

THE STORY OF THE DEVIL-FISH¹

BY THEODORE GILL

I

One of the most remarkable of animals is the great Ray, most widely known as Devil-fish, but which bears also several other names.

Devil-fish is a name by no means restricted to any one of the Rays, for it is well known in connection with the gigantic Cuttlefishes and is also used locally in England for the Angler (*Lophius piscatorius*), and in California for the Gray whale (*Rhachianectes glaucus*). Among the Rays the name is applied not only to all of the same family as the great fish, but also, in some places (for instance, North Carolina and the Gulf of Mexico), to species of Eagle-rays. Sea-devil may be considered to be a natural variant of the same name, but it has also been used for the same animals as Devil-fish and even for those of another family, the species of the Sharks known as *Squatina*.

Vampire originated in the form "Oceanic Vampire" as a selective name and was given by Dr. Samuel L. Mitchill, in 1823, as the popular name for his *Cephalopterus vampyrus*. He claimed that "this fish being perhaps the largest of the Rays, as the vampire is of the bats, or vespertilio, the name *vampyrus* may be attached." The name has somehow been taken up and found limited currency in certain localities where the fish abounds. Thus C. F. Holder² has recorded that it is in use in southern Florida. When, during a night on the water about Garden Key, he heard "a rushing, swishing sound; then a clap as of thunder," a negro boatman exclaimed "Vampa fish, sah," and later alluded to it as "Sea Vampa" or collectively as "Vampas."

¹ Every well-known fish student is more or less frequently asked some question or questions about the Devil-fish. Not infrequently the student is at a loss for an answer. The requisite information may have been published, but to obtain it perhaps hundreds of articles may have to be examined. After a search through such articles the present paper has been compiled and will furnish answers to many of the questions that may be propounded. It will at least serve as a basis for investigation and a repertory of what has been ascertained or thought to be facts.

² Big Game at Sea, 1908, pp. 2, 3, 4.

Sea-bat was found by Holder to be in use in the same locality as Vampire. When the negro Paublo exclaimed "Sea Vampa, sure," the Seminole chief in the same boat corroborated his identification rather than contradicted by exclaiming, "Sea-bat. . . . They

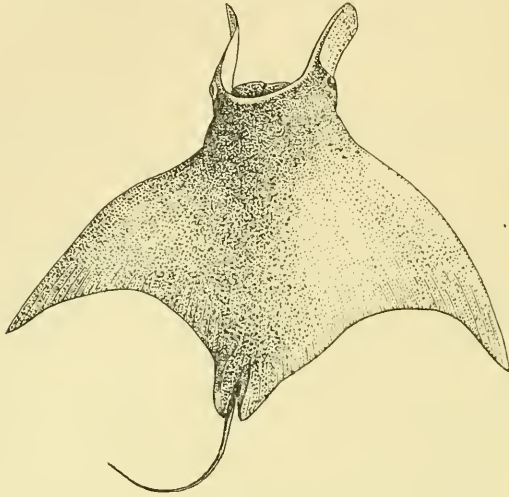


FIG. 40.—The Devil-fish. After a photograph.¹

¹ The iconography of the Devil-fish is very defective and the figures herewith given are merely provisional. The plate first given by Jordan and Evermann (1900), later reproduced by Fowler (1906), Hugh Smith (1907) and others, is quite inaccurate so far as the tail is concerned. Instead of the tail being much longer than the body, as therein represented, it is only about 6/10 as long. Elliott (p. 101) especially criticized De Kay's "characteristic, viz., tail longer than the body," and affirmed "that the length of the tail is, to that of the body, as six to ten." He had examined "almost twenty individuals." The illustration cited was drawn in Dec., 1894, but the present writer was long unable to learn what was the basis of the figure. He finally traced it to De Kay, who published a composite figure based on Mitchill's and Lesueur's plates. There is no specimen of the Devil-fish in the National Museum. The figures here presented are (1) the old one with the tail modified to suit photographs and Elliott's description; (2) one drawn after the former outline with the under surface represented from a photographic illustration in Holder's work, and (3) a reproduction of a photograph of a fish caught in 1869 or 1870, during a cruise in the Pacific of a revenue cutter (Captain Freeman commanding). The last was taken while the fish was suspended from a tripod and the drooping fins may have been partly at least due to the suspension. That fish was about 13 feet wide. The photograph is very obscure behind and the reproduction consequently is unreliable, as are the other figures. Seven photographs or reproductions are at hand, but all are too obscure behind for guidance. A good one is extremely desirable as are also exact data as to relative proportions and weight. All published are deficient. A special article on the subject will follow.

jump five—yes, eight—feet high.” Bat-fish and Black-bat are sometimes used variants.

Another name for the monster Ray has been borrowed from the Spanish. Among the fishermen, and especially the pearl divers of Central America and western Mexico, it is known as the Manta; this is a Spanish term, meaning originally blanket, and was given by the fishermen of parts of Spain and the island of Mallorca to a species of the Mediterranean¹ and extended thence to similar fishes of other regions. It has been explained that the name was given by the Spaniards of America to the Devil-fish because it was alleged to hover over and cover a fisherman at the bottom as a blanket preparatory to killing him for good. The belief, indeed, that the Devil-fish may so attack a man is not only widely spread, but of an ancient origin.

Such an idea, however, is contrary to our knowledge of the fish. Like several other of the gigantic selachians,² its diet is in almost inverse ratio to its size.

Inasmuch as Devil-fish is the best known of all these names and has been long current in story as well as in works on natural history, it will be retained here and will be used for the great fish best known as such, as well as for its congeners of smaller size. The species especially called Devil-fish is one of a number having the same essential characters and all designated in a general way as Devil-fishes.

II

The form of the Devil-fishes is extraordinary; the body, exclusive of the tail, is about twice as wide as long; the tail, however, corresponds to the hind part of the body in distant relations of the Devil-fish. Different as the animal is from Sharks generally, there is or has been every gradation from an ordinary Shark to the Devil-fish.

¹ The Manta of Mallorca, or Majorca, is the *Mobula giorna*, and is the Vacca or Vaca (Cow) with various qualifications of some other localities in the Mediterranean. It is also the Bous of Aristotle. The names Vacca and Bous allude to the horn-like caropteres or head-fins. The species is said sometimes to reach a width of 28 feet. Carus, in his *Prodromus Faunæ Mediterraneæ* (II, 1893, p. 520), specifies “Longit. 1.5-3 m.” Pellegrin in 1901 (*Bull. Mus. Hist. Nat.*, VII, 327) noticed one 5m. 20 wide, and 4m. 15 long. There is record of one 28 feet wide and 21 feet long and “estimated to weigh a ton” (*Zoöl.*, 1899, p. 146). The data are insufficient and a fish of the dimensions noted must have weighed very much more than a ton.

² The gigantic Basking Shark (*Cetorhinus maximus*) and the still larger Rhinodon (*Rhineodon typus*) of the Indian Ocean subsist mainly on the minute crustaceans and other animals living near the surface of the ocean.

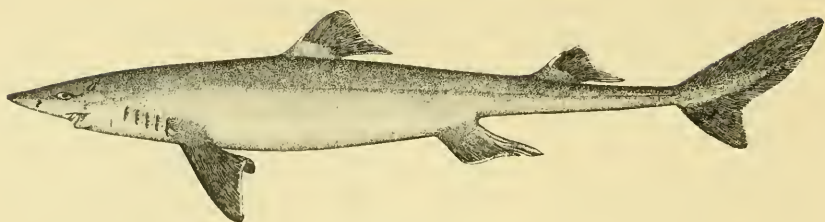


FIG. 41.

