it from the small organ, and which gives a kind of fixed point for the lateral muscles of the fin. Its most internal

surface is a plane adapted to the partition which divides the two organs from one another. The edge next to the muscles of the back is very thin, but the organ becomes thicker and thicker towards its middle, where it approaches the centre of the animal. It becomes thinner again towards the lower surface or belly, but that edge is not so thin as the other. Its union with the parts to which it is attached is in general by a loose, but pretty strong, cellular membrane; except at the partition, to which it is joined so close as to be almost inseparable. The small organ lies along the lower edge of the animal, nearly to the same extent as the other. Its situation is marked externally by the muscles, which move the fin under which it lies. Its anterior end begins nearly in the same line with the large organ, and just where the fin begins. It terminates almost insensibly near the end of the tail, where the large organ also terminates. It is of a triangular figure, adapting itself to the part in which it lies. Its anterior end is the narrowest part: toward the tail it becomes broader; in the middle of the organ it is thickest, and from thence becomes gradually thinner to the tail, where it is very thin. The two small organs are separated from one another by the middle muscles, and by the bones upon which the bones of the fins are ar-The large and the small organ on each side, are separated from one another by a membrane, the inner edge of which is attached to the middle partition, and its outer edge is lost on the skin of the animal. To expose the large organ to view,

nothing more is necessary than to remove the skin, which adheres to it by a loose cellular membrane. But to expose to view the small organ, it is necessary to remove the long row of small muscles which move the fin. The structure of the organs is extremely simple and regular, consisting of two parts, viz. flat partitions or septa, and cross divisions between them. The outer edge of these septa appears externally in parallel lines, nearly in the direction of the longitudinal axis of the body. These septa are thin membranes, placed nearly parallel to one another. Their lengths are nearly in the direction of the long axis, and their breadth is nearly the semi-diameter of the body of the animal. They are of different lengths, some being as long as the whole organ. I shall describe them as beginning principally at the anterior end of the organ, although a few begin along the upper edge; and the whole, passing towards the tail, gradually terminate on the lower surface of the organ; the lowermost at their origin terminating soonest. Their breadths differ in different parts of the organ. They are in general broadest near the anterior end, answering to the thickest part of the organ, and become gradually narrower towards the tail: however they are very narrow at the beginning or anterior ends. Those nearest to the muscles of the back are the broadest, owing to their curved or oblique situation upon these muscles, and grow gradually narrower towards the lower part, which is in a great measure owing to their becoming more transverse, and also to the organ becoming thinner at that place. They

have an outer and an inner edge. The outer is attached to the skin of the animal, to the lateral muscles of the fin, and to the membrane which divides the great organ from the small; and the whole of their inner edges are fixed to the middle partition formerly described, as also to the air-bladder; and three or four terminate on that surface which incloses the muscles of the back. These septa are at the greatest distance from one another at their exterior edges near the skin, to which they are united; and as they pass from the skin towards their inner attachments, they approach one another. Sometimes we find two uniting into one. On that side next to the muscles of the back they are hollow from edge to edge, answering to the shape of those muscles; but become less and less so towards the middle of the organ; and from that, towards the lower part of the organ, they become curved in another direction. At the anterior part of the large organ, where it is nearly of an equal breadth. they run pretty parallel to one another, and also pretty strait; but where the organ becomes narrower, it may be observed that two join or unite into one; especially where a nerve passes across. The termination of this organ at the tail is so very small that I could not determine whether it consisted of one septum or more. The distances between these septa will differ in fish of different sizes. In a fish of two feet four inches in length I found them one twenty-seventh of an inch distant from one another; and the breadth of the whole organ. at the broadest part, about an inch and a quarter,

in which space were thirty-four septa. The small organ has the same kind of septa, in length passing from end to end of the organ, and in breadth passing quite across: they run somewhat serpentine: not exactly in strait lines. Their outer edges terminate on the outer surface of the organ, which is in contact with the inner surface of the external muscle of the fin, and their inner edges are in contact with the centre muscles. They differ very much in breadth from one another; the broadest being equal to one side of the triangle, and the narrowest scarcely broader than the point or edge. They are pretty nearly at equal distances from one another, but much nearer than those of the large organ, being only about the fifty-sixth part of an inch asunder: but they are at a greater distance from one another towards the tail, in proportion to the increase of breadth of the organ. The organ is about half an inch in breadth, and has fourteen septa. These septa, in both organs, are very tender in consistence, being easily torn. They appear to answer the same purpose as the columns in the Torpedo; making walls or butments for the subdivisions, and are to be considered as making so many distinct organs. These septa are intersected transversely by very thin plates or membranes, whose breadth is the distance between any two septa, and therefore of different breadths in different parts; broadest at that edge which is next to the skin, and narrowest at that next the centre of the body, or to the middle partition which divides the two organs from one another. Their lengths

are equal to the breadths of the septa between which they are situated. There is a regular series of them continued from one end of any two septa to the other. They appear to be so close as even to touch. In an inch in length there are about two hundred and forty, which multiplies the surface of the whole to a vast extent.

