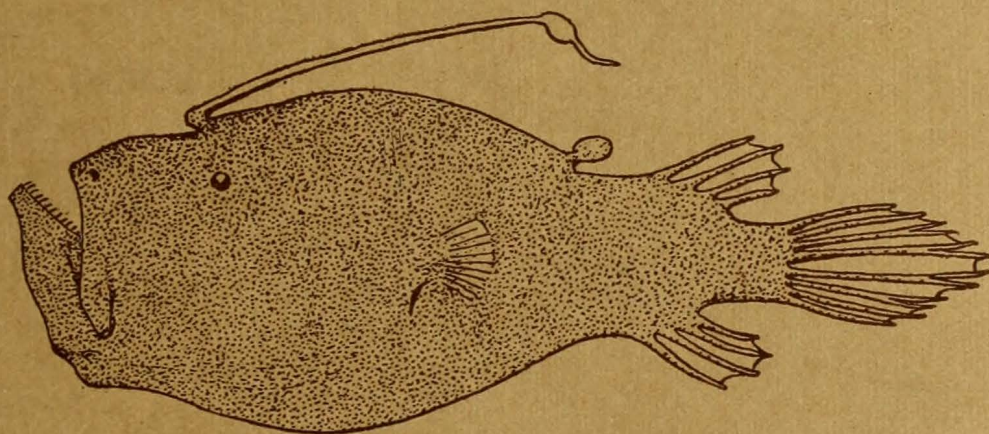


THE AMERICAN MUSEUM OF NATURAL HISTORY

DEEP SEA FISHES

