

THE LIFE HISTORY OF THE ANGLER

By THEODORE GILL

One of the most interesting and remarkable fishes of the North Atlantic is that whose cognomen in books is angler, but which has received a number of true vernacular names in the countries bordering the waters in which it lives; it is scientifically known as *Lophius piscatorius*. It is the best known representative of a large group (order or suborder) of fishes named Pediculates. The essential characteristics of this group may be first indicated.

I

In almost all osseous fishes there are four bones (actinosts) set apart for the base of each of the pectoral fins, and these are generally short and imbedded in the flesh so that the pectoral fins appear to rise directly from the sides of the body close behind the head. In some remarkable forms, however, which in most respects agree with the Acanthopterygians, the pectorals originate from arm-like bases resulting from the elongation of the actinosts after their reduction in number to three or even two; these form pseudobrachia or false arms. With this character is associated the reduction of the branchial apertures to narrow foramina in the axils of the pectoral fins, or rather their supports or "pseudobrachia." The usual headbones are not manifest externally, being covered by the skin, but almost all are present, though much modified. There are, however, no sub-orbital bones. There are soft dorsal, anal, and caudal fins presenting no unusual features, but the spinous or first dorsal is more or less modified, one tendency being the production and recumbency of the foremost interspinal bone on the front of the head, and the consequent position of the ray over or near the snout, and in one genus (*Malthe*) this tendency is carried to such an extreme that, the forehead being horizontally extended, the dorsal ray is rooted *under* the snout! The ventral fins, when present, are "jugular," but in one polymorphous family (Ceratiids) there are none. The order, according to the best recent authorities, includes five families—Lophiids, Antennariids, Ceratiids, Gigantactids and Malthids. It is the first that is typified by the angler.

The family of Lophiids, or anglers, is distinguished for its large and much depressed head, the mouth directed upwards, the bran-

chial apertures mostly in the lower axils of the pectorals, in some continued round the pectorals in front; the pectorals with two actinosts and little geniculated but directed outwards, the ventrals moderate, and the first dorsal represented by a fin of three spines and, in advance of them, by three free spines of which the first is generally longest.

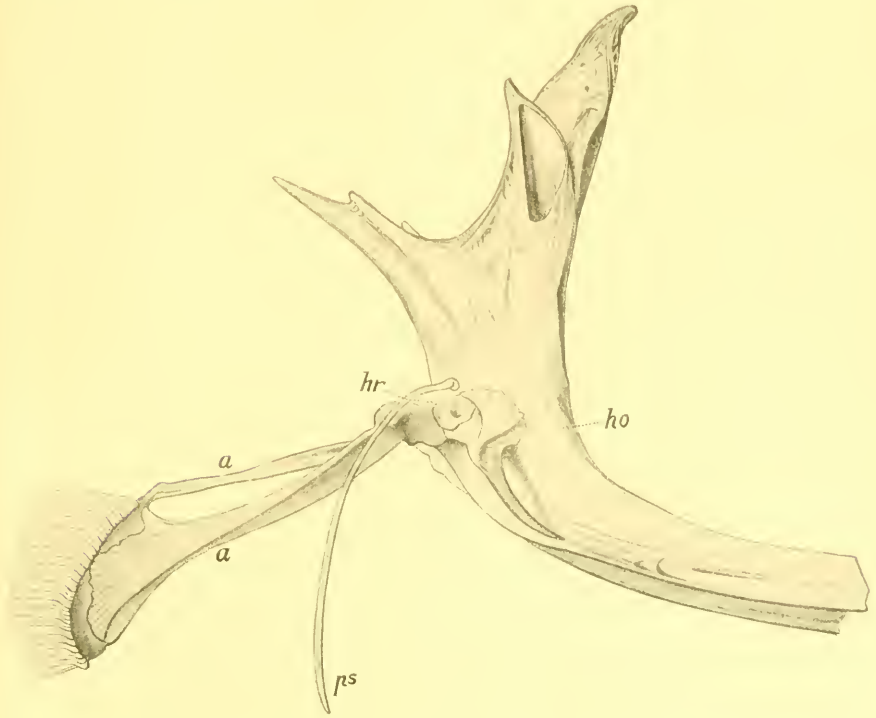


FIG. 94.—Shoulder girdle of the angler, showing the pseudobranchium or false-arm with its 2 actinosts (*a*), the hypercoracoid (*hr*), hypocoracoid (*ho*), and postscapula (*ps*) as well as proscapula or conosteon. (After Mettenheimer.)

While the head, as a whole, is much depressed, there is no fundamental difference between it and that of a pediculate with a compressed head, such as that of an ordinary Antennariid. The cranium itself is narrow and the breadth results from the flaring outwards of the opercular apparatus. In the earliest stages, indeed, the head is compressed and then the young fish lives near the surface of the sea and it is only when it takes to the bottom that the depressed form is assumed.

For a long time only a couple of species of this family were known, but successive deep-sea explorations have brought to light quite a

number, and the last reviser of the group—C. Tate Regan—in 1903 recognized as many as thirteen distributed among three genera—*Lophius*, *Lophiomus* and *Chirolophius*. All the species have a very strong family likeness, all having a wide mouth, gills on the lower halves of the first three branchial arches only, the fourth being without, pseudobranchiæ, the three epipharyngeal bones of each side coalescent (the first being undeveloped), and the first two dentigerous, but the last edentulous.