"The nerves in this animal may be divided into two kinds: the first appropriated to the general purposes of life; the second for the management of this peculiar function, and very probably for its existence. They arise in general from the brain and medulla spinalis, as in other fish; but those from the medulla are much larger than in fish of equal size; and larger than is necessary for the common operations of life. The nerve which arises from the brain, and passes down the whole length of the animal (which I believe exists in all fish), is larger in this than in others of the same size, and passes nearer to the spine. In the common eel it runs in the muscles of the back, about midway between the skin and spine. In the cod it passes immediately under the skin. From its being larger in this fish than in others of the same size, one might suspect that it was intended for supplying the organ in some degree; but this seems not to be the case, as I was not able to trace any nerves going from it to join those of the medulla spinalis, which run to the organ. This nerve is as singular an appearance as any in this class of animals; for surely it must appear extraordinary, that a nerve should arise from the brain to be lost in common parts, while there is

a medula spinalis giving nerves to the same parts. It must still remain one of the inexplicable circumstances of the nervous system. The organ is supplied with nerves from the medulla spinalis, from which they come out in pairs between all the vertebræ of the spine. In their passage from the spine they give nerves to the muscles of the back, &c. They bend forwards and outwards upon the spine, between it and the muscles, and send out small nerves to the external surface, which join the skin near to the lateral lines. These ramify upon the skin, but are principally bent forwards between it and the organ. into which they send small branches as they pass along. They seem to be lost in these two parts. The trunks get upon the air-bladder, or rather dip between it and the muscles of the back, and continuing their course forwards upon that bag, they dip in between it and the organ, where they divide into smaller branches: they then get upon the middle partition, on which they continue to divide into still smaller branches; after which they pass on, and get upon the small bones and muscles, which are the bases for the under fin, and at last they are lost on that fin. After having got between the organ and the above-mentioned parts, they are constantly sending small nerves into the organs; first into the great organ, and then into the small one: also into the muscles of the fin, and at last into the fin itself. These branches, which are sent into the organ, as the trunk passes along, are so small that I could not trace their ramifications in the organs. In this fish as well as in the Torpedo, the nerves which supply the organ, are much larger than those bestowed on any other part for the purposes of sensation and action; but it appears to me that the organ of the Torpedo is supplied with much the largest proportion. If all the nerves which go to it were united together, it would make a vastly greater chord than all those which go to the organ of this eel. Perhaps when experiments have been made upon this fish, equally accurate with those on the Torpedo, the reason for this difference may be assigned."

It has been affirmed that the Gymnotus electricus, even for some time after its death, cannot be touched without feeling its electric shock. This is by no means incredible, when we consider the effect of the Galvanic pile, so well known to modern philosophers.

### CARAPO GYMNOTE.

Gymnotus Carapo. G. unicolor, dorso apterygio, pinna ani longitudine cauda attenuata, maxilla superiore longiore. Lin. Syst. Nat. Gmel. p. 1136.

Brown Gymnote, with the vent-fin of the length of the attenuated tail, and the upper jaw longer than the lower.

Gymnotus macrourus. G. macrourus, maxilla superiore longiore, Bloch.

Gymnotus carapo. G. nudus, dorso apterygio, pinna ani longitudine cauda attenuata. Lin. Syst. Nat. p. 427.

THE head of the Carapo is of a compressed form, and the upper jaw projects beyond the lower: the tongue is short, thick, broad, and furnished like the jaws with a great many small sharp-pointed teeth:

the eyes are very small, and the front of the head is marked, as in the preceding species, by a number of small round pores: the body gradually decreases towards the tail, which is extremely slender, and terminates in a point. The colour of the whole animal is brown, marked by a few irregular spots or patches of a deeper cast: the scales are small, and the lateral line strait. This fish is a native of the American seas, and is said to be most frequent about the coast of Surinam. It is supposed to live chiefly on small fishes, sea insects, &c. it possesses any electric power, like the former species, may be doubted; yet the structure of the lower part of the body seems to imply somewhat of a similar contrivance of Nature. The usual length of the Carapo is from one to two feet; but it is sometimes found of the length of three feet, and of the weight of more than ten pounds. It is considered as an esculent fish by the South-Americans.

## VAR.

## SHORT-TAILED CARAPO.

Gymnotus fasciatus. G. nudus fasciatus, dorso apterygio, pinna ani longitudine caudæ attenuatæ, maxilla inferiore longiore.

Naked-backed pale-brown Gymnotus, with darker transverse fasciæ, short tail, and lower jaw longer than the upper.

Gymnotus carapo. G. brachyurus maxilla inferiore longiore, Bloch.

Gymnotus fasciatus. Lin. Syst. Nat. Gmel. p. 137.

In general appearance this fish so much resembles the preceding that it has been considered both by Artedi and Linnæus as no other than a variety, differing principally in the shortness of the tail, and in the inferior size of the body. By Seba, however, it was regarded as a distinct species, and Dr. Bloch in his Ichthyology observes, that it not only differs from the former in the part above mentioned, but also in the contrary outline of the mouth; the lower jaw advancing beyond the upper: he also adds, that the number of rays in the vent-fin is different, and that the back is marked by a furrow, extending from the neck to the middle of the trunk. This fish inhabits the same seas with the preceding.

## ROSTRATED GYMNOTE.

Gymnotus Rostratus. G. rostro tubulato, piuna ani cauda breviore. Lin. Syst. Nat. p. 428.

Spotted Gymnotus, with tubular snout, and vent-fin shorter than the tail.

Gymnotus varius rostro productiore. Seb. 3. p. 99. t. 32. f. 5.

In its general aspect this species is much allied to the Carapo, but is readily distinguished by the peculiar form of the head, which terminates in a narrow, slightly compressed, tubular snout, the jaws appearing in a manner connate: the colour of the body is pale reddish brown, variegated with differently sized spots of a darker colour, and which are much smaller, as well as more numerous, on the fin than on the other parts: the pectoral fins are round and rather small for the size of the animal: the eyes are very small: the scales, if any, are so small as to be not distinctly visible on a general view. This species is a native of Surinam, and seems to have been first described and figured by Seba.