BY

LOUIS HUSSAKOF

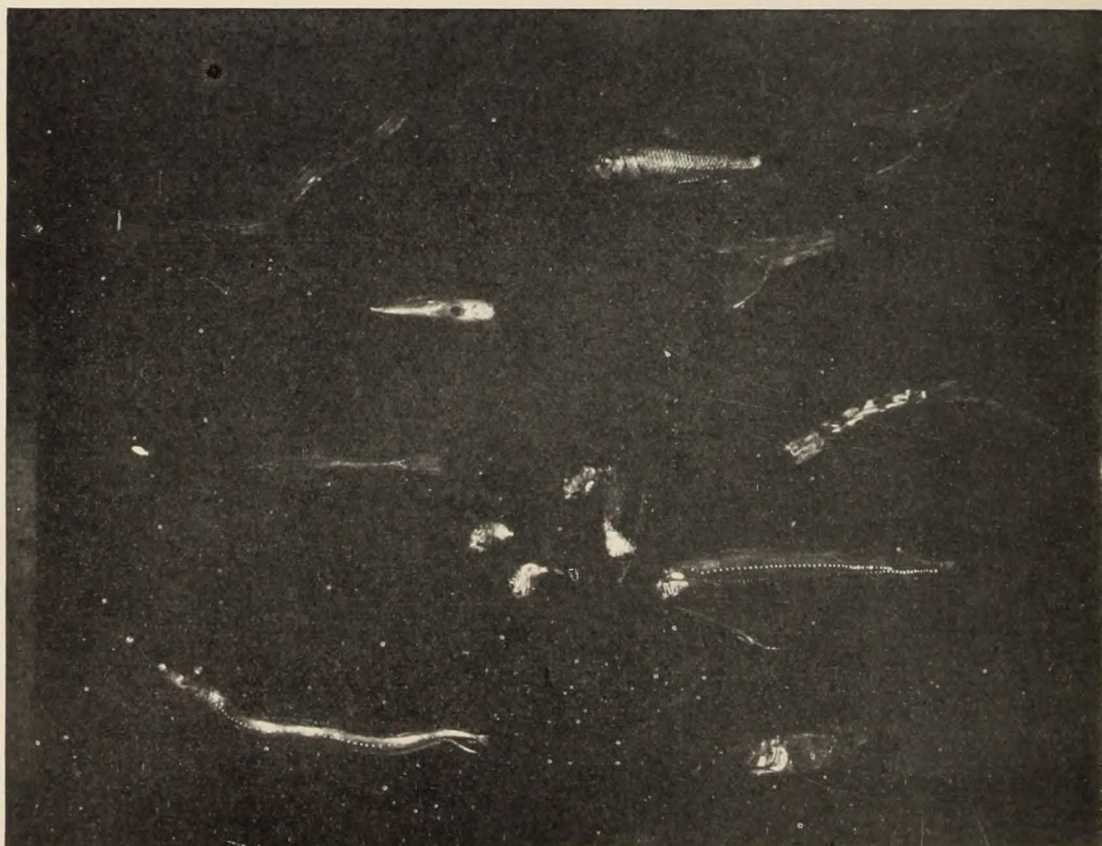
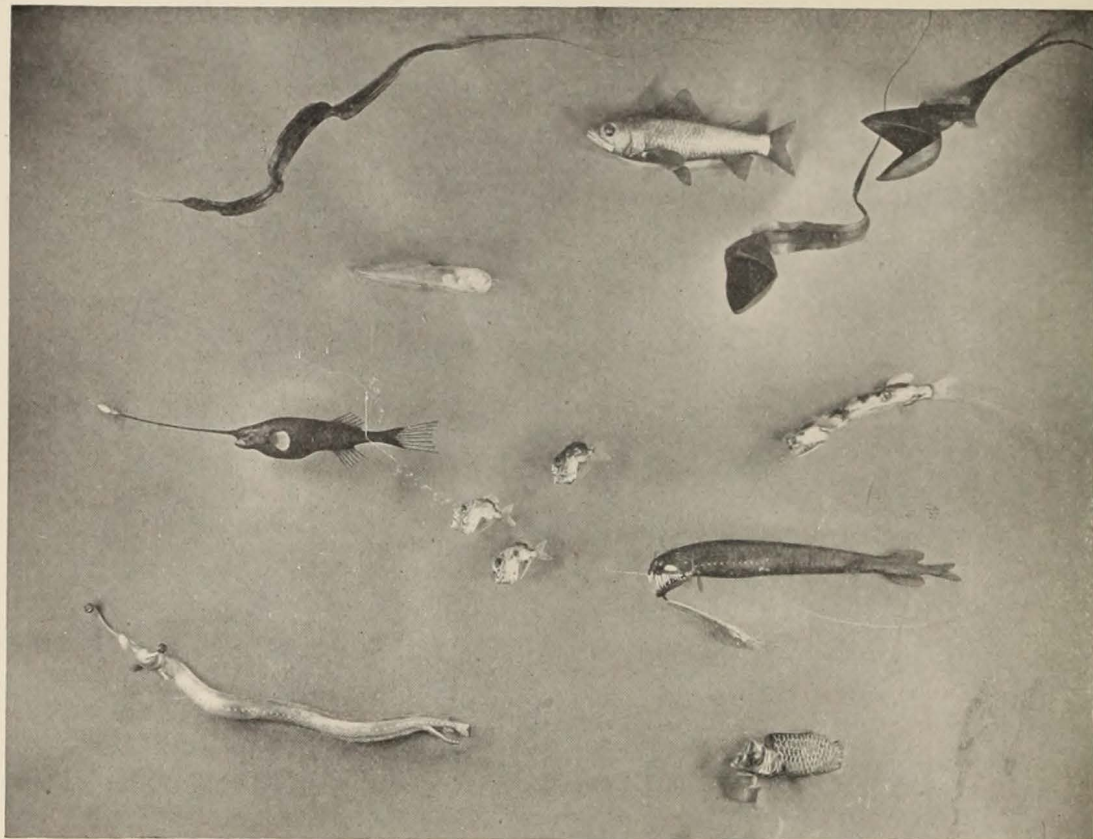