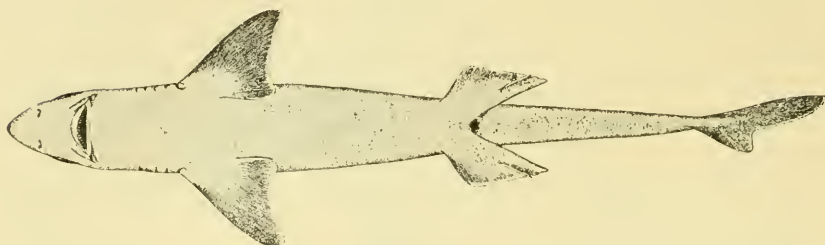


FIG. 42.

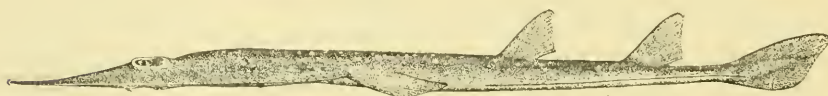


FIG. 43.

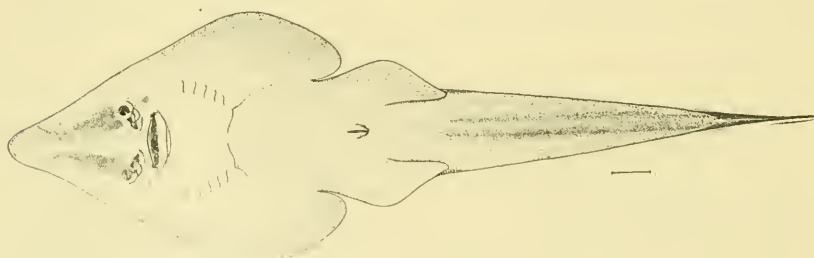


FIG. 44.

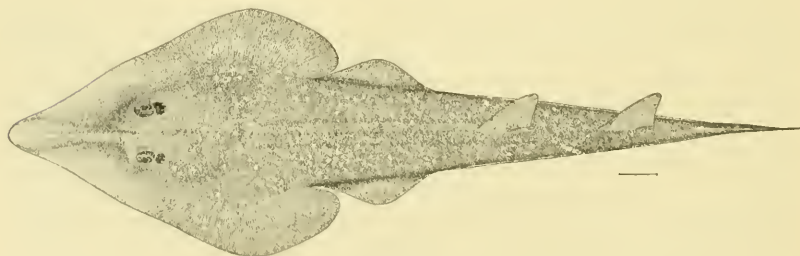


FIG. 45.

FIGS. 41 AND 42.—*Squalus acanthias*. FIGS. 43 TO 45.—*Rhinochimaera lentiginosa*.

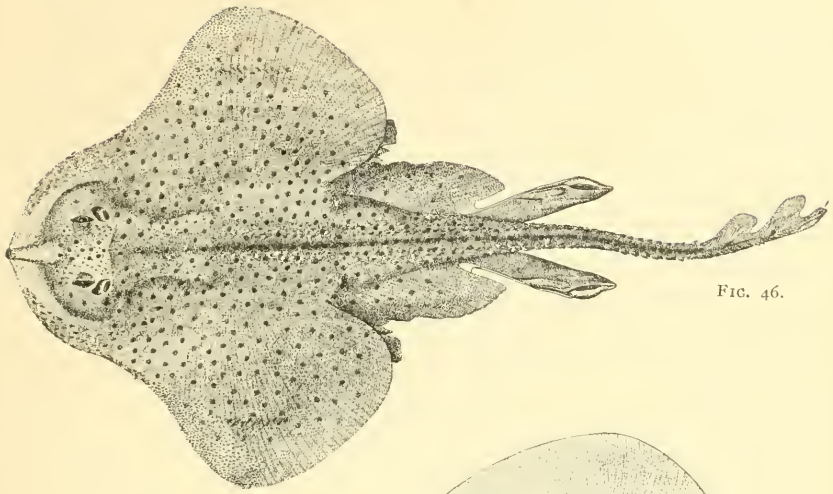


FIG. 46.

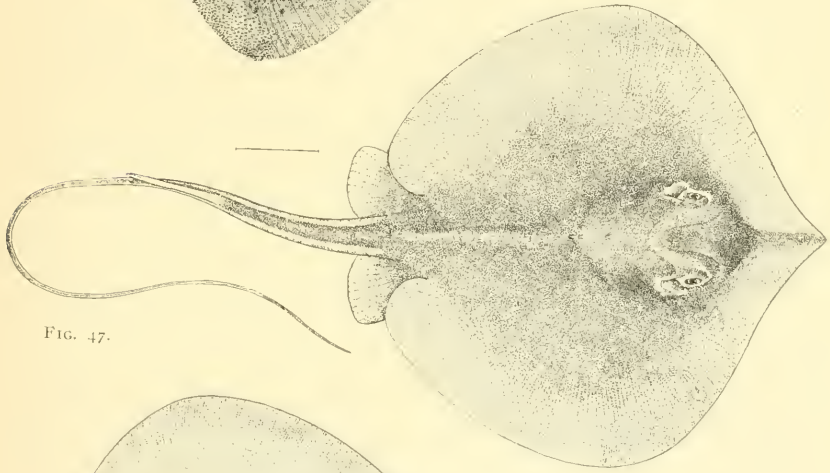


FIG. 47.

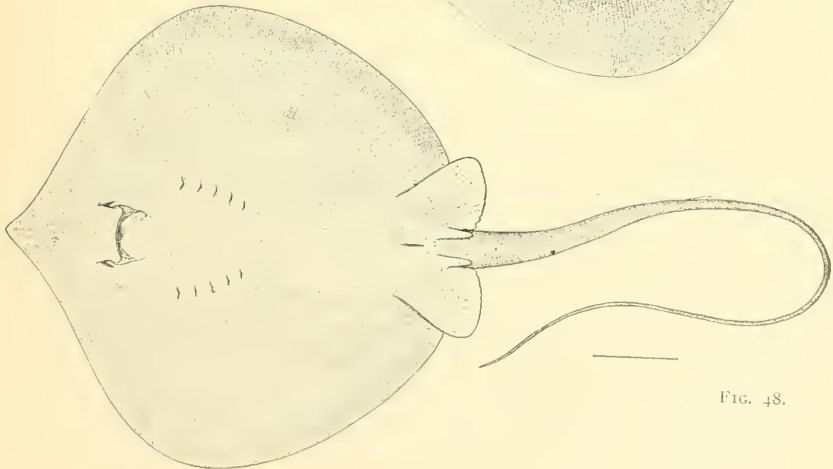


FIG. 48.

FIG. 46.—*Raja erinacca*. FIGS. 47 AND 48.—*Dasybatis sabina*.

A few forms still living exemplify the manner in which the extreme modification of the last has been attained; these forms, it is true, are not in the direct line of descent, but they are not very far off. The common Dog-fish of the New England coast (*Squalus acanthias*) has a slender tail, but there is a regular gradation from the preanal region, or trunk, into the postanal, or tail, and the pectorals have the slender bases characteristic of the Sharks generally. The Guitar-fishes (*Rhinobatidæ*) still have the regular gradation of the trunk into the tail, but the pectorals have a broad basis of union with the body and head, and a narrow disk is thus formed. In the ordinary rays (*Raiidæ*) the tail has become disproportionately slender and the disk wider and more sharply differentiated; in the Sting-rays (*Dasybatidæ*) the tail has almost entirely lost its muscular development, but the disk is much like that of an ordinary ray. The tail of the Sting ray is essentially like that of the Devil-fish, but in the Devil-fish the disk has become extended sideways into acutely angulated and wing-like fins. The homologies of the respective parts are thus evident. In the course of evolution, more and more resort has been had to the pectoral fins for progression and the tail correspondingly disused; the culmination has been reached in the Devil-fishes, which progress by wing-like flapping of their pectorals and the tail is carried inert behind.