#### WHITE GYMNOTE.

Gymnotus Albus. G. albus, maxilla inferiore longiore, labiu superiore utrinque lobulo notato.

White Gymnotus, with the lower jaw longest, and the upper lip marked with a lobule on each side.

Gymnotus albus. Pall. Spic. Zool. 7. p. 36.

Gymnotus albus. Lin. Syst. Nat. Gmel. p. 1137.

Size and general habit of the Carapo and fasciatus; colour white or whitish; scales moderately large; tail naked for about an inch, and ending in a point, as in others of this tribe; pectoral fins very small; mouth furnished on each side the upper lip with a small lobule or abrupt cirrus, as it were, situated at about half the distance of the gape; eyes very small; head marked on each side by several pores. Native of Surinam.

#### WHITE-FRONTED GYMNOTE.

Gymnotus Albifrons. G. dorso anteriore niveo. Lin. Syst. Nat. Gmel. p. 1139. Pall. Spic. Zool. 7. p. 35. t. 6. f. 1. Gymnote with the fore part of the back snow-white.

First described by Dr. Pallas: native of Surinam: head with wider mouth than the rest of its tribe, very obtuse, fleshy, and sprinkled over with small pores: upper lip very thick, including the lower, which is very high on each side: no tongue: palate beset with papillæ: gill-covers with a semilunar opening before the fleshy base of the pectoral

fins, which are black and prominent, with the first ray doubled by a small bone at the base: anal fin beginning from the throat: fore part of the back convex, with a soft, brown, fleshy process\* behind the middle, beyond which it is destitute of scales: tail compressed, flat, with an ovate fin: from the tip of the lower mandible to the middle of the back runs a snow-white band.

## NEEDLE GYMNOTE.

Gymnotus Acus. G. nudus, dorso ventre caudaque apterygiis, pinna anuli ante apicem caudæ terminata radūs sexaginta. Lin. Syst. Nat. Gmel. p. 1140.

Naked Gymnotus, with finless tail and belly; the anal fin terminating before it reaches the tip of the tail.

This species is described by Brunnich, in his history of the fish of Marseilles. It is whitish, with reddish and brown spots, which cause a kind of clouded variegation on the back; while a blueishtinge prevails towards the under parts: on the back is a kind of projection, which may be rather considered as a rudiment of a fin than a perfect one: the

<sup>\*</sup>This process, which is of considerable length, is, according to the observations of the Count de Cepede, attached also at its smaller or opposite extremity to the skin of the back, very near to the origin of the tail: it is also connected throughout its whole length by twelve short, oblique filaments, to the subjacent furrow into which it is received. In the specimen described by Dr. Pallas, it appears to have been imperfect, and is improperly called a circus.

whole animal is of a long, compressed, and attenuated form, and the mouth is destitute of tentacula. This is the only European species of Gymnote yet discovered, and is a native of the Mediterranean sea.

#### FIN-BACKED GYMNOTE.

Gymnotus Notopterus. G. argenteo-inauratus, dorso pinnatu pinnisque cinerascentibus. Lin. Syst. Nat. Gmel. p. 1139. Pall. Spic. Zool. 7. p. 40. t. 6. f. 2.

Silvery Gymnote, with a gilt hue, with the dorsal and other fins of a pale ash-colour.

It must, no doubt, appear in some degree absurd to place a fish which is furnished with a dorsal fin in a genus distinguished by the want of that part: but since in every other respect the present animal agrees with the rest of the Gymnoti, I shall consider it as belonging to that tribe rather than institute for it a separate genus. It is a native of Amboyna, and is of the length of about eight or nine inches, though it probably arrives at a larger size. The head is short and obtuse: the eyes large. and above them is placed a small pore or foramen: the jaws are furnished with sharp teeth, those in the lower jaw being largest: besides these is a row of very minute teeth within the jaw: the palate is also edged with similar small teeth: the gill-covers are scaly, with a membranaceous edge: the scales on the body are very small: the anal fin at its origin is fleshy, and narrower than elsewhere.

#### ASIATIC GYMNOTE.

Gymnotus Asiaticus. G. squamosus dorso pinnato. Lin. Syst. Nat. Gmel. p. 1140.

Brownish Gymnote, with deeper bands, distinct scales, and finned back.

This, like the former, departs, in some degree, from the generic character: it is of a thickish form, and more than a span in length, and is covered both on the head and other parts with moderately large rounded scales: the head is depressed, smoothish, marked with five hollow dots, and by a small foramen in front: before the nostrils are two abrupt tentacula: the tongue is smooth: the teeth in both jaws small, and there is also a row of small teeth within the upper jaw, and a few hollowed points in the lower; the gill-covers have a wide opening: the body is subcylindric, compressed at the hind part: the dorsal fin commences a little behind the neck, and extends as far as the tail, and, together with the hind part of the body, is speckled with white: the lateral line is elevated and strait, but descends over the vent.

## OPHIDIUM. OPHIDIUM.

## Generic Character.

Caput nudiusculum: dentes maxillis, palato, faucibus.

Membrana branchiostega radiis septem, patula. Corpus ensiforme.

Head somewhat naked: teeth in the jaws, palate, and throat.

Branchiostegous membrane seven-rayed, patulous. Body ensiform.

#### BEARDED OPHIDIUM.

Ophidium Barbatum. O. cirro utrinque gulari duplici. Ophidium with a long double cirrus on each side the throat. Ophidium barbatum. O. maxilla inferiore cirris quatuor. Lin. Syst. Nat. p. 431.