The generic differences are notable: *Lophius* and *Lophiomus* have the "gill-openings entirely below or behind the pectorals," while *Chirolophius* has them "partly below, partly in front of and above the pectorals"; *Lophius* has as many as 27 to 32 vertebrae, while all the others have only "about to vertebrae." The *Lophius piscatorius* may attain a length of three feet or more, but most of the species, so far as known, are less than a foot long.

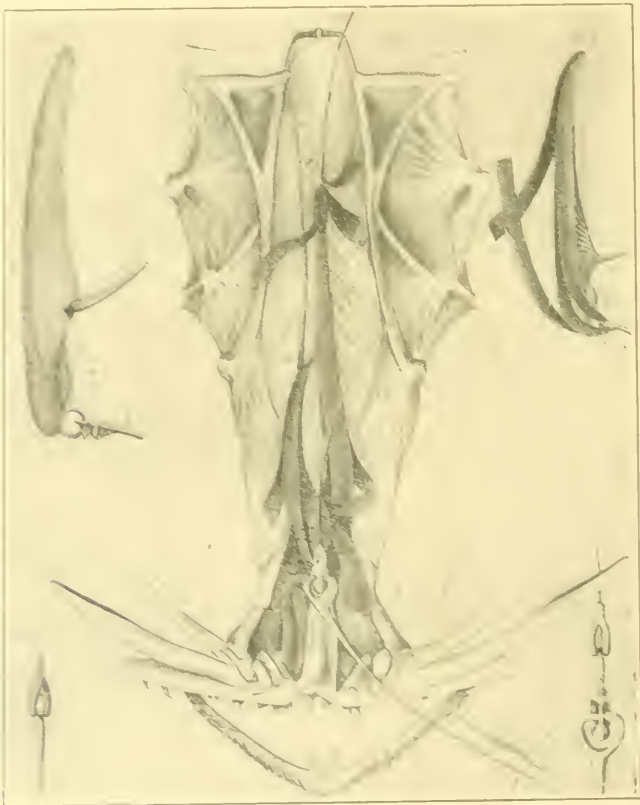


FIG. 95.—Upper view of cranium of angler, showing its narrowness and the relations and mode of articulation of the jaws, interspinals and spines. (After E. M. Baily.)

II

The name *angler*, which is almost universally used for the fishes of this genus in books, is really a book-name, and not one in general use among shoremen and fishermen. It was, indeed, especially coined for the *Lophius piscatorius* by the English litterateur and naturalist, Thomas Pennant, in 1776; in his *British Zoology*, as he says, he "changed the old name of *fishing frog* for the more simple one of *angler*," simply because he did not like the former, which was one of the popular names. But there was no lack of real vernacular names. In England, besides *fishing-frog*, there are *frog-fish*, *toad-fish*, *pocket-fish*, *monk-fish*, *nass-fish*, *sea-devil*, *devil-fish*, *wide-gut*, *wide-gap* and *kettle-mare*, and these are supplemented by other local names in Wales, Scotland and Ireland. In America another set of names replaces the English ones. The most common along the Massachusetts coast is *goose-fish*; in Rhode Island *bellows-fish* is in use; in Connecticut, *molligut* may be heard, and in North Carolina *allmouth*. One who has looked into the vast cavity behind the jaws will concede the aptness of the last name.

Although Angler is not a true vernacular name for the *Lophius*, it is an analogue of names in popular use in other countries, as *Pecheur* or *Poisson-pecheur* at Bordeaux, *Pescatrice* at Rome and some other places in Italy, and *Petricia* at Malta. The modern Greeks have adopted the Italian name with a modified form (*Peskandritza* or *Peskanritza*) into their own language; a true Greek word, *Batrachopsaro* (Frogfish) is also in vogue at some places (*Patras*). Among the Ancients it was known as the sea frog, the Greeks calling it *Batrachos o alieus*; the Romans, *Batrachus marinus*.

III

The angler's horizontal as well as vertical range is great, and covers a large portion of the North Atlantic on both sides, where the temperature may range between 32° and 60° F.—perhaps even higher. On the eastern side it is common in the Mediterranean and along the western coasts of Europe, becoming less common along the Scandinavian shores to the northward; it wanders upward, however, to the North Cape and the Farøe Islands.¹ Along the American coast it is most common in the comparatively shallow waters of New England, and in deeper water about Nova Scotia and Newfoundland to the north, and as far to the south as the Caribbean Sea. "There is some reason to think that south of Cape Cod it retreats to deep water in summer."

¹ If the identification be correct, it even reappears around South Africa.

While thus quite common along many coasts in rather shallow water, it appears to be at home in deep water. In the cold water under the tropical surrounding Barbados, at a depth of 209 fathoms; at another place, from "a depth of 365 fathoms" (according to Goode and Bean), specimens were dredged.²

IV

It is emphatically a bottom-fish, as its depressed form and up-looking eyes sufficiently indicate. It is also addicted to solitude, living apart from its fellows. In some selected nook, perhaps "hidden among seaweeds or stones"; perhaps "buried in the mud, with only the mouth and the gill-openings free," it "lies in ambush for its prey." At depths where algal vegetation no more thrives, it doubtless lies exposed or half-buried in the bottom, for the light is dim and extraneous concealment not much required. According to Day (evidently guided by Couch), in England "during the summer and autumn it resides near the shore where, by means of its pectoral fins, it forms for itself a cavity in the sand," or, should the ground be rough, it lies as if dead, while "its floating filaments, kept in motion by the tide, decoy other fish, and the angler's tendril is no sooner touched than the game is caught." Saville Kent, who had excellent opportunities of observing a large individual in the Manchester Aquarium (1874), was struck by its adaptation to its natural environments, and has given a graphic description of it.