The transformation of shark-like forms into the ray-like type must have commenced early in Mesozoic times, for well-developed representatives of the Dasybatids and Myliobatids were living in the Cretaceous epoch and were abundant in the Eocene. It has been believed that no fossil remains of Devil-fishes have been found, or rather identified. If this had been a fact, it might have been partly explained by the pelagic habitat of the species and partly by the reduction of teeth and spines, the parts most likely to be preserved. There is, indeed, one record of an extinct form which, however, only takes us one stage back in the geological series. The record is of a supracaudal tubercle from the "phosphate beds" of South Carolina, which are supposed to be of post-Pliocene age; the tubercle has been considered by Joseph Leidy to represent an extinct species closely related to the living Devil-fish of the same State and has received from him the name *Ceratoptera unios*; it was described and figured in 1877 in the Journal of the Academy of Natural Sciences of Philadelphia (2nd ser., VIII, 248-9, pl. 34, figs. 1, 2).

The individual development of the fishes is to a large extent parallel with the evolution of the type from the shark-like form to the ray-like one.

The Devil-fishes form a family of ray-like Selachians to which the

names *Cephalopteridæ*, *Pteroccephalidæ*, *Mobulidæ*, and *Mantidæ* have been given. *Mantidæ* is that used for it by most recent Ameri-

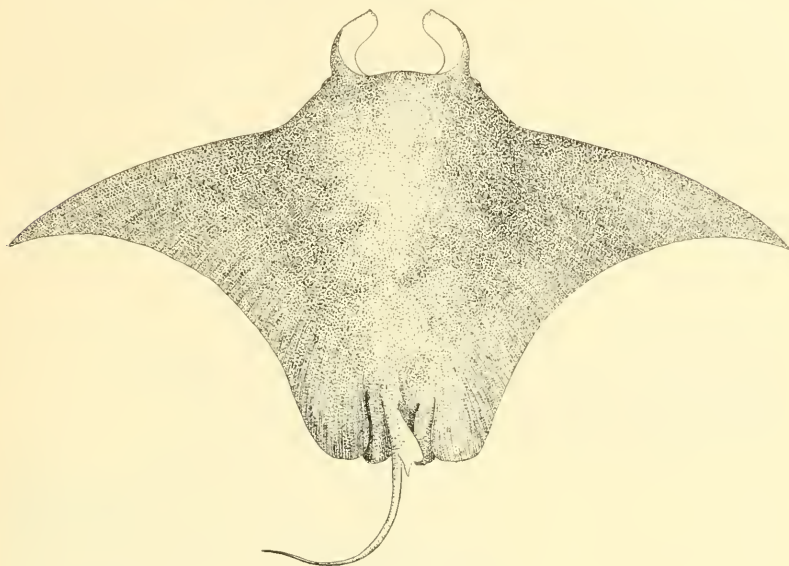


FIG. 49.

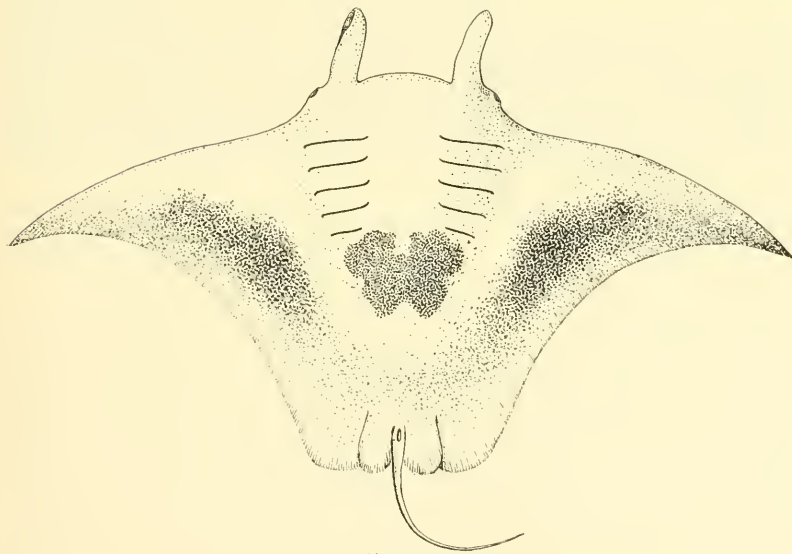


FIG. 50.

FIGS. 49 AND 50.—The Devil-fish. After Jordan and Evermann.
(With reduced tail.)

can ichthyologists, as Jordan and Evermann, but it had been previously taken for a family of insects. *Mobulidæ* may be used here. The essential external characters of the family follow:

MOBULIDÆ

The Mobulids or Devil-fishes include the largest as well as the widest of rays. Behind the anus the tail is abruptly attenuated and developed as a whip-like appendage without efficient spines. The mouth, instead of being inferior, as in other types, is in front, and the jaws have weak teeth or are partially toothless. The pectoral fins are extended outward in a wing-like manner, and long, flexible, horn-like processes or fins are developed on each side of the head and bound a preoral space. These processes (caropteres, head-fins, or horns) can be used for grasping, and a number of cases have been

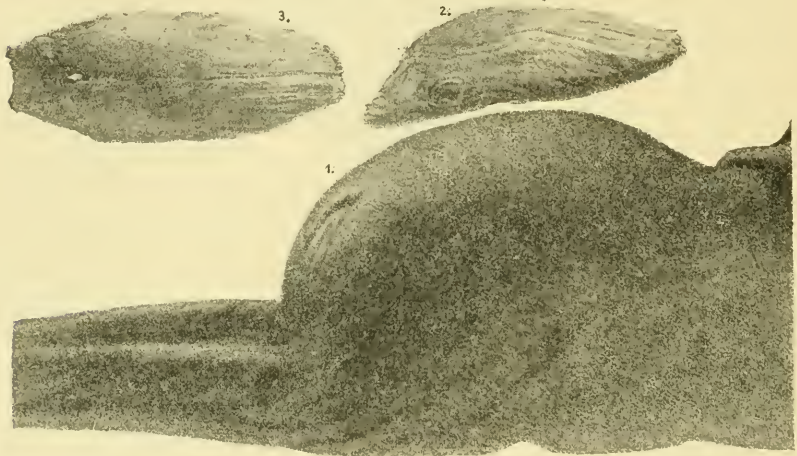


FIG. 51.—Tail of the Devil-fish. After Holmes. (Proceedings Elliott Society of Natural History, I, pl. 3.) About half natural size. 1. Knob and base of tail. 2. Bone with the small spine as extracted from the knob. 3. Upper view of the same with the posterior spinelet (in white).

recorded of a Devil-fish seizing the anchor of a vessel and running away with both anchor and vessel for some distance, to the wonder and fear of the sailors. The spines about the base of the whip-like tail, characteristic of the nearest relations of the Devil-fishes, the Sting-rays and Eagle-rays, are reduced in size and sometimes to a minimum in the Devil-fishes. In the typical species the spine is quite rudimentary and concealed in a subosseous swelling at the base of the tail behind the small dorsal fin.

Further, the Devil-fishes are peculiar in the possession of pre-branchial organs, to be noticed later.

III

The Devil-fishes are inhabitants of warm-water seas. They are to some extent pelagic, though, as a rule, they appear not to extend far out into the high seas. They belong to the category of tropicopolitan forms, some one or other species occurring in every tropical and every subtropical sea. Besides, some may venture far beyond the limits of the Tropic of Cancer or of Capricorn, one wandering occasionally as far as New York and another into the Mediterranean Sea.

If we may also believe Turner-Turner, "a characteristic pose is that of lying motionless, or at most with its disk slightly undulating with respiration, in the sand just under the water. Sometimes, indeed, they are found a yard or so above low-water mark, in pits of their own making." This observation needs confirmation for Devil-fishes, although applicable to Sting-rays. But certainly they require to rest on the ground, and sometimes, when harpooned, they descend and (to use a term of the angler) sulk on the bottom. Elliott remarks that at times one "plunges desperately for the bottom, to which he sometimes clings for hours." But they are best known as active—and very active—frequenter of the surface waters.