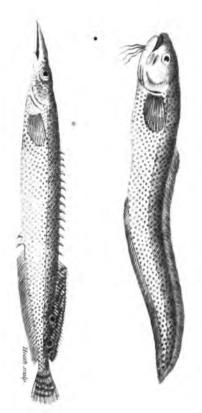
Ophidium cirris quatuor gularibus. Bloch, 5. p. 58. t. 159. f. 1.

THE head of this fish is small; the upper jaw rather longer than the lower, and both beset with a great many small teeth: the lips are strong and fleshy: in the throat are several small teeth: between the eyes and mouth are four small pores: the tongue is strait and short: beneath the throat are two long, bifid cirri, representing at first view four distinct ones: the body is long, moderately thick, and of a smooth surface: it is irregularly covered with small scales, resembling in their structure those of an eel, and attached to the skin by

 ${\bf g}^{i}$ 

BEARDED OFHIDIUM.

10



ROSTRATED OPHEDIUM.

their middle or central part: the colour of the body is a subargenteous white, with a dusky cast above, reddish beneath, and spotted all over with small, oblong, dusky specks. It is commonly found of the length of eight or nine inches, and sometimes twelve or fourteen, and is met with in all parts of the Mediterranean sea, and in great plenty in the Adriatic. It is often taken by nets in Provence and Languedoc with other kinds of fish, and is most common during the summer season. It is not considered as an elegant fish for the table, the flesh being rather coarse. It feeds on small fishes, crabs, &c. &c:

In the Philosophical Transactions \* we meet with some accurate observations on this fish by the ingenious Dr. Broussonet, who has considerably advanced the science of Ichthyology. The first author, according to Dr. Broussonet, to whom we are indebted for a description and figure of the Ophidium barbatum, is Bellonius, who seems to have been doubtful to what class to refer it, but has placed it among the Gadi, though of a very different family. Rondeletius, who wrote soon after Belon, has given a better description and a more accurate figure, though the cirri are very ill represented, and the whole fish appears without any spots, whereas in the Rondeletian representation it is spotted all over; and this difference caused Gesner and some others to consider the Belonian and Rondeletian animals as distinct species. Willoughby

has described the scales, which are oblong, distinct, and disposed without regular order, and the difference between the figures of Rondeletius and Bellonius arises from the former having expressed the scales, which are omitted by the latter: yet Ray in his Synopsis follows Gesner in supposing two distinct species. Artedi has not noticed the spots, which, however, have been observed by Klein, who has mistakenly followed Rondeletius, in affirming that the fish has two cirri, while, on the contrary, Willoughby asserts that there are four; but it is easy to reconcile these descriptions, since though the cirri are only two, yet each being divided, they appear to be four.

#### BEARDLESS OPHIDIUM.

Ophidium Imberbe. O. maxillis imberbibus, cauda obtusiuscula. Lin. Syst. Nat. p. 431.

Ophidium with beardless jaws and rather obtuse tail.

Ophidion cirris carens. Artedi gen. 24. Syn. 42. Gronov. Zooph. 1. p. 131.

This species seems to be much allied to the former, but is described as altogether destitute of cirri or beards: the body is oblong and slender, gradually decreasing in thickness to the tail, and covered with very small pellucid scales: the head is short, a little flattened, very thick and rounded at the muzzle: the mouth large; the teeth numerous, sharp, and small, as in the former: the upper jaw rather longer than the lower: the gill-covers short, and ending on the upper part in an angular manner, with a strong and sharp point lying over the valve: the gill-membrane furnished with seven rays: eyes large; irides broad and silvery: lateral line near the back: vent situated almost in the middle of the abdomen: scales on the body and gill-covers very small: dorsal, caudal, and anal fins united: dorsal beginning at a little distance beyond the head: tail sharp: vent-fin of equal length with the dorsal: pectoral fins rather large, and of a lanceolate shape. Native of the Mediterranean.

Ophidium Mastacembalus. O. maxillis subacutis æqualibus.
Ophidium with sharpish-pointed equal jaws.
Mastacembalus maxillis subacutis æqualibus. Gron. Zooph. 1.
p. 132. t. 8. a. f. 1.
Mastacembalus. Russel Alepp. ed. 2. Vol. 2. p. 208. pl. 6.

The first description of this species seems to have been given by Dr. Alexander Russel, in his Natural History of Aleppo. It has so much the general appearance of an eel, that, according to Dr. Russel, it is considered as such by the Europeans resident at Aleppo, where it is often brought to table, and eats like an eel, though somewhat less fat. Its usual length is from a foot to eighteen inches or more: the head is oblong, subcylindric, narrower than the body, and contracted into a subacuminate snout in front: the eyes are small, situated on each side at no great distance from the tip of the snout:

the nostrils are seated at some distance before the eyes: the mouth is small; the jaws are equal, with lax, fleshy lips: the teeth of moderate size, and somewhat confusedly placed in both jaws: the tongue and palate are smooth: the gill-covers smooth, the branchial apertures opening widely beneath: the gill-membrane five-rayed: the body anguilliform, and marked down the back, as far as the beginning of the dorsal fin, by a row of about thirty-two small, sharp spines, set at equal distances, and each recumbent in a small furrow, from which it is erigible at the pleasure of the animal: the dorsal fin commences at about two thirds of the length of the body from the head, is of moderate width, and is continued into the tail and vent-fin in the manner of those of an eel; the vent-fin running beneath to about the same distance with the dorsal above: at the origin of the vent-fin are two strong, short spines, and at a little distance farther on the abdomen is a third: the pectoral fins are very small and rounded: the lateral line is pretty strongly marked, and runs from the top of the gills along the middle of the body to the tail: the whole body is covered with small scales, like those of an eel: the colour on the upper parts is a clouded variegation of whitish and rufous, the under parts being entirely white: it is principally taken in the river Kowick near Aleppo.