92-67

New York, 1925

Third Edition

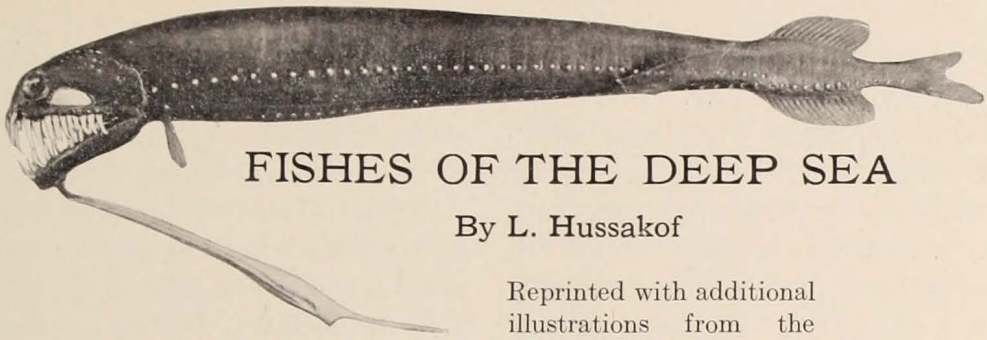
Reprinted from the AMERICAN MUSEUM JOURNAL



SOME DEEP-SEA FISHES

Some characteristic types of fishes found in the profound depths of the sea, half a mile or more from the surface, photographed from a group installed in the hall of fishes in the American Museum. The illumination of the group is so adjusted that the fishes are seen first for a few seconds in full light, and then in darkness as they are supposed to appear in the sea, lit up only by their own phosphorescent organs.

The specimens are models, mostly enlarged several times the natural size. The fishes were prepared by Mr. F. F. Horter of the Museum's department of taxidermy, under the direction of Dr. L. Hussakof.



FISHES OF THE DEEP SEA

By L. Hussakof

Reprinted with additional
illustrations from the
American Museum Journal for 1915, Vol. XV, pages 248-253.

UP to the time of the "Challenger" expedition, very little was known regarding the fish life of the abyssal depths of the sea. Only about thirty species were known. But the wonderful collections brought back by the "Challenger" from her four-year cruise (1873-1876) made known the vast diversity, the strangeness and even weirdness of this fish fauna. Several hundred kinds of deep-sea fishes had been collected—some of them dredged from a depth of more than a mile—and it required a huge quarto¹ to describe and picture them. From this volume dates our real knowledge of the fishes of the abyssal deep. The "Challenger" expedition was, indeed, a "Columbus voyage" in ichthyology; it opened a new chapter in the history of the science.

Since that time many deep-sea exploring expeditions have been sent out by the various nations, and hosts of other fishes have been brought up from the oceans in all parts of the world. More than a thousand species are now known, and we can appreciate at its full value the richness and strangeness of this fauna. A large proportion of these fishes are described and figured in two quarto volumes by G. Brown Goode and Tarleton H. Bean, entitled *Oceanic Ichthyology*, published by the U. S. National Museum. Moreover, not only do we know the fishes themselves,

but as a result of the scientific investigations carried on by the various expeditions, we now know a good deal of the physical conditions under which they live, so that we can, in a measure at least, explain the why and wherefore of their extraordinary characteristics.

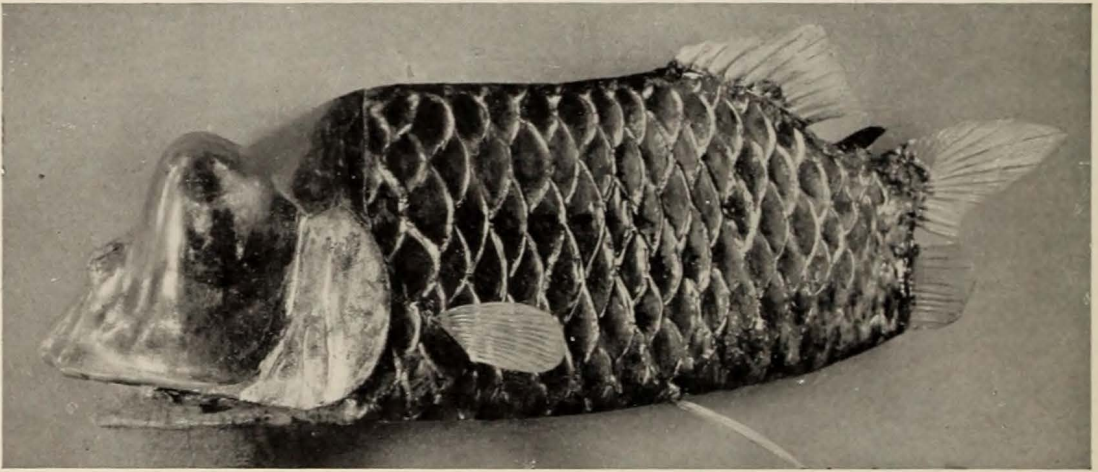
When we think of life in the deep sea, there comes to mind, first of all, the enormous pressure which these creatures must withstand. This pressure becomes the greater the deeper we go down, and in the profoundest depths it equals thousands of pounds to the square inch. The result of this pressure is that the tissues of these fishes are tender and loosely knitted together. When they are brought up out of the dark depths, and the great pressure under which they live is removed, the explosion of the gases within them bulges out the eyes, and often blows out the viscera through the mouth, while the muscles collapse, leaving them soft and flabby like moist rags. Most deep-sea fishes are very small also, usually only a few inches in length, and it is probable that this reduction in size has come about to some extent at least, from the great pressure under which they live.