"Commencing with generalities, one of the most striking features that first attracted notice in this specimen was the remarkable likeness of the animal's head to a mass of rugged rock—the irregular outline formed by the prominent ridges of its upper surface, and the excessive projection of the massive lower jaw, especially favoring this simile. Following up the idea still farther, the illusion was found to be carried out to an extent altogether marvelous to contemplate. This prominent lower jaw in itself formed a natural rocky ledge springing from the parent mass. Along its lower margin are dependent, in the most highly developed state, those singular lobulate processes which extend in a straight line backward to the creature's tail. The size and shape of these processes vary considerably, though generally following a more or less leaf-like contour, and one between every two or three being much longer than its neighbors. As far as I am aware, no attempt has yet been made to explain the purpose

²The deep-sea Caribbean fishes are not in the National Museum and the writer is unable to confirm the identification. They probably belong to a different species.

or function of these appendages; but to one accustomed to hunting for marine treasures at low tide on a rocky coast line, their resemblance to the small flat calcareous sponges (*Grantia compressa*), ascidians, zoophytes, and other low invertebrate organisms which fringe the lower margin of every conspicuous ledge, is strikingly suggestive. The next point we arrive at is the wonderful apparatus upon its head, with which the animal has been supposed to lure on its prey to destruction. It consists of two erectile filaments, the foremost of which is produced at its extremity into a membranous digitiform expansion. According to the books, this expanded membrane owes its especial attractive qualities as a bait to fish in its vicinity to the glittering metallic colors which play upon its surface. As far as I can ascertain, however, by both personal observation and that of others, no such distinctive coloring really exists, the membrane sharing the sombre hues of the general surface of the body. Following out our rock simile, these organs yield another point remarkably favorable thereto; the foremost filament, with its digitiform membrane, is the facsimile of a young frond of oar-weed (*Laminaria digitata*) in both shape and color; and in the tendril behind it we have a repetition of the same with the blade of the frond, as it were, worn away by the current of the ocean. Our rock, however, is not yet clothed with all the growths that contribute to perfect its mimicry of nature; for where we least expect it—that is, in the animal's eye—we find the most extraordinary mimicry of all. These organs are very large and prominent, the iris being conical in shape, of a yellow ground color, with longitudinal stripes of a darker shade, while the pupil, commencing abruptly at the summit, is of so jetty a hue that the aspect of the whole is that of a hollow truncated cone, resembling, with its longitudinal stripes, the deserted shell of an acorn barnacle, and with an amount of exactness that is apparent to the most ordinary observer. We have here in this fish, then, the most perfect possible embodiment of a rocky boulder, with its associated animal and vegetable growths. Lying prone at the bottom of the ocean among ordinary rocks and debris, it might well pass muster as an inanimate object, and the other fish on which it preys would approach it with impunity, and never discover their mistake until too late to escape from its merciless jaws. Esconce the animal snugly, however, in the crevice of some precipitous submarine cliff, and the illusion is more perfectly complete. No strategy need now be exerted by the voracious fish to attract his prey; he has only to lie close and quiet, letting his tendrils sway to and fro in the

passing current like the weeds around him, and the shoals will approach, browsing the vegetation, or pursuing their crustaceous diet right into his very mouth. And that such surroundings as the foregoing are most congenial to the angler's tastes is abundantly evinced by the habit of the specimen in the Manchester Aquarium. He is ever slinking off to the rock work, and establishing himself so closely in some snug corner that it requires, notwithstanding his large size, a considerable amount of diligent search to detect him."

Conceding the perfect aptness of Kent's remarks, the story is yet only half told. There can be little question that the foremost spine of the angler, with its leaf-like or worm-like appendages, does really attract fishes, in so far as they are moved by curiosity at least to approach so near that the angler can leap upon them and engulf them in its capacious mouth. Two thousand years ago and more the adaptation for concealment as well as for capture, by attracting other fishes, was recognized by naturalists and philosophers. Cicero of old, in his work on Natural Theology, looking at one side only of the question, called attention to the ability of the angler (or sea frog as he called it) to conceal itself and yet attract other fishes for its consumption.¹ Could those other fishes be heard, they would tell a story against providential interference!

Not long after the observations made by Kent in England, even better ones were made by the German naturalist Schmidlein on individuals kept in captivity in aquaria at the zoölogical station of Naples. His account is here translated from the original German:

Lophius embodies, so to speak, a living angling apparatus. Unfortunately there is not much to record concerning its habits in captivity that might be considered as a contribution to the already known characters, for it is so peculiarly adapted for its dark mud-bottom, that it can never endure the confinement in our bright, well-lighted prisons with the clean sand for more than a few days. It lies for the most part on the bottom in perfect apathy without burying itself in the sand, and stares with its big dull, glazed eyes straight before it, while the jaws of the enormous mouth open a little and close at every breath, and the lobed barbels on the chin swing back and forth. At times it raises the "hooks" on the head and lets the terminal lappets play, or it yawns and changes the color of its dull mud dress into a lighter or darker shade. It never takes any food

¹Ranæ autem marinæ dicuntur obruere sese arena solere, et moveri propè aquam, ad quas, quasi ad escam, pisces cum accesserint, confici a ramis, atque consumi. De Natura Deorum, I, 49.

either voluntarily or by force. If it is made to feed it will spit out the morsel again. Before death the skin of the tail generally peels off, and the tail putrefies from the point upwards.

The sea-devil attains considerable size, and the aquarium several times possessed specimens more than a meter in length; the latter, however, could not survive even as long as the smaller fishes.