Another characteristic of a Devil-fish's action is a tendency to turn somersaults. According to Elliott,¹ "It is a very curious exhibition. You first see the feelers thrown out of the water; then the white stomach, marked with five gills, or branchial apertures, on each side (for the fish is on his back); then his tail emerges. After a disappearance for a few seconds, the revolution is repeated, sometimes as often as six times. It happens occasionally that in making these somersets the fish does not rise quite to the surface, but is several feet below; so that his revolutions are detected by the appearance and disappearance of the white or under part of his body, dimly seen through the turbid water in which he delights. Sometimes, indeed, he is unseen; but his presence is shown to the observant sportsman by the boiling of the water from below, as from a great caldron. With no better guide than this, the harpoon has been darted down, and reached him when twelve feet below the surface."

These somersaults (or somersets as Elliott² calls them) are often made by the fishes when leaping out of the water. Elliott especially noticed a number in 1846 (July 1st) at four o'clock in the afternoon near Hilton Head (S. C.): "They did not show themselves *somer-*

¹ Op. cit., p. 75.

² Op. cit., p. 85.

setting for some time, but after a while began to sport and throw somersets under the water, but so near to the surface as to show their bellies in the evolution. We saw, I do not doubt, as many as twenty fish. We counted eleven that leaped entirely out of the water. They were in the channel, and were further from shore than where we had usually met with them; and, on approaching near to them in our boat, we remarked that those which leaped entirely out of the water did not again show themselves on the surface until they had silently gone a mile or so toward the sea, when they reappeared, gambolled awhile, threw new somersets, and again disappeared for a new seaward movement. The fish which were behind came along sporting until they had reached the spot where the first had thrown their somersets. They, too, then threw their somersets, and disappeared like the first. Usually they leaped twice—leaping from their backs, and falling likewise on their backs; leaping, I should say, at least ten feet above the water.”

The appearance and evolutions of the Devil-fish are indeed impressive and startling. Holder¹ thought that “no more diabolical creature could be imagined. They resembled enormous bats, and in following one another around the circle raised the outer tip of the long wing-like fin high out of the water in a graceful curve, the other being deeply submerged.” They might be seen, “now gliding down with flying motion of the wings; sweeping, gyrating upward with a twisting vertical motion marvelous in its perfect grace; now they flashed white, again black, so that one would say they were rolling over and over, turning somersaults, were it possible for so large a fish to accomplish the feat.” Such evolutions, Holder learned, were “really a common practice of the big rays.” But it is the great leaps out of the water that are most striking, especially during the stillness of the night. Holder,² on such an occasion on the outer Florida reef, first encountered the fish. “There came out of the darkness, near at hand, a rushing, swishing noise; then a clap as of thunder, which seemed to go roaring and reverberating away over the reef, like the discharge of a cannon. So startling was the sound, so peculiar, that the negroes stopped rowing, and one or two dropped their oars in consternation.”

¹ Op. cit., p. 8.

² Op. cit., p. 2.

IV

In some warm sea a fortunate observer may find perhaps a Devil-fish or a couple swimming on or near the surface; not rarely a school, or "shoal," of them. (Shoal is the word used by the Hon. William Elliott in his earliest full treatise on them as subjects of sport.¹) Frequently they project themselves in the air to a considerable height and for some distance. Their progression indeed is rather of the nature of flight than swimming, and has been likened to "the flight of a bird of prey"; it is by flaps of the wing-like pectoral fins and not at all by the tail, as in Sharks and fishes generally.



FIG. 52.—Eagle-rays in motion. After Mangelsdorff. (*Natur und Haus*, 8, 1900, p. 255.)

In fact, the progression of the Devil-fishes is quite similar to that of their near relatives, the Eagle-rays, which have been portrayed from life by Mangelsdorff. Meanwhile, according to Holder, their caropteres, or head-fins, otherwise called arms, feelers, claspers, or horns, are "in constant motion, being whirled about like the tentacles of a squid."

Mr. Hector von Beyer, of the U. S. Bureau of Fisheries, informed Dr. Hugh Smith² that he had "observed the animal in the Gulf of

¹ *Carolina Sports by land and water, including incidents of Devil-fishing, [etc.]*. Charleston, 1846. (2d edition, N. Y., 1850; 3d edition, N. Y., 1859.)

² *The Fishes of North Carolina*, 1907, p. 48.

California" and noticed that "each of these appendages may be curved on itself like an elephant's trunk, and can firmly grasp objects within reach." According to Elliott,¹ "It is the habit of this fish to ply these arms rapidly before its mouth while it swims, and to clasp with the utmost closeness and obstinacy whatever body it has once inclosed. In this way, the boats of fishermen have often been dragged from their moorings and upset by the Devil-fish having laid hold of the grapnel."

That these "arms" are muscular and powerful has been demonstrated on many occasions. The natural movement of the head-fins or caropteres is inward, and when any object strikes between them it is instinctively held, a proceeding which explains the undoubted fact that these fishes can run away with quite large vessels. Many such cases of towing vessels have been recorded.

One of the characteristics for which the Devil-fishes are celebrated is the capture of vessels and carrying them off far from their moorings. In one of the earliest notices of the Devil-fish, by John Lawson in "The History of Carolina" (1714), this peculiarity is described. "The Devil-fish," he says, "has been known to weigh a ship's anchor, and run with the vessel a league or two, and bring her back, against tide, to almost the same place." Later notices do not give the animal credit for the same accommodating treatment! A number of accounts, however, corroborate the tendency indicated. William Elliott noticed several instances, and, in later times, Holder (p. 18) records that "at least instances of this were heard of on the reef occurring from Tampa Bay to Garden Key." He adds: "In every case the vessels, always at anchor, suddenly moved off in a mysterious manner and were towed greater or less distances. The Ray had collided with the chain, and, true to its instincts, threw its two tentacular feelers or claspers around it and rushed ahead, thus lifting the anchor."

In accordance, too, with this proclivity to seize upon objects which bar their progress, Devil-fishes have been charged with damage and destruction to wharves which extend into the water. "It was in obeying this peculiarity of their nature that a shoal of these fish, as they swept by in front of 'Elliott's' grandfather's residence, would sometimes, at floodtide, approach so near to the shore as to come in contact with the water fence, the firm posts of which they would clasp and struggle to uptear, till they lashed the water into a foam with their powerful wings."² Any such action, however, would be entirely exceptional and the statement requires authentication.

¹ Op. cit., p. 16.

² Op. cit., p. 16.

V

The food of the Devil-fishes, so far from being large animals and occasionally a man or so, as has been alleged, appears to be chiefly the small crustaceans and young or small fishes which swarm in certain places near the surface of the water. Rarely does one prey on large fishes. Once only did the man who had the most experience with the fish (Hon. William Elliott) see evidence of disposition to resort to scaly fish; he gives this testimony:¹ "I have frequently examined the contents of their stomachs, and found little else in them than portions of shell-fish, highly triturated, resembling the shells of shrimps. Once a small crab was found entire; but I sought in vain for the scales of small fish, which I supposed to be their food, partly because the Devil-fish make their appearance in our waters in *May*, before the shrimps are found on our shores, and would thus be anticipating their food—a mistake which fish are not apt to make—and partly because I witnessed a performance on the part of a Devil-fish which could scarcely be referred to anything else but to an occasional indulgence in a fish diet.

"I was watching a Devil-fish, who was playing close to the shore. But in shallow water he is often alarmed by the noise of the oars, and he would not suffer my approach within striking distance. While thus engaged, I observed a shoal of small mullets swimming near the surface, and showing signs of extraordinary agitation, when suddenly the open mouth of the Devil-fish was protruded from below, and the small fry disappeared from view, and were received into it, as into the mouth of an enormous funnel. I do not think it was mere wantonness on the part of the fish, but that he was, on that occasion, indulging a caprice of appetite, and substituting a diet of scaly-fish for his ordinary mess of shrimps."