Another important condition is the dimness of light, or even darkness in the profound depths of the sea. If we imagine ourselves descending into the deep ocean, we see the light grow dimmer and dimmer as we go down, until

¹Challenger Reports, Vol. XXII, 1887.

finally a level is reached beyond which no light penetrates at all. The entire avst depth below it is in eternal darkness. Now the fishes living in this dim light, or in total darkness, have been profoundly modified by it. In some forms the eyes have become very small, and in some cases have entirely disappeared. There are even fishes in which the skin and scales of the body

mers, the coating of slime which exudes from the pores and lateral canals emitting a soft silvery glow. In others, rows of minute, luminous organs run along the sides of the body, or there are flashing light-spots on the head or face. What a wonderful sight would be to us a small black fish flitting through the silence and darkness of the deep with its headlights and row of pores gleam-



In this deep-sea fish the head glows with a soft pale light, while the body is quite dark, being covered with large opaque scales. The species (*Opisthoproctus soleatus*) is known by only two examples dredged from a depth of two and a half miles; one off the northern, and the other off the western coast of Africa

This specimen is not shown in the general photograph of the group, having been cut out for convenience in reproduction. It is situated in the group below the bottom fish on the right-hand side

have grown over the place where the eyes should be, so that these fishes are, as has been aptly said, "blind beyond redemption." Other forms, on the other hand, have been affected in an entirely different way. The eyes, instead of growing smaller, have grown larger, as if in an attempt to catch every fleeting ray of light. In some fishes this has been carried so far that the eyes have become like enormous goggles.

Most deep-sea fishes have luminous organs of one kind or another, so that they carry their own light about with them. In some the entire body glim-

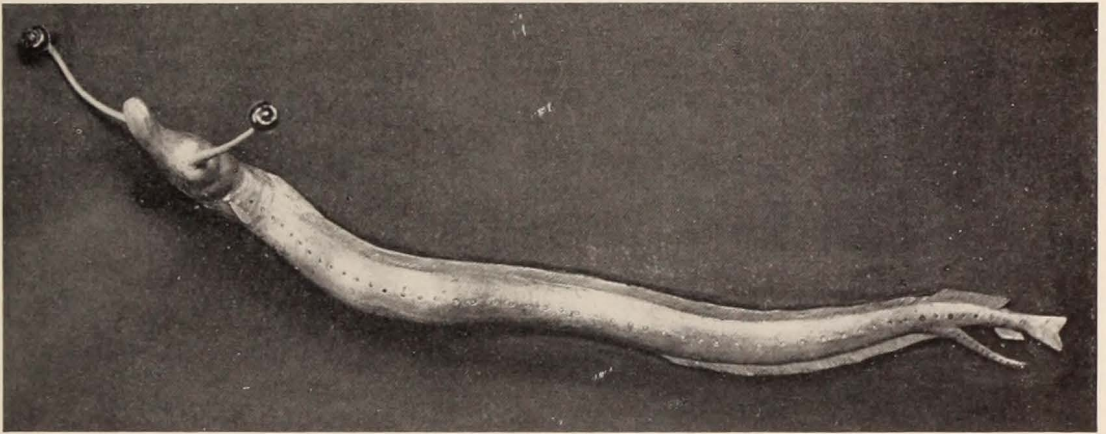
ing through the darkness like some small ship passing through the night with its portholes all aglow! Some deep-sea fishes have a luminous organ at the end of a feeler on the head. This is waved to and fro to act as a lure to attract the prey.