V

As one of the popular names, *Allmouth*, indicates, the fish is well fitted to ingest food, and its instinct is coordinate with its capacity. It is, in fact, a most voracious carnivorous animal, and, so far at least as flesh is concerned, omnivorous. It is indiscriminate, too, for in Massachusetts some "annoy the fishermen by swallowing the wooden buoys attached to the lobster pots," and a man "caught one by using his boat-anchor for a hook." A bottom fish, it naturally feeds largely on fishes living on or near the bottom, such as flatfishes, gurnards, sculpins, sea-ravens, dog-fishes and small rays, as well as crabs, lobsters, squids and starfishes. Impartiality in accepting what offers itself was manifest in one from which Buckland took "two mary-soles, one common sole, one piked dog-fish, 1 ft. 6 in. long, three moderate-sized crabs, fourteen five-fingers, and one whiting." Observations were made on three Massachusetts individuals taken in 1897 and 1899 and recorded by Edwin Linton (1901). One "had in its stomach a large quantity of mud which was rich in mollusca, annelids and small crustaceans." Another, "a small specimen, had in its stomach a winter flounder almost as large as itself." A third had "fragments of fish." The first observation is of unusual interest as an evidence of what the fish may do when unsuccessful in securing larger prey.

Its search for food is by no means restricted to the bottom, however, for though a slow and clumsy swimmer, by stealthy approach, it succeeds in surprising not only active fishes, but even birds and mammals swimming on the surface. According to R. Q. Couch (1847), in Cornwall, it also "frequently rises to the surface of the water in the summer and autumn, and lies basking in the sun."

Its success in capturing large birds swimming on the surface, is commemorated in a name most in vogue along some parts of the coast (goosefish); several "have been known to swallow live geese." A fisherman told G. Brown Goode that "he once saw a struggle in the water, and found that a goose-fish had swallowed the head and neck of a large loon, which had pulled it to the surface and was trying to escape. There is authentic record of seven wild ducks

having been taken from the stomach of one of them. Slyly approaching from below, they seize birds as they float upon the surface."

A number of analogous instances of capture of birds might be given. Birds quite as large as a goose have been taken, such as the loon and gull (*Larus argentatus*). Reliable Cape Cod fishermen, Captains Nathaniel E. Atwood and Nathaniel Blanchard, assured Dr. D. H. Storer that "when opened, entire sea-fowl such as large gulls, are frequently found in their stomachs, which they supposed them to catch in the night, when they are floating upon the surface of the water." Storer was also "informed by Captain Leonard West, of Chilmark, that he had known a goose-fish to be taken having in its stomach 6 coots in a fresh condition. These he considered to have been swallowed when they had been diving to the bottom in search of food."

By far the most valuable studies of the food of the angler were made by T. Wemyss Fulton and published in 1903. No less than "541 anglers of various sizes, caught mostly in the Moray Firth, Aberdeen Bay, and the deep waters of the Shetlands were examined." Fulton's studies were for the purpose of ascertaining "the amount of destruction caused by this species among the food fishes." It appears that, "so far as the anglers investigated" were concerned, "the principal food consisted of whittings, sand-eels, haddocks and common dabs, and in smaller amount of herrings, solenettes, and others." The "proportions differ on the different grounds, and at different seasons." A noteworthy circumstance is that "the great majority of the fishes found in the stomachs were small, even when the angler was large." The rarity of large fishes was supposed by Fulton to point "to their greater caution than when younger." Besides fishes "the only other organisms found in the stomachs were a shore-crab in one and a swimming-crab in another, and cephalopods in thirteen."

Another noteworthy characteristic of the angler is the tenacity with which it holds on to what it has seized. A couple of anecdotes told by Jonathan Couch (1862) will illustrate. "Mr. Thompson, of Belfast, records an instance where a gentleman discovered an angler near the shore, and presented the butt-end of his whip to it, when it seized and held by it until it was thus drawn on shore. An angler of large size was also discovered in shallow water by a couple of boys who were in a boat, where they happened to be without oars. But with the intention, perhaps, of annoying the fish, they loosened a board that lay along the bottom of the boat and thrust it within the creature's expanded jaws, which immediately closed upon it. A

struggle then commenced, but so firmly did the fish retain its grasp, that it suffered itself to be dragged out of the water and secured."

Another feature of the fish is the slowness of its digestive powers. Couch has also aptly illustrated this characteristic, where the angler's skill was utilized by other fishers. "On one occasion there were found in the stomach of an angler nearly three quarters of a hundred herrings; and so little had they suffered change that they were sold by the fisherman in the market without any suspicion in the buyer of the manner in which they had been obtained. In another instance there were taken from the stomach twenty-one flounders and a dory, all of them of sufficient size and sufficiently uninjured to make a good appearance in the market where they were sold." Still more apt evidence of the slowness of digestion has been given by James T. Linsley (1844). A large angler (3 ft. 8 in. long), caught near Bridgeport, Conn., "continued alive out of water about 24 hours," and when cut open, Linsley "took from its stomach subsequently, a large half pail-full of fishes, of various species, such as tom-cods, cunners, bass-fry, etc.; of the latter, some were as perfect as when swallowed, notwithstanding the lapse of time mentioned."

VI

Of all the remarkable characteristics of the angler, perhaps the most remarkable are the manner in which the eggs of the female are consigned to the waves and the subsequent development and metamorphosis of the young. As much as 22 or 23 centuries ago, at least, the manner of oviposition was known to Greek fishermen and briefly noticed by Aristotle.