We have, in this observation, a hint as to the function of the "horns" or head fins; these may not only serve by their extension to partly confine the prey, but they may be actively used to drive or scoop them in. The stories of their grasping intentionally may be received with some skepticism, although they do so accidentally.

It is, indeed, largely by means of the head fins, or caropteres, that the Devil-fishes secure their food. That consists at least in part of crustaceans and other organisms which live about the surface of the seas they frequent. In the Gulf of California, where the Devil-fishes are most numerous, such animalcules are said by one observer to so abound that a thick sheet (*nappe épaisse*) of the organisms is

¹ Op. cit., pp. 84, 85.

formed at the surface of the water. The fishermen in such localities affirm that they never find any large animals in the stomachs of the Devil-fishes.

But, if Richard Hill¹ is to be credited, some Devil-fishes may be also "ground feeders." They are, he thought, "formed for shoving through the fields of turtle grass, *testudinaria*, but, unlike the Rays, which are likewise ground feeders," one of the Devil-fishes "does not seize its prey on the ground, but, pushing on through the marine herbage, it takes into its wide-open mouth the congregated living things that are in the way—it may be the fish that nestle in the vegetation or the naked mollusca that depasture there—at once swallowing them, or rather cramming them in with its cranial arms into its mouth and stomach, without deglutition, having no œsophagus. As the animal in this gathering in of food can not see forward, it must depend on casualties in the course it steers through the marine meadows for prey. The rolled-up head-fins between the crescented head sufficiently direct the food to the mouth."

In the Gulf of Mexico and elsewhere, the Devil-fish has been charged with feeding on shell-fish and complaint has been made that it does considerable damage to oyster beds. This charge is due simply to the fact that the animal has been confounded with the Eagle-rays, whose large molar teeth eminently fit them for crushing shells. The general resemblance as well as real relationship of the Devil-fish to the Eagle-rays is indeed such as to leave no room to wonder that the same name is applied to species of both families, but the singular head-fins of the Devil-fish distinguish it from all its relations of different families.

Probably connected with the food and feeding of the Devil-fishes are peculiar organs within the mouth, called by Panceri² and Duméril,³ who first described them, "prebranchial appendages."

"On examining at the bottom of the mouth the pharyngeal apertures of the branchial chambers, or separating the walls of their external apertures, we see, in front of each of the respiratory surfaces, a very regular series of organs which do not occur in any other fish, whether bony or cartilaginous.

"These organs are elongated lamellæ, the aspect of which somewhat reminds us of that of the stems of ferns, but with the leaflets

¹ The Devil-fish of Jamaica. Intellectual Observer, 2, 1862, p. 167-176.

² Panceri (P.) e Leone de Sanctis. Sopra alcuni organi delle Cephaloptera Giorna, M. H. Atti Accad. Pontoniana, Napoli, vol. 9, 1871, pp. 335-370, 2 pls.

³ Duméril (A.). On the presence of peculiar organs belonging to the Branchial Apparatus in the Rays of the Genus Cephaloptera. Ann. Mag. Nat. Hist. (4), 5, 1870, pp. 385, 386.

turned back toward the branchiæ. Each being formed of a fold of mucous membrane supported by a cartilage, these lamellæ are attached to the anterior surface of the branchial arches, in front of the membranous and vascular folds of the respiratory organs; and it is their position that has suggested the name of *prebranchial appendages*, by which they are designated by the Italian anatomist.

"They do not serve for respiration. By means of injections, M. Panceri has ascertained that they receive arterial vessels, like the other organs, and not branches of the branchial artery."

These organs are thought by Panceri (and Duméril did not dissent) to be "destined, on account of the remarkable size of the apertures of the branchial chambers, the orifices of which are much

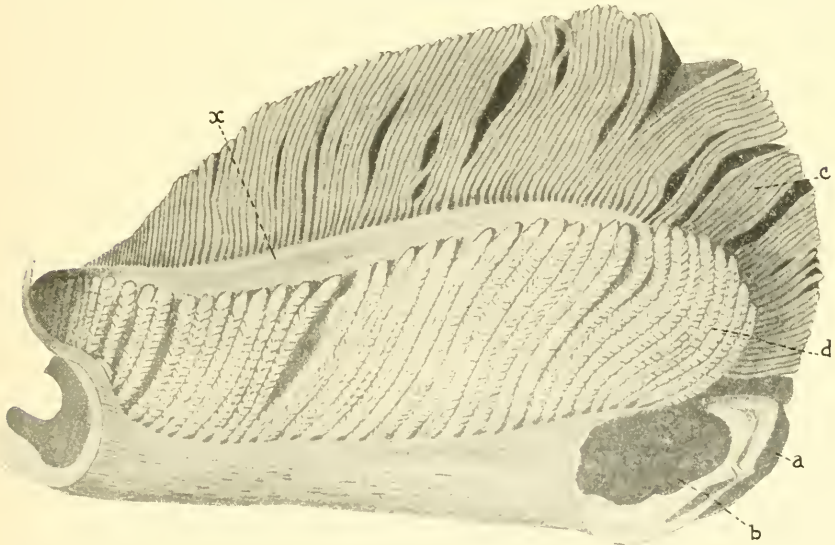


FIG. 53.—Anterior Hemibranch of the Fourth Left Pouch.

- a. Fourth branchial arch.
- b. Section of the special muscle of the branchial arch or adductor of the two ceratobranchial and epibranchial portions.
- c. Branchial lamellæ.
- d. Prebranchial appendages.
- x. Fold of the mucosa which partly covers the branchial lamellæ.

smaller in the other Rays, to retain the water and prevent it from traversing these cavities with a rapidity which would be injurious to the perfect accomplishment of the act of hæmatosis."

A more probable use for these organs would be as strainers, subserving thus the same function, or rather an analogous one, as that of the gill-rakers of the giant Sharks. They would retain the small organisms contained in the ingesta taken into the mouth, while the

water itself would find exit as usual, relieved of a large part of its life.

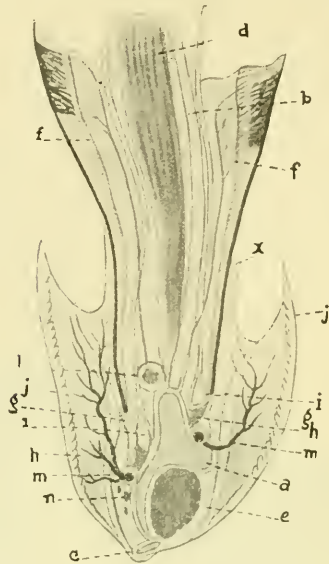


FIG. 54.—A Branchial Arch with Annexed Organs; transverse section next to the articulation of the arch (semischematic).

- a.* Branchial arch with fossa of adductor muscle.
- b.* One of the cartilaginous rays of the branchial diaphragm adherent to the anterior branchial lamellæ.
- c.* Accessory stem which connects with the arch.
- d.* Muscle of the branchial diaphragm or interbranchial muscle to which posterior branchial lamellæ adhere.
- e.* Adductor muscle of the ceratobranchial and epibranchial parts of the arch.
- ff.* Branchial lamellæ whose external surface as usual is folded.
- gg.* Cartilaginous stems of the bases of the branchial lamellæ.
- hh.* Muscles which unite the latter to the arch.
- ii.* Hydrophorous canals.
- jj.* Prebranchial appendages in profile.
- l.* Branch of the branchial artery.
- mm.* Branchial veins with efferent lamellar branches, from which proceed the branches for the prebranchial appendages.
- n.* Principal nervous trunk.
- x.* Fold of mucosa covering partly the branchial lamellæ.