A pertinent question may be asked: How do we know these fishes glow and glimmer, since no human eye has ever beheld them in their abyssal home? We know this partly from analogy and partly from actual observation. When one is in a boat in the tropics, on one of those sultry nights when everything is a dead calm, and the black clouds hang

so low that sky and sea form one continuous blackness, then one may see the glimmering fishes darting out of the path of the boat, their forms, silvery and ghostlike, outlined for one moment against the blackness of the sea. This effect is chiefly due to the oxidizing of the slimy secretion covering their bodies. Why shall we not believe, then, that in deep-sea fishes a similar phenomenon takes place, particularly as in many of them, the slime pores and canals are greatly developed and must exude large quantities of slime? Then

ference, as well as by actual observation, we must believe that what we call luminous organs in deep-sea fishes, emit light into the darkness about them. In the case of fishes totally blind, the absence of light is compensated for by the development of enormous antennæ-like feelers, modified from fin rays, so that these fishes can feel their way, as it were, through the darkness.

The absence of light however entails another important consequence. As is well known, no plant life can exist in darkness. There is, therefore, no vege-



A small, silvery, eel-like fish which has been found in all the oceans at depths ranging from a little less than a mile to two and one-half miles. It has a row of luminous pores running the length of the body; and, in the blackness of the profound depths it must appear like a miniature long dark boat with gleaming portholes. Its greenish, glittering eyes are perched on the ends of slender, hornlike tentacles—a feature which has suggested its scientific name, *Stylophthalmus paradoxus*

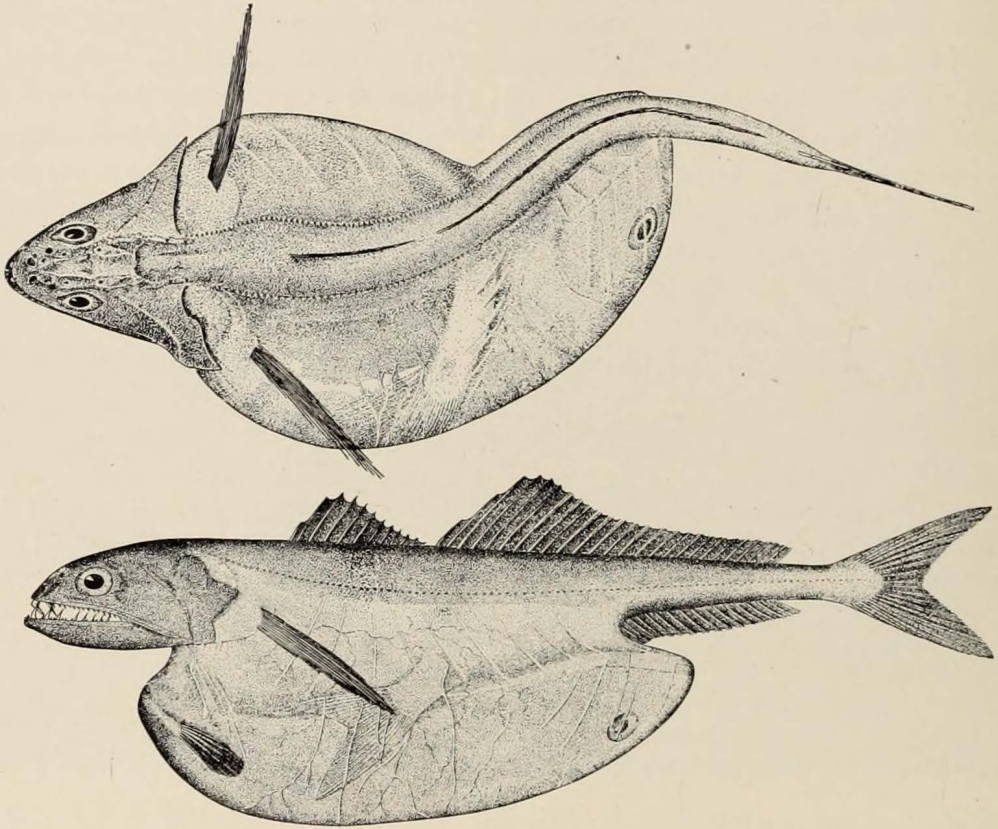
too, on deep-sea expeditions, on favorable occasions, as for instance, a dark calm night, fishes that have been brought to the surface and placed in water were seen to flash light from the ends of the tentacles or the phosphorescent pores, precisely as we should have expected from a study of these organs. Major Alcock, in his interesting volume *A Naturalist in Indian Seas*, mentions a specimen brought up from a profound depth which “glimmered like a ghost as it lay dead at the bottom of the pail of turbid sea-water.” So that by in-