Leaving aside his irrelative and speculative remarks, he declared that the sea frog lays its eggs in a bunch near the shore. Not until quite recently was more information communicated, and then in a land unknown to the Greek philosopher.

About the end of summer the fishes seek shallower water and the inhabitants of the depths advance upwards; the sexes must then consort together, but in what manner and what rites of marriage are performed is unknown; the result, however, is, that about the time indicated "the fishermen on the New England coast often notice a substance floating on the water, which they term 'a purple veil,' the precise nature of which has caused much speculation on their part, and which answers singularly well to its designation." S. F. Baird, in 1871, became interested in the accounts he heard and sought to determine the origin of the "purple veil." He found one "which presented the appearance of a continuous sheet of a purplish brown

color, 20 or 30 feet in length, and 4 or 5 in width, composed of a mucous substance which was perfectly transparent, to which, as a whole, a purple color was imparted by the presence of specks distributed uniformly throughout the mass to the number of about

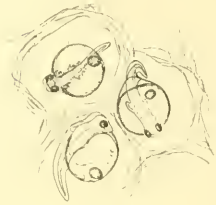


FIG. 96.—Three eggs embedded in the gelatinous membrane in which they are laid; magnified. (After A. Agassiz.)

thirty or more to the square inch." The little specks were embryonic fishes "moving vigorously in their envelope, but without any appreciable latitude of motion, or change of relative position to each other." Baird could not identify the little fishes but it happened that Alexander Agassiz had shortly before observed and investigated the veil with its contents and determined it to be the product of the angler. In 1882 Agassiz published the results of his investigations and a remarkable history was disclosed, which has been supplemented by the more recent observations of Prince, McIntosh and Masterman.

The "violet veil," in fact, is a great communistic cradle for the large family of a single mother angler. It is, according to Agassiz, "an immense ribbon-shaped mucous band, from two to three," or it may be five, "feet broad, and from twenty-five to thirty feet," or even, according to Prince, thirty-six feet long. "It looks at a short distance like an immense crape. The mucus is of a light violet gray color and the dark black pigment spots of the young *Lophius*, still in the egg, give to the mass a somewhat blackish appearance. The eggs are laid in a single irregular layer through the mass, usually well separated by the mucus in which they float." The color of the veil must vary from light when first issuing from the mother *Lophius* to dark when the eyes of the larvæ have become conspicuous. The eggs may be as many as a million or more. (Thompson estimated 1,420,000 and Fulton, 1,345,848.) Each egg is about a twelfth of an inch or two millimeters in diameter. Thus the earliest stages of development are passed and when the larva has burst its shell envelope it immediately leaves the veil and begins life free on the surface of the sea.

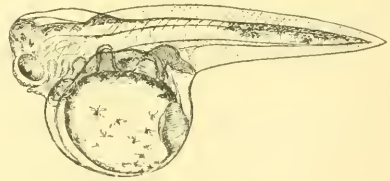


FIG. 97.—Young angler taken out of the egg just previous to hatching. (After A. Agassiz.)

The newly hatched young, as Agassiz well says, "it would be difficult to recognize" as the embryo of the angler. It would, indeed, be impossible to do so without extraneous information. It is an elongated, mouthless and almost shapeless being with the yolk still forming nearly half its bulk and with simply a continuous fin fold.



FIG. 98.—Young angler not long after hatching; the yolkbag has entirely disappeared. (After A. Agassiz.)

About a week later it has obtained a mouth, a dorsal ray has been evolved, and long spatula-like ventrals as well as short broad pectorals have been developed.

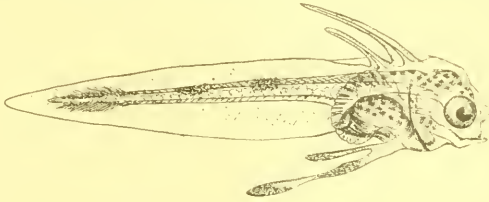


FIG. 99.—Young angler with 2 elongated dorsal rays and rudiment of third, and 2 large ventral rays. (After A. Agassiz.)

In about a fortnight or little more a second dorsal ray has become manifest, the pectorals have developed incipient rays, and the ventrals show two rays.

At a considerably later period the early form is still retained but the head is more pronounced, the mouth and jaws better defined, and

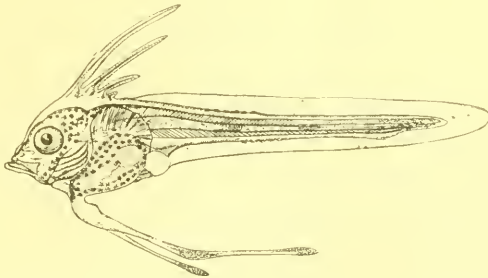


FIG. 100.—Young angler showing still greater increase in length and number of anterior dorsal and ventral rays. (After A. Agassiz.)

the four distinct dorsal rays over and behind the head are manifest; the two ventral rays have become longer. There is an indication in

the lower fold of the future caudal and where the notochord is to be tilted up.

Later still the continuous fold has been broken up and distinct rayed dorsal and anal fins are developed, but the caudal is "hetero-



FIG. 101.—Young angler in oldest pelagic stage measuring 30 millimeters in length, seen in profile. (After A. Agassiz.)

cercal." The anterior dorsal has been increased by a short ray in front and another behind and all are more elongated and ray-like than in earlier stages. The pectorals have become well developed and the ventrals enormously elongated so that, when seen swimming from above the little fish reminds us of a long-tailed butterfly.



FIG. 102.—Young angler of oldest pelagic stage seen from above. (After A. Agassiz.)