VI

The Devil-fishes, of course, like other Selachians, come together in sexual intercourse.¹ The details of their union as well as the

¹According to Risso (Hist. Nat. Europe Mer., 1826, p. 165) the female of the *M. giorna* is always (toujours) much larger than the males. No observations have been made on the American Devil-fish; it is to be hoped that some may be.

length of gestation are unknown. Even the exact date of the one observation that has been published has not been given, although it appears to have been some time in July. It is, indeed, quite possible that the appearance of the animals close to the coasts of the Southern States may be for the purpose of finding a suitable place for the birth of the young. By Elliott,¹ it was found, in the first years of his experience with them, that they appeared "only in August"; in 1843, "for the first time, in July," and in 1844 they were "taken in June."

Care seems to be extended even to the place of parturition by the Sting-rays, so that the young shall encounter the least danger from the tide as well as from living enemies. Alcock tells that all the small Sting-rays (*Dasybatis walga*) with embryos he observed "were found in shallow little tidal pools lying behind natural breakwaters of sand," and he urges, "it seemed as if this comparatively safe situation had been deliberately chosen by the mother as a nursery for her expected family, as, in the opinion of Professor McIntosh, is the case with the viviparous Blenny (*Zoarces*) of northern seas." Analogous care may therefore be exercised by the Devil-fishes, the relations of the Sting-rays.

A pair of these huge animals, male and female, were seen in union by Mr. Elliott and described by him.²

VII

Whatever be the size or other characters of the Devil-fishes, so far as observed, they agree among themselves and differ from most other fishes³ by having, normally, only a single young one at a birth. The giant mothers noticed by Duhamel, Risso, Mitchill, and Lamont

¹ Op. cit., p. 67.

² Subito, læva—sed longiore spatio, quam, si jaculatus essem, speraverim transfigere ictu—duos pisces cephalopteras aspexi, amplexu conjunctos. Ventribus juxtapositis—capitibus erectis, et supra undam oblatis—antennis lascive intersertis—coitum salacem, ut solet genus squalus, ipso contactu corporis, tunc sine dubio exercere. Ferire, ob distantiam non licitum, aut duos cephalopteras, solo ictu transfixisse, gloria inopinata mihi contegisset. Cymbam appropinquantem, hastamque minantem, circumspicte evitant—et, in profundo paulisper latentes, iterum, dextra emergunt, ludosque lascivos repetunt. Tunc, quasi deliciis satiati, saltatione in aëre, utrinque facta—aperitum mare petivere. Hoc concursu tam raro notato—antennis albis, cum nigris admixtis utsi lacertis—imago fœdi et immundi coitus, nudi Africani cum Caucasiana, plane præfigurabatur. (Elliott, *Carolina Sports*, 3d edition, pp. 93, 94).

³ The Stingrays (*Dasybatids*) of some species at least have only a single young.

each had only one (one or two, according to Risso¹). In case of the small species named *Ceratobatis robertsii* or *massenoidea*, the mother likewise had a single fœtus (a fœtus sixteen inches wide).

Although only one young is formed, that one is worthy of the giant mother and larger than any of the full-grown common Rays of ordinary size. It is practically immune from danger from the customary enemies of fishes and well able to take care of itself.

Nature is economical in her methods and there is some adjustment of ways and means. In the case of egg-laying fishes of inferior size and when no care is taken of the eggs, many thousands—even millions—may be laid by a single fish, and yet the number of adults remains practically the same, generation after generation. In the case of viviparous fishes like the Devil-fishes, a single young one at a birth is enough to keep up the species.

The fishermen of Jamaica, according to Hill, “say that the mother fish makes the violent leaps she is seen to take out of the water to eject the fœtus from the matrix; that the young fish is then observed to fall from her; and that for a time it swims upon the parent’s back, and possibly enters the wide mouth-sack when necessary to seek shelter from apprehended danger.” All this is improbable. It appears to be certain that the “leaps” are habitual to males and females alike, and it is probable that they are the extension of their peculiar mode of progression or “flight.”

A pregnant female, 15 feet wide and which with difficulty forty men with two lines attached to it could drag along the ground, was landed, after a five hours’ fight, at Port Royal, Jamaica, in 1824. “On opening it a young, about 20 pounds weight, was taken out, perfectly formed”; it was five feet broad. An account of the capture was given by Lieutenant Lamont in the Edinburgh Philosophical Journal (XI, 113-118).

Two observations respecting the procreation of Devil-fishes require attention.

That the Devil-fishes have only one young each, and consequently are viviparous, is the statement made by all observers. This viviparity is in analogy with the gestation in the relatives of the Devil-fishes, all the Sting-rays and Eagle-rays. Nevertheless a gentleman

¹ Risso, in his “*Remarques*” on the “*Céphaloptères*” gives the following data: L’époque de leurs amours est l’hiver; les femelles mettent bas en Septembre un à deux petits, qui originaiement sont renfermés dans un œuf oblong jaunâtre. Les mâles paraissent quelquefois n’abandonner leur compagne qu’après qu’elle a déposé ses fœtus; et si l’un des deux se jette dans un filet, l’autre ne tarde jamais à le suivre. Risso Hist. Nat. Europe Mer., 3, 1826, p. 165.

with considerable knowledge of ichthyology, Swinburne Ward, once the Civil Commissioner of the Seychelles Islands, after an account of the capture of a Devil-fish which "ten men could not haul" up on the beach, concluded with the affirmation that "she was full of eggs." The idea might be (and has been) derived that this may have been a case of oviparity or multiparity, but the eggs (if they were such) were possibly the reserve stock left perhaps after the birth of a young one. The statement is in great need of confirmation.

Mitchill, in 1823, tells that a "female that was struggling after having been wounded brought forth in her agony a living young one, as Captain Potter related, and Mr. Patchen, while he showed [Mitchill] the orifices through which sucking is probably performed, declared that on dissection mammary organs were found, which discharged as much as a pailful of milk." This at first incomprehensible and incredible statement may be reconciled with facts when we recall the mode of nutrition of the embryo among the Sting-rays, described by Alcock. It was the honest statement of an inexperienced observer who misinterpreted facts.

A remarkable provision among the Sting-rays for the nutrition of the embryo within the body of the mother has been made known by A. Alcock, on whose description, published in 1902, we may draw.¹

It is by means of a secretion which is regarded as "analogous to milk" that the embryo is for some time fed. The mucous membrane of the oviduct is "shaggy, with vascular filaments [named *trophonemata*] dripping with milk" or rather a milk-like fluid, and on microscopic examination it was found that "each filament was provided with superficial muscles whose contraction must serve to squeeze the milk out. Some such mechanism is undoubtedly necessary, seeing that the young one has no power of extracting the secretion for itself. On examination of the young one, the mother's milk was found inside the modified first pair of gill-clefts or spiracles (the other gill-clefts being tightly closed), and also in large clots within the spiral valve of the intestine, so that there can be no doubt that in these viviparous Rays the unborn young ones may be said to

¹ Alcock (A.). A Naturalist in Indian Seas [etc.], London, 1902, pp. 210, 71, 159. See, also, Observations on the Gestation of some Indian Sharks and Rays. Journ. Asiat. Soc. Bengal, 59, pt. 2, 1890, pp. 51-56, pl. 1; On the Uterine Villiform Papillæ of *Pteroplatea micrura*, [etc.] Proc. Roy. Soc., 49, 1891, pp. 359-367, pls. 7, 8; Further observations on the Gestation of Indian Rays; [etc.]; Proc. Roy. Soc., 50, 1891, pp. 202-209. On Utero-gestation in *Trygon bleekeri*. Ann. Mag. Nat. Hist., (6), 9, pp. 417-427, pl. 19, 1892; Some Observations on the Embryonic History of *Pteroplatea micrura*. Ann. Mag. Nat. Hist., (6), 10, pp. 1-8, pl. 4, 1892.

'drink its mother's milk' like a mammal, even though the milk-like secretion does not go in at the mouth, but by channels homologous with the ear-drum of air-breathing vertebrates.'