tation of any kind in the profound depths of the sea. The deep-sea fishes are, in consequence, all carnivorous, the more powerful ones seizing and devouring the weaker ones. It is a cold black world where might reigns supreme. Many have enormous mouths, and formidable teeth to insure holding the prey. In some forms the teeth are so large that the mouth cannot be shut! Moreover, since meals are performed far between, they must be as large as possible; hence many forms have extraordinarily capacious stomachs. Speci-

mens have been dredged from the deep which were enormously distended through having swallowed fishes larger than themselves.

The temperature of the water in the profound depths of the sea is always

When we think of the vast diversity among these fishes, the question arises: Are they all representatives of a single family, or group, that has become specially adapted to life in the deep sea; or do they belong to different families



CHIASMODON

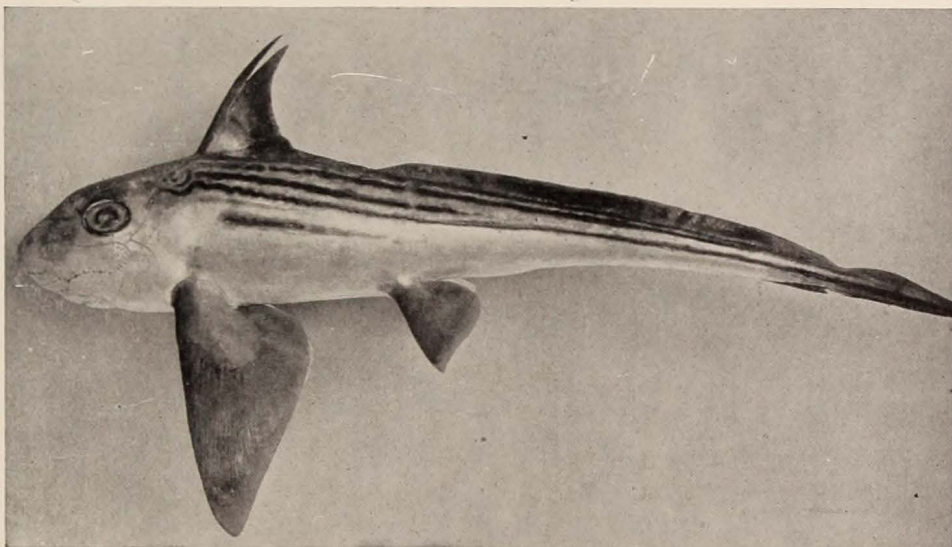
A fish that swallows fishes larger than itself; the original of this picture was nine inches long and had caught a fish eleven inches long

low and near the freezing point. This is true everywhere, even at the equator. Undoubtedly this has an effect upon the fishes, although it is not yet known what it is. The amount of oxygen dissolved in the water also, is much less than in water nearer the surface. The breathing apparatus of the deep-sea fishes is modified to suit these peculiar conditions. The gill filaments have become much reduced in size, and in a number of instances some of the gill-arches bear no gill filaments at all. The fishes are apparently adapted to a much smaller oxygen supply than those living in rivers or in the shallow sea.