## ROSTRATED OPHIDIUM.

Ophidium Rostratum O, rostro acuminato longissimo.
Ophidium with extremely long sharp-pointed snout.
Ophidium aculeatum. O. rostro acuminato. Lin. Syst. Nat.
Gmel., p. 1147.
Ophidium rostratum. Block. 5. p. 60. t. 159. f. 2.
Pentopthalmos. Will. Ichth. Append. t. 10. f. 1.

This species is much allied to the O. Mastacembalus, having a series of dorsal spines, and two or three immediately before the vent-fin. It is readily distinguished by the very great elongation of the upper lip, which terminates in a very sharp, slender snout: the head is small, and the body very long, and somewhat compressed: the gill-covers large, and the gill membrane lax: the lateral line is placed near the back: the dorsal fin commences at no great distance from the tail, but is not united with it as in the former species: the vent-fin is about the same length, and is situated in a correspondent manner beneath: the tail, which is distinct from both, is of an ovate form, and rather small: the pectoral fins are of moderate size, and of an oval shape: the number of dorsal spines is fourteen, and of those before the vent-fin two: the colour of this fish is rufous brown above, silvery on the sides and beneath: the dorsal fin is variegated with oblique dusky streaks, and is marked with from two to five round, black spots, each surrounded by a pale yellowish circle.

#### ODONTOGNATHUS. ODONTOGNATHUS.

## Generic Character:

Lamina longa, denticulata, | Mouth furnished with mobilis utrinque maxillæ superiori adnata.

Membr. branch. radiis quinque.

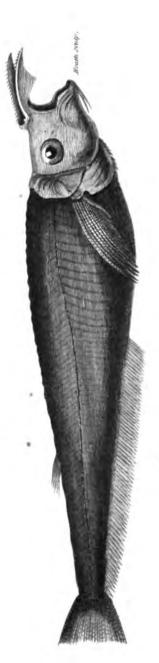
strong, moveable lamina or process on each side the upper jaw.

Gill-membrane five-rayed.

#### ACULEATED ODONTOGNATHUS.

Odontognathus abdomine aculeato. Odontognathus with aculeated abdomen. L'Odontognathe aiguillonné. Cepede pisc. 2. p. 222.

THE genus Odontognathus, instituted by Cepede. consists of a single species, of which the following is the description. The head, body, and tail are very compressed: the lower jaw, which is longer than the upper, is very much elevated towards the other when the mouth is closed, insomuch as to appear almost vertical, and is lowered somewhat in the manner of a drawbridge when the mouth is opened, when it appears like a small scaly boat, very transparent, furrrowed beneath, and finely denticulated on the margins: this lower jaw, in the act of depression, draws forwards two flat, irregular laminæ of a scaly substance, a little bent at their posterior end, and



ACTLEATED ODONTOGNATHUS

larger at their origin than at their tips, denticulated on their anterior margin, and attached, one on one side, and the other on the opposite, to the most prominent part of the upper jaw: when the mouth is closed again, these pieces apply themselves on each side to one of the opercula, of which they represent the exterior denticulated border: in the middle of these jaws is placed the tongue, which is pointed and free in its movements: the gill-covers, which are composed of several pieces, are very transparent at the hind part, but scaly and of a bright silver-colour in front: the gill membrane is also silvery, and has five rays: the breast is terminated below by a sharp carina furnished with eight crooked spines: the carina of the belly is also furnished with twenty-eight spines, disposed in two longitudinal ranges: the anal fin is very long, and extends almost as far as the base of the tail-fin, which is of a forked shape: the dorsal fin is placed on the tail, properly speaking, at about three quarters of the whole length of the animal, but it is extremely small. The general length of this fish is three decimetres, and its colour, so far as may be conjectured from specimens preserved for some time in spirits, is a bright silver. It is a native of the American seas, and is common about the coasts of Cayenne, where it ranks in the number of edible fishes.

## COMEPHORUS. COMEPHORUS.

## Generic Character.

Cuput grande, rostro de presso.

Os amplum, dentibus minutis.

Corpus elongatum, compressum.

Pinna dorsalis secunda radiis pluribus nudis elongatis.

Head large, with depressed snout.

Mouth large, with small teeth.

Body elongated, compressed: the second dorsal fin furnished with several long naked rays.

#### BAIKAL COMEPHORUS.

Comephorus Baikalensis. C. pinna dorsali prima minima, secunda radiis cirrhiferis.

Comephorus with the first dorsal fin very small, the second with many naked cirrhiform rays.

Callyonimus Baikalensis. C. pinnis ventralibus nullis, dorsali prima minima, secunda radiis cirrhiferis. Lin. Syst. Nat. Gmel. p. 1153. Pall. it. 3. p. 707.

THIS fish, arranged under the above-named genus by Cepede, was by Pallas described as a species of Callionymus, and referred somewhat improperly to the Jugular Fishes. Its length is about a span; its shape slender, compressed, and gradually decreasing to the tail: its flesh very soft, and oily: the head large, and the mouth wide: the eyes large and black: the gill-membrane lax, with very remote

reaching half down the body, and furnished with very slender, stiff rays: the first dorsal fin is very small; the second larger, and furnished with fifteen elongated bristle-like rays stretching beyond the membrane: tail bilobate, of a stronger nature than the fins: lateral line nearer the back than the belly. Native of the lake Baikal, where it was discovered by Dr. Pallas. From its conformation it appears to be capable of swimming swiftly, and, perhaps, of occasionally springing out of the water somewhat in the manner of a flying-fish.