When the angler has reached this stage, it has become a respectable fish. It does not, indeed, look at all like its mother but nevertheless an ichthyologist, perfectly familiar with the fishes of the North Atlantic, would have no difficulty in recognizing it as the young of the angler. The numbers of rays, and more especially the six nearly or quite free anterior dorsal rays, are characteristic and distinguish the fish from all others. The condition and mode of development of these free rays are indeed noteworthy on account of their early appearance, inasmuch as the anglers are not in other respects radically differentiated from other families of pediculate fishes.

Development still goes on and the caudal fin becomes homocercal, the other fins still better defined. The head grows disproportionately, the ventral fins become much reduced and the pectorals less so, the foremost dorsal spine grows out beyond all the others and the second to sixth, arrested in development, are much shorter, and the four median caudal rays become forked. A regular fully developed Angler is the outcome.

The next noteworthy stage in development is in the way of perfecting the fins, especially the rays, and the isolation of the three foremost dorsal rays and their advance forwards so that the first arises from the snout. The tag-like appendages are concurrently developed along the sides of the body, the edges of the lower jaw and opercular apparatus, and the dorsal spines. By this time the

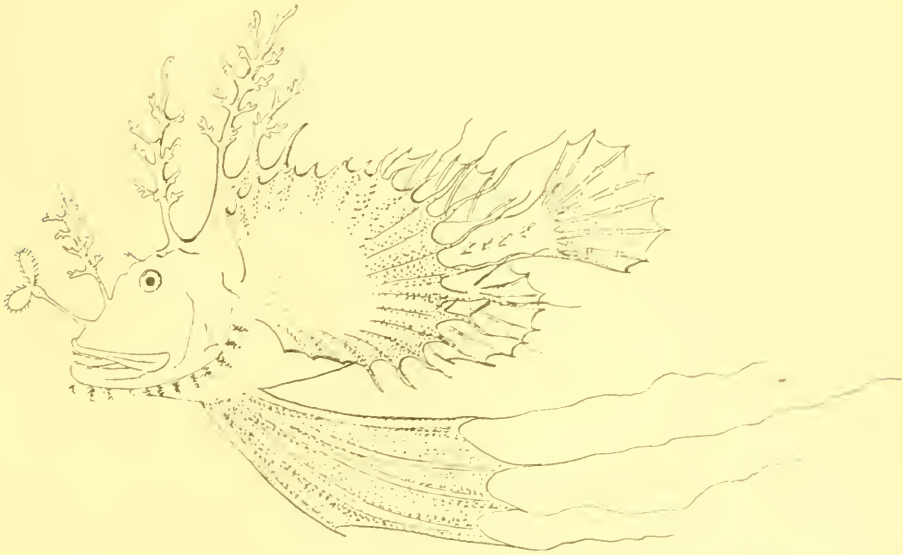


FIG. 103.—Young angler with most of the characteristics of adults but larger pectorals and ventrals, and less flattened head. (After Ruppell.)

little angler is two or three inches long. The ventrals are still very long but all the rays are developed and the head and body have not yet assumed the much depressed form characteristic of the adult.

When the young fall to the bottom they are supposed "to frequent rocky algæ-covered ground where they can have a shelter and also suitable food." Few are ever taken by the dredge or trawl even in ground where the old are abundant. It is only when they become older that most of them leave such secluded nooks and come out into the open.

The growth of the angler has been especially studied by T. Wemyss Fulton (1903) based on the examination of large series. When six months old, the "mean" length is $6\frac{3}{8}$ inches ($5-8\frac{3}{4}$), when "1 year and 6 months," it is $12\frac{1}{2}$ inches ($9-15\frac{1}{8}$), and "when 2 years and 6 months," it is $18-18\frac{1}{2}$ inches ($14\frac{1}{2}-21-22$).

"When 3 years old, supposing a little less than the same rate of

increase continues—and in fishes growth is not usually much reduced in rapidity before the period of maturity is reached—the angler will measure approximately 21 inches in length, and when 4 years old about 26 or 27 inches. The information as to the size at which maturity is first attained is not extensive, but males may be found ripe at the size stated. Females probably do not become mature as a rule until over 30 inches in length, and the facts point to the males first reaching maturity when 4 years of age and the females when 5 years.”

As such an angler, it passes its life, year after year. It becomes “a huge unshapely creature, and is of a soft, gelatinous, and flaccid consistence. Its mouth is enormous,” and its “antipathy to action is strangely contrasted with the enormity of its appetite, to satisfy which it has recourse to stratagem in the capture of its prey.”

VII

The angler is not usually ranked among food-fishes and is generally unceremoniously rejected; nevertheless it is said to furnish excellent meat. According to Donovan (1808), “the flesh of this fish is white, and having, it is said, the same flavor as the common frog, is eaten in many countries as a delicacy.” Couch (1863) reported that it “is a delicious dish.” In Scotland, Parnell long ago (1839) had declared that “the flesh is considered good, especially near the tail,” and McIntosh and Masterman (1897) state that “it comes under the category of a food-fish and is treated in a similar way to the wolf-fish. The head is cut off and only the trunk is sent into the market. This is sold under the name of ‘croan’ and sometimes of john dory, a name that of right belongs to a very different fish.”

In Massachusetts, where it is most frequently caught, according to Storer (1855), “no use is made of this fish, as its liver contains but little if any oil; and its flesh has no fat. This,” he thought, “is a singular fact, as most, if not all, other fish have either fat in their livers or in their flesh.” But although not eaten now, it was by the aboriginal Americans, as is evidenced by the discovery by Wyman (1868) of osseous remains in a shell-heap in Maine (Crouch’s cove).