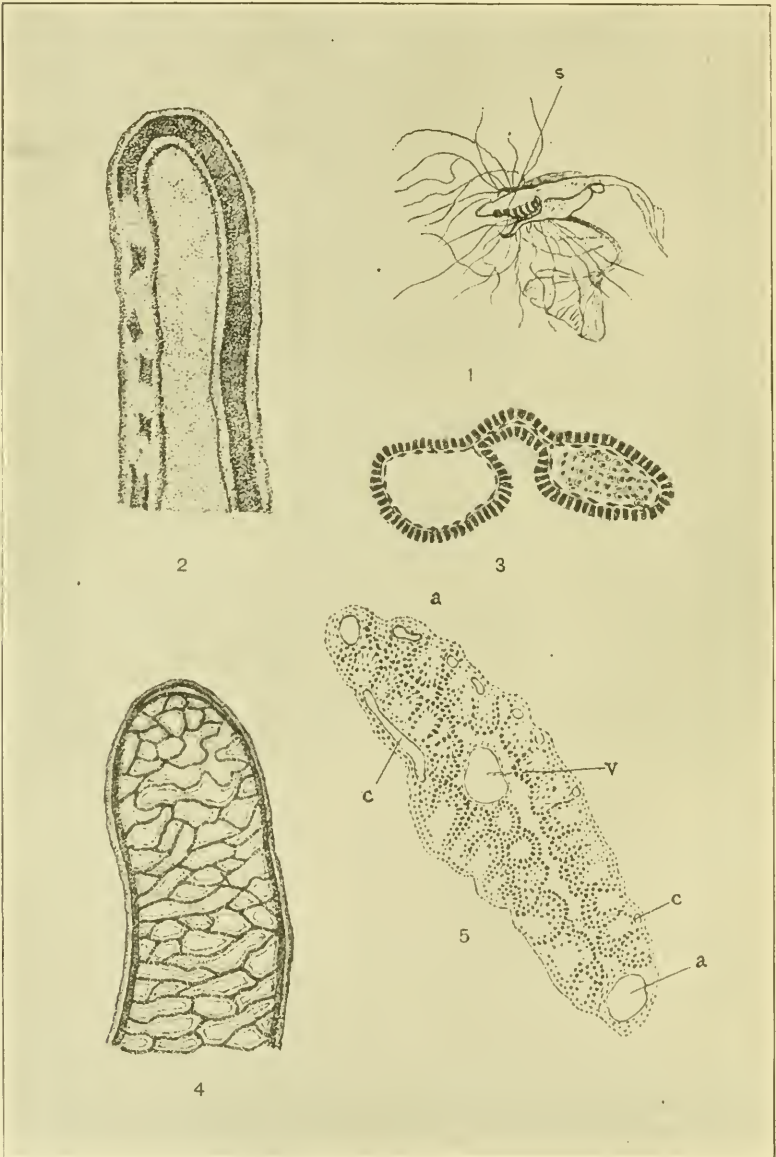


FIG. 55.—*Pteroplatea micrura*. After Alcock.

EXPLANATION OF FIG. 54.

1. Embryo of *Pteroplatea micrura*, from dorso-lateral aspect; nat. size, but with only a few of the gill-filaments represented, for the sake of clearness. *s*, spiracle.
2. End of a gill-filament, showing marginal capillary filled in places with blood-clot. $\times 42$.
3. Transverse section of a gill-filament, showing the marginal capillary in section and the single fold of epithelium. $\times 188$. For the sake of clearness the blood-clot is represented in one limb of the capillary only, and the spaces between the nuclei of the surface epithelium are a little exaggerated.
4. End of a trophonema, or nursing-filament, seen as a transparent object in glycerine, showing the marginal artery and the superficial capillary plexus. $\times 42$. The median vein is not seen so near the end.
5. Obliquely transverse section through a nursing-filament, showing the glands still in the form of solid bulbs lying beneath a still unbroken surface of epithelium. $\times 110$. *aa*, arteries; *v*, vein; *cc*, superficial capillaries.

Doubtless an analogous provision for the nutrition of the embryo is developed in the Devil-fishes, and thus we have a satisfactory explanation of the statements of Patchen and Mitchill. Something like milk is secreted by the mother fish and is ingested by the young, but it is chemically different from milk, and instead of being sucked in by the mouth is absorbed through the postocular spiracles. The statements which have been much ridiculed have therefore a sound foundation in fact and are susceptible of a natural explanation.

Nothing is known respecting the development of the embryo of any Devil-fish, but undoubtedly it is similar to that of the Sting-rays.

The very young embryo of the Sting-rays, as of all other Rays, contrasts remarkably with the mother, especially in the case of the very wide forms, such as the Pteroplateines. The embryo at an early stage has a form very like that of a Shark, but with pectorals provided with basilar extensions free from the head, and extending forward parallel with it in advance of the eyes. These extensions later unite with the sides of the head, and the regular Ray has then become developed. Essentially, the form of the mother has been attained by the young when ready for extrusion from the mother's womb. This much at least is known of the new born of Devil-fishes.

VIII

The various species of Devil-fishes are representatives apparently of three different generic types, distinguished by differences of derivation. *Mobula* (also called *Aodon*, *Cephaloptera*, or *Diccrobatis*;

has teeth in both jaws; *Manta* (or *Ceratoptera*) has teeth confined to the lower jaw, and *Ceratobatis* has teeth only in the upper jaw. The species also differ in size and the character of the dorsal spine. While a width of twenty feet or more may be attained by some, others become sexually mature when four feet wide. In most of them the tail is short and the dorsal spine characteristic of Sting-rays is obsolete, but it is asserted to be well developed in the *Mobula giorna*.

The number of species of Devil-fishes is uncertain. In 1870 seven species were recognized, five of the genus *Dicerobatis* (*Mobula*)¹ and two of *Ceratoptera* (*Manta*). One representing a new generic type (*Ceratobatis*) was added in 1897. One of gigantic size, generally supposed to be *Manta vampyrus*, has been observed at many places. Whether there are more than one species is uncertain.² There is a discrepancy in the length of the tail assigned to some. Most of the giants have a tail nearly as long as the body, but one referred to by Hill, about fifteen feet wide, had a tail only two feet long.³ The species of *Mobula* differ. The *M. giorna* of the Mediterranean is said to have a tail about three times longer than the width of the disk; the *M. japonica* one "nearly thrice as long as the body," and the *M. olfersii* of Brazil and the Caribbean Sea one about as long as the disk and much less than its width. The *Ceratobatis robertsii* has the tail not much less than twice the length of the disk (620:350), but considerably less than its width (620:780).⁴

One species—the true Devil-fish of the United States, *Manta vampyrus*—is not uncommon in the warm American waters and appears on the South Carolina coast in summer in "shoals."

The *Manta vampyrus* has a body or disk nearly twice as wide as long, and a tail about 6/10 as long as the body; the body and tail are rough from the development of small tubercles which extend almost everywhere; the band of teeth (confined to the lower jaw) extends over almost the whole width of the jaw and is composed of about a

¹ Three nominal species were described later—*Dicerobatis draco*, Günther, 1872; *D. monstrum* Klunzinger, 1871, and *Cephaloptera tarapacana*, Philippi, 1894.

² This subject will be considered in a future article.

³ The tail may have been decurtated in youth.

⁴ The figure in Day's *Fishes of India* (1878, p. 745), which he "surmises" may represent "*Ceratoptera chrenbergii*" is nothing but an illustration of a not uncommon monstrosity of an ordinary Ray (*Raia*) with free anterior extensions of the pectorals, resulting from arrest of development. (See Proc. U. S. Nat. Museum, 1895, pp. 195-198.)

hundred transverse rows; the rows are separated from each other by well-marked interspaces. It is said to attain a width of 30 feet.¹

This or a very closely related species has been found not only in the West Indian and Carolinian seas, but along the west coast of America, along the African coast, and in the Indian Ocean. A Devil-fish fourteen feet six inches wide, caught near Durban, Natal, also presented the same proportions as the American species. A plate representing it from before and behind was published in the *Zoölogist* for April, 1899.