## TRIURUS. TRIPLE-TAIL.

## Generic Character.

Rostrum cylindricum.

Dens unicus in utraque maxilla.

Pinna dorsi anique ultra caudam extensa,

Snout cylindric.

Tooth single in each jaw.

Fin dorsal and anal extended beyond the tail.

#### COMMERSONIAN TRIPLE-TAIL.

Triurus Commersonii. T. orificio operculorum valvula clausili.

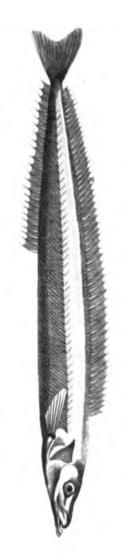
Triple-tail with the branchial orifice closed at pleasure by a valve.

Le Triure Bougainvillien. Cepede pisc. 1. p. 201.

THE genus Triurus is instituted by Cepede from a remarkable fish discovered by Commerson in the Indian seas, and of which the following is the description. Its general appearance and size is that of a herring: the body is much compressed, and covered with scales, so small and deeply scated, that, at first sight, the animal appears destitute of any: the head, which is compressed as well as the body, and a little flattened above, is terminated by a very lengthened snout in form of a strait tube, at the end of which is a round hole by way of mouth, and which the fish has no power of closing: in the bottom of this tube are the two bony jaws, each composed

of a single incisive and triangular tooth, no others . being observable either on the palate or tongue; which latter is very short, cartilaginous, but rather fleshy at the tip, which is rounded: the nostrils are very small, and placed nearer to the eyes than to the tip of the snout: the eyes are moderately large, slightly convex, not covered by the common skin. as in the Gymnotes and some other apodal fishes, and the irides are of a bright gold and silver colour: the gill-covers are situated beneath the skin, and are each composed of an osscous lamina in form of a sickle: the gill-membrane is five-rayed, and is attached to the head or body round its whole contour, in such a manner as to leave but a small orifice just beyond the snout; in which respect it appears analogous to the Syngnathi or Sea-Needles, as well as to the Callyonimi and some other fishes; but what renders the Triurus most remarkable is, a particularity of which we find no example in the whole class of Pisces: this consists in a soft, fleshy, lunated valvule, attached to the anterior edge of the branchial orifice, which it closes at the pleasure of the animal, by applying itself to the posterior edge: the body is not marked by any lateral line; the belly is terminated beneath by a sharp keel almost throughout its whole length, and the vent is situated at the extremity of the abdomen: the pectoral fins are small, delicate, transparent, of an almost triangular form when expanded, and have twelve or thirteen rays: the vent-fin has fifteen soft rays, and is directed backwards, its sharp end stretching almost as far as the posterior edge of the tail-fin, of

which it represents a continuation or appendix, and even seems to form a part: the dorsal fin is in the same manner a kind of auxiliary to the tailfin: 'it is formed of an equal number of rays with the vent-fin, but is situated at a greater distance from the head, and is a third part longer, stretching backwards, not only as far as the tail, but beyoud it; and as these two fins, viz. the dorsal and anal, reach that of the tail, it follows that the latter, at first view, appears as if composed of three distinet parts, and hence the name of Triurus, or Triple-Tail, applied to this fish by Commerson. In the mean time the real tail is so short that it appears more like a defective than a finished part, and is fringed at the edge by the terminations of the numerous, soft, divided rays of which it is composed. The colour of this fish is a brownish red, changing into silvery beneath the head, and into flesh-colour on the sides, belly, and tail, while a spot of clear white appears beyond the base of the pectoral fins. This curious genus was discovered by Commerson in the stomach of a species of Scomber; five individuals, perfectly uninjured by the action of the stomach, being taken out: several others were afterwards observed sporting on the surface of the sea. In some points this fish seems to bear a near alliance to the genus Centriscus.



AND LAUNCE

# AMMODYTES. LAUNCE.

# Generic Character.

Caput compressum, corpore angustius: labium superius duplicatum: mandibula inferior angusta acuminata: dentes acerosi.

Membrana branchiostega radiis septem.

Corpus teretiusculum squamis vix conspicuis: cauda distincta. Head compressed, narrower than the body: upper lip doubled: lower jaw narrow, pointed: teeth small and sharp.

Gill-membrane seven-rayed.

Body long, roundish, with very small scales: tail distinct.

#### SAND LAUNCE.

Ammodytes Tobianus. A. maxilla inferiore longiore.
Launce with the lower jaw longer than the upper.
Ammodytes Tobianus. Lin. Syst. Nat. p. 430.
Ammodytes Gesneri. Sand-Eel, Will. ichth. p. 113.
Sand Launce. Penn. Brit. Zool. 3. p. 137. pl: 25.

THE Launce, so named from its shape, is a native of the northern parts of Europe, commonly frequenting the coasts, and lying imbedded in the sand, in which it conceals itself at the depth of about a foot, with its body rolled into a spiral form. In this situation it is either dug out, or drawn up by means of a hook contrived for that purpose,