A singular superstition is entertained in some parts of Sweden (Bohuslan) according to Malm and Smitt. “It is so feared by many that the tackle is cut as soon as the ‘monster’ reaches the surface; and its captor hurries home in order to get there, if possible, *before the misfortune portended by the monster overtakes him.*” The extreme of misfortune—death—is believed by some to be indicated. Nilsson tells that the Swedish fishermen on the banks “believe that

on board the vessel on which an angler is taken, some one is *leg. i. e.*, doomed to die soon. They therefore never or hardly ever take the angler on board, but prefer to cut the line and thus lose the hook with the fish."

An anemometrical faculty is attributed to the angler in Massachusetts. According to Storer, "among the fishermen in some parts of the bay, there is a common saying, 'when you take a goose-fish, look out for an easterly storm.'"

VIII. RELATIONS OF THE ANGLER

Although the angler is the only species of its family in northern seas, quite a number are found elsewhere, and especially in deep seas.

The most primitive genus, if we may take the position of the branchial apertures for our guide, is *Chirolophius*. This has, as C. T. Regan has recently (1903) shown, the "gill openings partly below, partly in front of and above the pectorals." So far as known the vertebræ are only 19 or thereabouts. The typical species, *C. naresii*, was made known from a specimen "taken at the Philippines at a depth of 115 fathoms." Other species are the *C. moseleyi*, *C. murrayi*, and probably *C. gracilimanus*, *C. mutilus*, and *C. lugubris*, all inhabiting the depths of the Indian and neighboring oceans. Another Lophiid found off the coast of Central America is also supposed to belong to the same genus and designated *C. spilurus*.

A genus agreeing with *Chirolophius* in the number of vertebræ (19) but having the gill openings below or behind the bases of the pectorals, as in *Lophius*, is *Lophiomus* which is now limited to a single species—*L. setigerus*, occurring in moderately deep water from Japan to the Cape of Good Hope.

The genus *Lophius* still includes, besides the common angler, *L. piscatorius*, a species as yet found only in the Mediterranean sea, *L. budegassa*, and two others. One is the *L. litulon* which has been found along the coasts of Japan and extends further northward than the *Lophiomus setigerus*; another has recently (1903) been described as *L. vaillanti* of which specimens were found in the Atlantic around "the Azores and Cape Verde islands at depths of 460-760 meters."

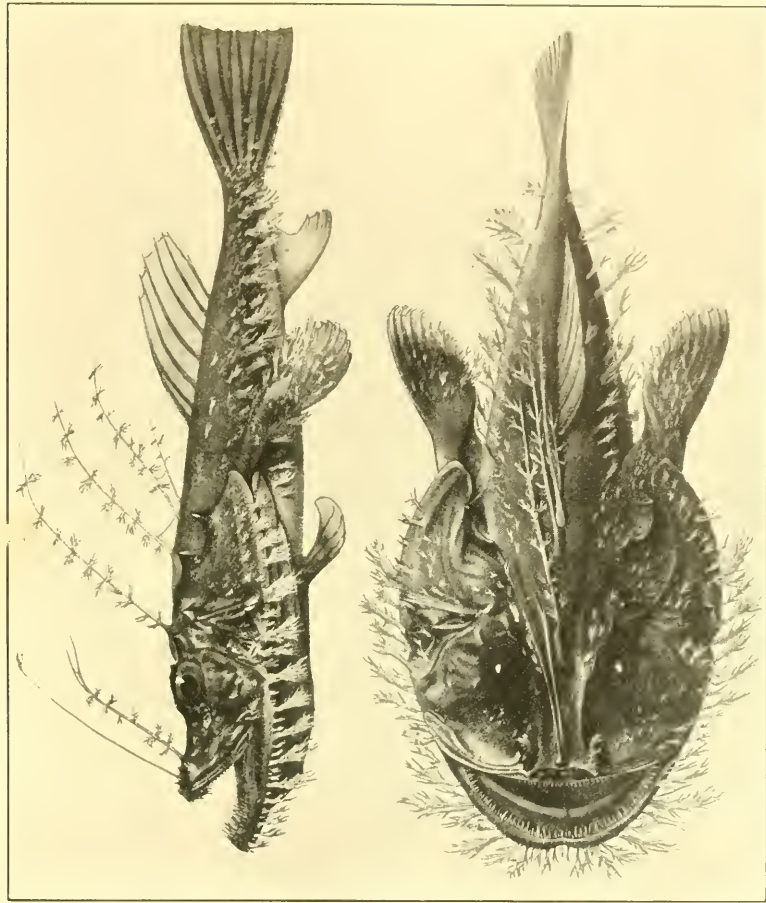
A Lophiid said to have no vomerine teeth and consequently regarded by some as a distinct genus—*Lophiopsis*—is retained in *Lophius* by Regan.