Like most other large Selachians, the Devil-fish is beset by Echenidids, commonly known as Sucking-fish or Suckers and often confounded with the Pilot-fish. Elliott² noted that "he is attended by a band of parasites," which "followed him into shoal water" and "adhered so closely after he was aground that several suffered themselves to be taken by the hand."³

IX

The Devil-fish from time to time has been the object of sport. He who indulged most in it and captured almost twenty has given animated pictures of some of his adventures. One of the most condensed and entertaining accounts may be welcome here.

One day in late June (24th), sailing toward "Hilton Head" (South Carolina), Mr. Elliott with his crew went after Devil-fish. Soon he saw "a shoal" of them "sweeping along the beach, traveling rapidly downward with the tide" and freely showing themselves at the surface. After an ineffectual cast with a harpoon, "three showed themselves below and one above."

¹The records of size are very defective. The largest actually measured by Elliott was 17 feet wide (p. 64), another 16 feet (p. 80), and another 15 feet (p. 43). Another lost after being dragged "into three feet water" was estimated to be larger; "there he lay, extending twenty feet by the wings" (p. 51). One taken in the Gulf of California in 1846 was 19 feet wide, 3 feet 6 inches thick, and had a mouth 3 feet 5 inches wide (*Zoöl.*, 1849, p. 2358). Another noticed by Gosse (*The Ocean*, p. 193-194, Amer. Edit., p. 189) taken at La Guayra, was 20 feet wide, with a "length from end of tail to end of tusks [caropteres] 18 feet," a "mouth 4 feet wide," and "its weight 3,502 pounds."

²Op. cit., p. 44.

³Le Vaillant, near the African coast, met three Devil-fishes ("diable"), one of which was accompanied by a sucking-fish ("pilote du diable") attached to each horn ("corne") of the Devil-fish. His account is unreliable. The parasite is the *Remora remora* according to Street (*Bull. U. S. Nat. Mus.*, 7, p. 54). and Pellegrin (*Bull. Mus. Hist. Nat.*, Paris, VII, 327).

Now he shall speak for himself:¹

"I pushed at one that showed his back fairly above water, as he swam; but he sank just before I reached him, and I drove down the harpoon at a venture. He had a narrow escape, for the staff struck him. At this moment, three showed themselves below and one above. I pushed for the latter, and when I approached the spot, I saw the water boiling up like a caldron—from which sign I knew that the fish was throwing his somersets below the surface (in the way which is so very peculiar to them). Making the oarsmen check the headway with their oars, I looked anxiously for a view, when, unexpectedly, I saw the white of his belly far beneath the water, and quite away toward the stern. He was thus behind me, but wheeling suddenly to the right, I pitched the harpoon at him, across the oars, and felt a sensation of surprise, as well as pleasure, in finding that I had struck him. The fish dashed out violently for the channel, and we payed him out thirty fathoms of rope until, headway being given to the boat, we brought him to a dead pull; and now his motions were very erratic; unlike some that I had before struck, he did not take a direct course for the sea, but sometimes drew the boat against the tide, then suddenly turned and ran directly toward us, so as to give slack line. I inferred from these signs that he was mortally hurt. As often as he approached the Middle Bank and shoaled the water, he drew off in alarm, and would not cross it until he had got to its tail; his course was then for Paris Bank, which, suiting well with our intention to land him, if we could, at Bay Point, we did not interrupt. About this time he came to the surface without being pulled, and showed great distress—and we resolved, then, to draw upon him and get a second harpoon planted. It was after various fruitless efforts, and by shortening the rope as far as we prudently could, that we at length drew him so far up that the dark shadow of his body was indistinctly seen beneath. The second harpoon was now driven, and the gush of blood to the surface showed that it had done its work. We now drew mainly on this second, leaving only a moderate strain upon the first—and after a few convulsive runs, brought him up helplessly to the surface, and with a spear dispatched him outright. With a hatchet we now cut a hole in one of his feelers, and inserting a rope, passed it to the stern, drawing solely on this, so that the resistance of the fish through the water should be as small as practicable. The wind was now due east and moderately fresh; we raised both sails, and, helped at the same time by the oars, made some way in our tedious progress on towing our prize to land. At this time, espied a boat beating down from Beaufort, and on signaling her, she proved to be that of Col. De Treville, then on his way to Bay Point. His offer of assistance was accepted, and a tow-line being passed to his boat, we landed our fish at the Point exactly at sunset. This fish measured sixteen feet across, which I suppose to be the medium size of those that visit our waters. The first harpoon had struck it near the center of the belly—had pierced

¹ Op. cit., pp. 68-72. The punctuation of the original is preserved.

the liver, and passed nearly through to the back. The second had passed from the back into his lungs or gills—so that the full power of so large a fish was never fairly exerted against us. Had the same fish been struck in the wings, or other parts not vital, his capture would have been uncertain—and would at any rate have cost us the work of many hours.

“I suppose the shoal of Devil-fish was a large one; the third which appeared we struck at—the fourth we harpooned—and as we were rapidly drawing off from the shore, a fifth was seen. How many were still behind, we had not leisure to observe; but conjecture this was but the advance guard of the column.”

Later adventurers after sport with the Devil-fish have hunted it along the Florida coast as well as in the Gulf of Mexico and the Caribbean Sea. C. J. Holder has told of his experience in “Trailing the Sea-bat” in “Outing” for 1900, and J. Turner-Turner has devoted two chapters of his book entitled “The Giant Fish of Florida” (1902) to the “Enormous Rays, or Devil-fish,” which he pursued. The article by Holder has been republished in that author’s work entitled “Big Game at Sea,” published in 1908 (pp. 1-35).

The pursuit of such a giant as the Devil-fish is necessarily attended with some danger, but this incident adds to the zest the sportsman feels. Elliott records that he had been “carried twenty-five miles in the course of a few hours by two of these fish (having struck a relay when the first sea-horse escaped, and losing both), with three boats in train.”

According to Leon Diguët¹ (1898), in the Gulf of California, where Devil-fishes are numerous, the pearl-fishers, when caught during a calm away from mooring places, always take the precaution of dropping two anchors at night for fear that one should be seized by a Devil-fish and hauled afar by it. Diguët went in pursuit of a specimen for the Musée d’Histoire Naturelle of Paris, and, after one had been harpooned, it turned back on the boat, seized the bow with its headfins, and held it in its clasp till it was lanced a second time. But this clasping is largely automatic, and the Devil-fish only makes for the boat from which it has been attacked when it experiences the stress through the line from that direction. It is not like the attack of some sharks when wounded. The Devil-fish, in fact, has been called a “timid animal” by Diguët.

The Devil-fish, nevertheless, is the object of considerable dread among the fishermen of the Gulf of California; for, although not aggressive, it is frequently encountered, and Diguët tells that numer-

¹ Vaillant (L.) et L. Diguët. Sur le Céphaloptère du Golfe de Californie. Bull. Mus. Hist. Nat., Paris, 1898, pp. 127-128.

ous cases have occurred of death resulting to divers, as well as bathers from encounters with the Devil-fish, or Manta, as the men call it.¹ On the other hand, the carcasses of many that are killed are used for bait for other fishes.

¹An accomplished naturalist of the second quarter of the last century, Col. Hamilton Smith, "once witnessed the destruction of a soldier by one of these Cephalopteri off Trinidad. It was supposed that the soldier, being a good swimmer, was attempting to desert from the ship, which lay at anchor in the entrance of the Boca del Toro. * * * The Colonel is positive as to this fish being a Cephalopterus." The full account is given in Griffith's edition of Cuvier's Animal Kingdom ("The Class Pisces," p. 654). The evidence is very unsatisfactory.