and used by the fishermen as a bait: it is also considered as a delicate article of food. The general length of the Launce is from eight to ten mehes: its form slightly square, being rather/rounded on the sides, and somewhat flattened above and beneath: the head is small and taper, and the under jaw much longer than the upper: the mouth is destitute of teeth, but at the entrance of the throat are two rough oblong bones for retaining the prey: the openings of the gills are large, and the opercula consist of four laminæ: the nostrils are double, and placed midway between the eyes and the mouth: along the back runs a furrow, capable of receiving the dorsal fin: the lateral line is strait, running along the middle of the body, and besides this there is another near the back, and a third near the belly: the dorsal fin runs almost the whole length of the back, and is very narrow, and furnished with soft rays; the pectoral fins are small; the anal fin runs from the vent to the tail, and is narrow like that of the back: the tail is slightly forked, but the lobes rounded at their extremities: the general colour of the body is blue or greenish towards the back, and the sides and belly silvery, but sometimes of a yellowish cast, and over the whole fish are commonly seen numerous oblique fibres or markings on the surface of the skin. The Launce lives on worms, water-insects, and small fishes, and even occasionally on those of its own species, since Dr. Bloch informs us, that on opening two individuals, he found a young one of about two inches long in the stomach of each. It is itself preyed upon by the

larger fishes, and particularly by the Mackarel. The Launce spawns in the month of May, depositing it each in the mud, near the edges of the coast. It is remarkable that most of the older ichthyologists describe this fish as without scales, their small size apparently causing them to be overlooked. The swimming bladder is wanting, so that the animal is calculated only for a littoral residence.

## LEPTOCEPHALUS. MORRIS.

## Generic Character.

Caput parvum, angustum.
Corpus tenuissimum, compressum.
Pinnæ pectorales nullæ.

Head small, narrow.

Body very thin, compressed.

Pectoral fins none.

#### ANGLESEA MORRIS.

Leptocephalus Morrisii. L. corpore tenuissimo.

Leptocephalus. Gronov. Zoophyl. No. 409. t. 13. f. 3. Anglesea Morris. Penn. Brit. Zool. 3. p. 139. pl. 25.

It was in the British Zoology of Mr. Pennant that this small fish, the only one of its genus yet observed, made its first public appearance under the name of the Morris, having been first discovered on the coast of Anglesea by a gentleman of that name. Gronovius, to whom Mr. Pennant had some time before communicated it, distinguishes it by the title of Leptocephalus. The description given by Mr. Pennant is as follows: The length was four inches; the head very small; the body compressed sideways; extremely thin, and almost transparent; about the tenth of an inch thick, and in the deepest part about one third of an inch: towards the tail it grew more slender, and ended in a point: towards



ANGLESEA MORKIS.

the head it sloped down, the head lying far beneath the level of the back: the eyes large; the teeth in both jaws very small: the lateral line strait; the sides marked with oblique strokes that met at the lateral edge: the aperture to the gills large: it wanted the pectoral, ventral, and caudal fins: the dorsal fin was extremely low and thin, extending the whole length of the back very near the tail: the anal fin was of the same delicacy, and extended to the same distance from the anus.

Gronovius observes, that on account of the extreme tenuity of the body, the joints of the vertebræ appear to project so distinctly along the sides that it might almost pass, on a cursory view, for a species of Tænia or tape-worm: the vertebral joints, in some measure, expressing the papillary foramina on the bodies of those animals.

## STYLEPHORUS. STYLEPHORUS.

## Generic Character.

Oculi pedunculati, seu cylindro crasso brevi impositi.

Rostrum productum, sursum spectans, versus caput membrana interjecta retractile.

Os terminale, edentulum?

Branchiæ trium parium sub
jugulo sitæ.

Pinnæ pectorales parvæ: dorsalis longitudine dorsi: caudalis brevis, radiatospinosa.

Corpus longissimum, compressum. Eyes pedunculated: standing on a short thick cylinder.

Snout lengthened, directed upwards, retractile towards the head by means of a membrane.

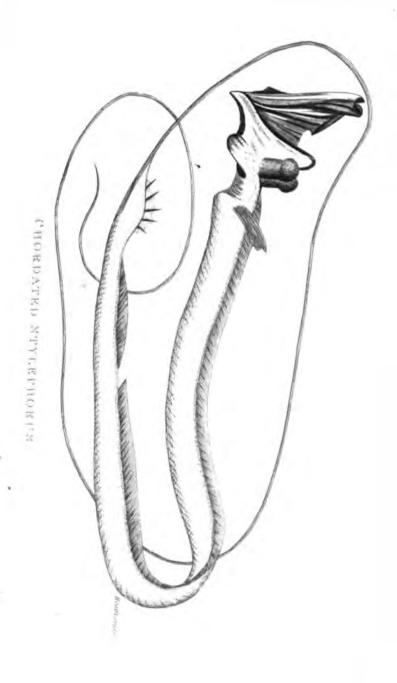
Mouth without teeth?

Branchiæ three pair beneath the throat.

Fins pectoral small: dorsal the length of the back; caudal short, with spiny rays.

Body very long, compressed.

THIS highly singular genus was first described in the year 1788, from a specimen then introduced into the Leverian Museum, and figured in the first volume of the Linnæan Transactions. I shall therefore repeat my former description from the abovementioned work, and have only to add, that the genus still consists of a single species, no other having been yet discovered.



## CHORDATED STYLEPHORUS.

Stylephorus Chordatus. S. argenteus, filo caudali longissimo.
Silvery Stylephorus, with extremely long caudal thread.
Stylephorus chordatus. Lin. Trans. vol. 1. p. 90. pl. 6. Nuturalist's Miscellany, vol. 8. pl. 274.