Of the extinct relatives of the angler little is known. No remains have been found in the pliocene or eocene formations but in an upper eocene bed of Monte Bolca (Italy) an imperfect fossilized body of a species was obtained more than a century ago and con-

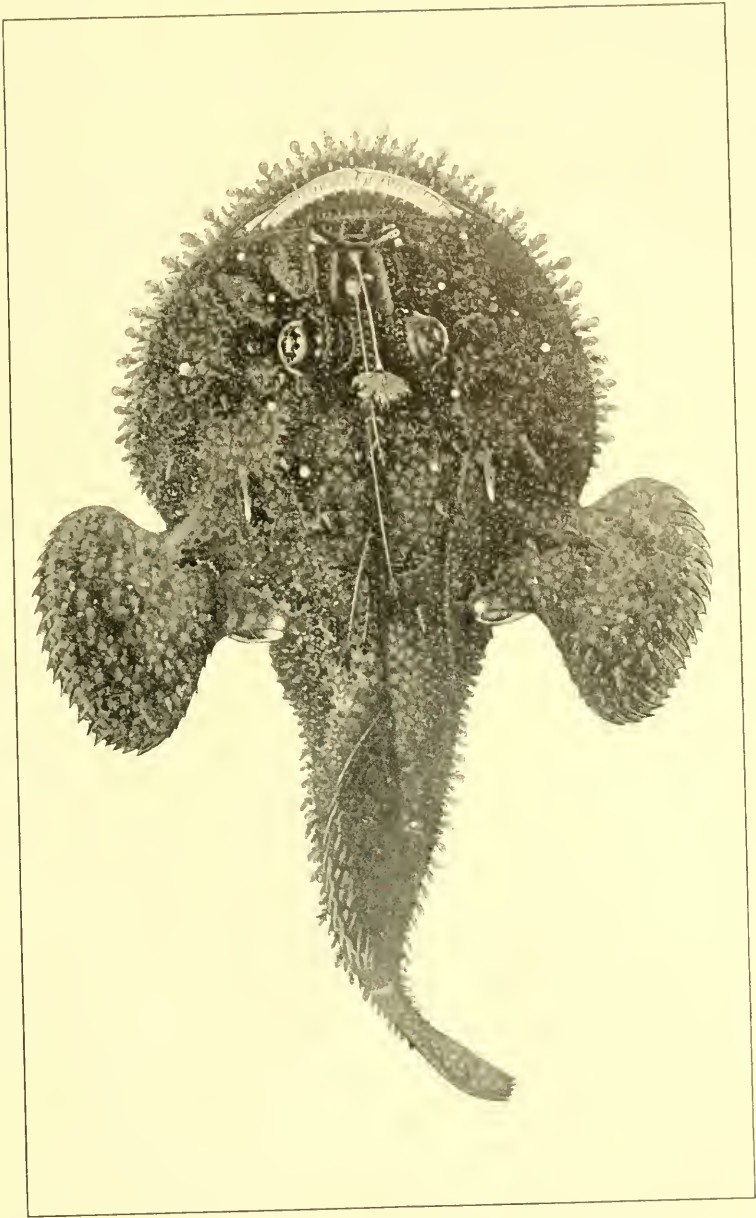
sidered by Volta to belong to the recent *Lophius piscatorius*; later (1835) it was named by Agassiz as a new species of *Lophius* (*L. brachysomus*). As A. S. Woodward (1901) has remarked, "it seems to be rightly placed here." It is probably otherwise with the so-called *Lophius patagonicus* named by Ameghino (1899). This was based upon teeth from a Patagonian bed supposed to be of cretaceous age.

IX

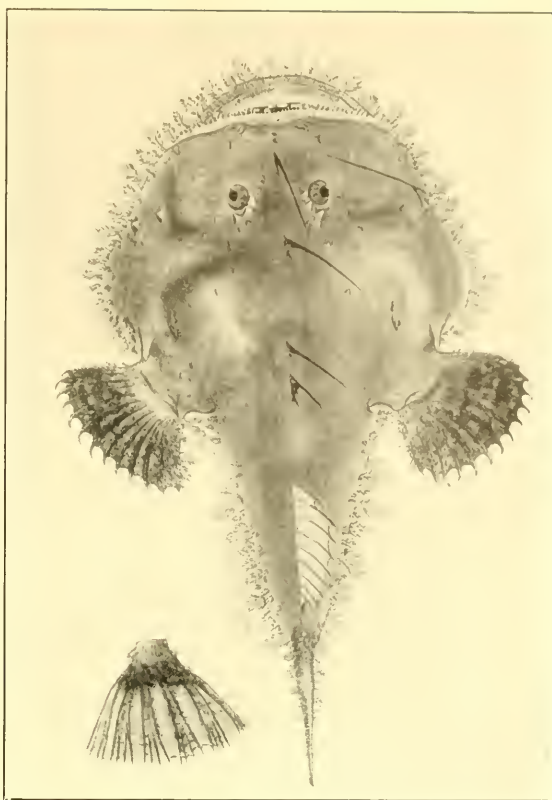
The nearest relations of the Anglers—the Antennariids—differ very decidedly in being compressed rather than depressed. This difference might lead the observer to assume that the shape of the head was equally different, but such is not the case, and the characteristic is chiefly superficial. The difference may be compared to that between an old-fashioned table with two folding sides, open and closed. The Angler is analogous to the table with the sides upraised and level with the middle; the Antennariid, to the table with the sides inclined to right angles with the middle. The cranium is essentially similar in both and the difference in physiognomy is the resultant of the spreading outwards of the opercular and other lateral bones in one form (the Angler), and the folding downwards or compression of the corresponding elements in the other (the Antennariid). While such are the facts, however, there are nevertheless many minor characteristics or details of structure which are associated with the ones noted and which demonstrate the natural character of each group.



Chirolophus naresii. (Alter A. Günther)



The Common Angler (*Lophius piscatorius*). (After W. von Wright in Smitt)



The Chinese Angler (*Lophiomus setigerus*). (After Temminck and Schlegel)



An Antennariid (*Pterophryne histrio*) with a compressed head. (After C. Erdmann in Smitt)