THE head of this extraordinary animal bears some distant resemblance to that of the genus Syngnathus, and its true structure cannot so easily be described in words as conceived by the figure. The rostrum or narrow part, which is terminated by the mouth, is connected to the back part of the head by a flexible leathery duplicature, which permits it to be either extended in such a manner that the mouth points directly upwards, or to fall back, so as to be received into a sort of case formed by the upper part of the head. On the top of the head are placed the eyes, which are of a form very nearly approaching to those of the genus Cancer, except that the columns or parts on which each eye is placed are much broader or thicker than in that genus: they are also placed close to each other, and the outward surface of the eye, when magnified, does not shew the least appearance of a reticulated struc-The colour of the eyes, as well as of the columns on which they stand, is a clear chesnut brown, with a sort of coppery gloss. Below the head, on each side, is a considerable compressed semicircular space, the fore part of which is bounded by the covering of the gills, which covering seems to consist of a single membrane, of a moderately strong

Beneath this, on each side, are three small The body is extremely long and pair of branchiæ. compressed very much, and gradually diminishes as it approaches the tail, which terminates in a string or process of an enormous length, and finishes in a very fine point. This string, or caudal process, seems to be strengthened throughout its whole length, or at least as far as the eye can trace it, by a sort of double fibre or internal part. The pectoral fins are very small, and situated almost immediately behind the cavity on each side the thorax, The dorsal fin, which is of a thin and soft nature, runs from the head to within about an inch of the tail, when it seems suddenly to terminate, and a bare space is left of about a quarter of an inch. I am, however, not altogether without my doubts whether it might not, in the living animal, have run on quite to the tail, and whether the specimen might not have received some injury in that part. From this place commences a smaller fin which constitutes part of the caudal one. The caudal fin itself is furnished with five remarkable spines, the roots or originations of which may be traced to some depth in the thin part of the tail. The general colour of this fish is a rich silver, except on the flexible part belonging to the rostrum, which is of a deep brown: the fins and caudal process are also brown, but not so deep as the part just mentioned. There is no appearance of scales on this fish. From the very singular figure and situation of the eyes I have given it the generic name of Stylephorus, and as the trivial name cannot be taken from any

circumstance more properly than from the extraordinary thread-like process of the tail, I have applied to it the title of *chordatus*. It is a native of the West-Indian seas, and was taken between Cuba and Martinico, near a small cluster of little islands about nine leagues from shore, where it was observed swimming near the surface. The whole length of this uncommon animal, from the head to the extremity of the caudal process, is about thirty-two inches, of which the process itself measures twentytwo. The plate represents it in its natural size.

## Generic Character.

lateralibus.

Dentes ensiformes, apice semisagittati.

branchiostega Membrana radiis septem.

compresso - ensi-Corpus forme, cauda subulata 'aptera.

Caput porrectum, operculis | Head stretched forwards, with lateral gill-covers.

> Teeth ensiform, semisagittate at the tips.

> Gill-Membrane seven-rayed.

Body ensiform, compressed, with subulate, finless tail.

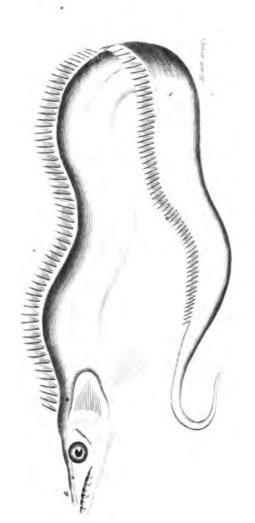
#### SILVER TRICHIURE.

Trichiurus Argenteus. T. argenteus maxilla inferiore longiore. Silvery Trichiure, with the lower jaw longer than the upper. Trichiurus Lepturus. Lin. Syst. Nat. p. 409.

Gymnogaster argenteus compressus, cauda attenuata impinna. Brown Jam. p. 444. t. 45. f. 4.

Trichiurus maxilla inferiore longiore, dentibus magnis. Bloch. ichth. 5. p. 55. t. 158.

I HIS fish is equally distinguished by the singularity of its shape, and brilliancy of its colour: the body is extremely compressed, of a great length, and gradually tapers, as it approaches the extremity. till at length it terminates in a very fine point: the whole fish, except on the fins, is of the brightest silver-colour: the head is narrow; the mouth very



SHATER TRRITING.

wide, the lower jaw longer than the upper, and furnished with differently sized teeth, the longest of which are barbed at the tips by a sharp descending process or hook on one side: the tongue is smooth, longish, and triangular: in the throat are two rough bones: the eyes are vertical, approximated, and large: the lateral line is of a gold-colour, and, commencing behind the gill-covers, is continued to the tip of the tail: the dorsal fin, which is of moderate width, transparent, and of a vellowish tinge, commences almost immediately behind the head, and runs to within a very small distance of the extremity of the tail, at which part it legenerates into a mere membrane, being strongly radiated in other parts: the pectoral fins are rather small, and of an ovate shape: there is, properly speaking, no direct ventfin, but a series of very small naked spines or rays, to the number of about 110, are continued from the vent, which is situated about the middle of the body, to near the tip of the tail. The general length of this fish is from two to three feet: it is said to be of a very voracious nature, swims with rapidity, and in the pursuit of its prey sometimes leaps into small vessels which happen to be sailing by. a native of the rivers and larger lakes of South America, and is considered as an eatable fish. It is also said to be found in some parts of India, and in China.

## ELECTRICAL TRICHIURE.

Trichiurus Electricus. T. fuscus, mandibulis æqualibus.
Brown Trichiure with jaws of equal length.
Trichiurus electricus. T. mandibulis æqualibus. Lin. Syst.
Nat. Gmel. p. 1142.
Anguilla Indica. Will. ichth. append. t 3. f. 3.

This species, which seems nearly equal in size to the preceding, differs not only in the conformation of the jaws, which are both of equal length, but in the form of its teeth, which are all very minute: the tail is not so extremely slender and sharp as in the former, and the colour of the whole animal is pale brown, variegated with spots of a deeper cast. It is a native of the Indian seas, and is said to possess a degree of electrical power.