or groups? One need hardly be an ichthyologist to answer this question. Even a cursory examination of the plates in a work on deep-sea fishes will show that different types are represented. In fact, a great many families are included in the deep-sea fauna. There are sharks and rays; salmonoids, herrings, perches, eels, and representatives of many other families. We can explain this heterogeneity among them in this way: we may imagine that fishes of many different kinds in their search, so to speak, for the unoccupied corners of the sea, found a haven in these deeper waters where they were

free from pursuit by their enemies. In the course of time they migrated farther and farther into the deep, a change in habits taking place *pari passu* with the changes in structure. Having started out with different degrees of variability, they became differentiated in diverse directions, so that while some developed enormous mouths, powerful teeth, or phosphorescent organs, others became bottom-living and partly or completely lost their eyes. Still others developed long feelers for groping their way through

the habitat groups displayed in the Museum; it is not a section, so to speak, taken from nature and transplanted to the Museum. In nature so many deep-sea fishes are not to be found in so small a space. What the group represents is a number of fishes which are in nature scattered over a vast area and through a great height of water, here brought together for museum purposes into a few square feet of space. Each fish is reproduced accurately with its phosphorescent pores and tentacles as these are known



CHIMAERA A DEEP SEA "SILVER SHARK"

the darkness. Now and again, however, fishes of separate groups developed similar structures, so that there are many striking cases among deep-sea fishes of what the biologist calls "convergence," or parallelism.

A group comprising ten noteworthy examples of deep-sea fishes forms part of the exhibit of the Department of Fishes and may be found in the north corridor, second floor, by the Paddlefish group. It was prepared by F. F. Horter and is the result of long and patient work and great ingenuity in overcoming difficulties. It is not, of course, a group in the sense of

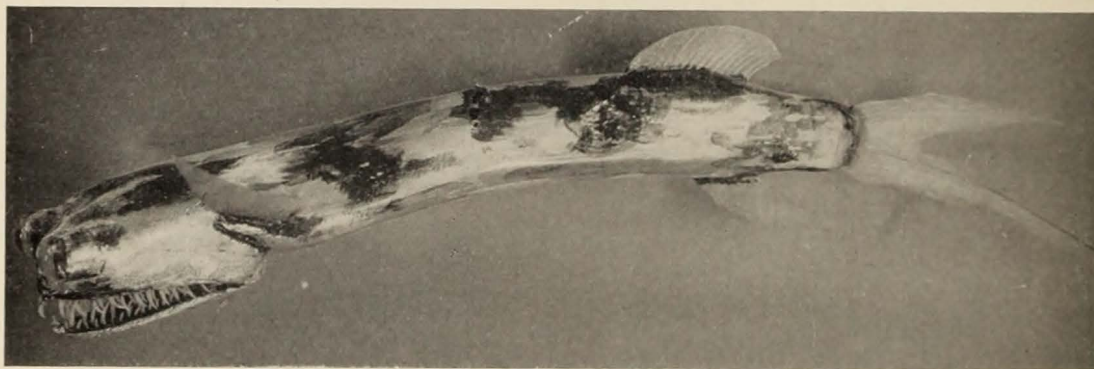
to exist. With one or two exceptions they are enlarged several times, as the fishes themselves are very small. And since it is known that the phosphorescent organs do not glow with a steady light, the illumination of the group has been arranged so as to have these luminous organs flash intermittently. Furthermore, the installation is arranged so that one may view the fishes for a few seconds in full light, as if in a synoptic exhibit, and then see them, when the light goes out, as they are supposed to appear in the darkness of the profound depths, lit up only by their own phosphorescent organs.

Near the top of the group is seen a fish which lives on the border line between the region of dimness and total darkness. Many of the fishes living in this region are not of a uniform sombre hue, but are brilliantly colored. *Neoscopeilus* is one of these. The body is "one dazzling sheen of purple and silver and burnished gold, amid which is a sparkling constellation of luminous organs" (Alcock).

The glowing fish in the center is *Barathronus diaphanus*, a small fish

a specimen in the Museum. The species occurs in the Atlantic Ocean, near the American coast, in the path of ocean liners. Specimens have been dredged from a depth of nearly three miles.

Near the bottom of the group at the left-hand side, is seen an eel-like fish with a line of lit-up pores. This is an enlarged model of *Stylophthalmus paradoxus*, a small silvery fish widely distributed in all the oceans, whose young also are known. The generic name it bears was given it in allusion to the fact



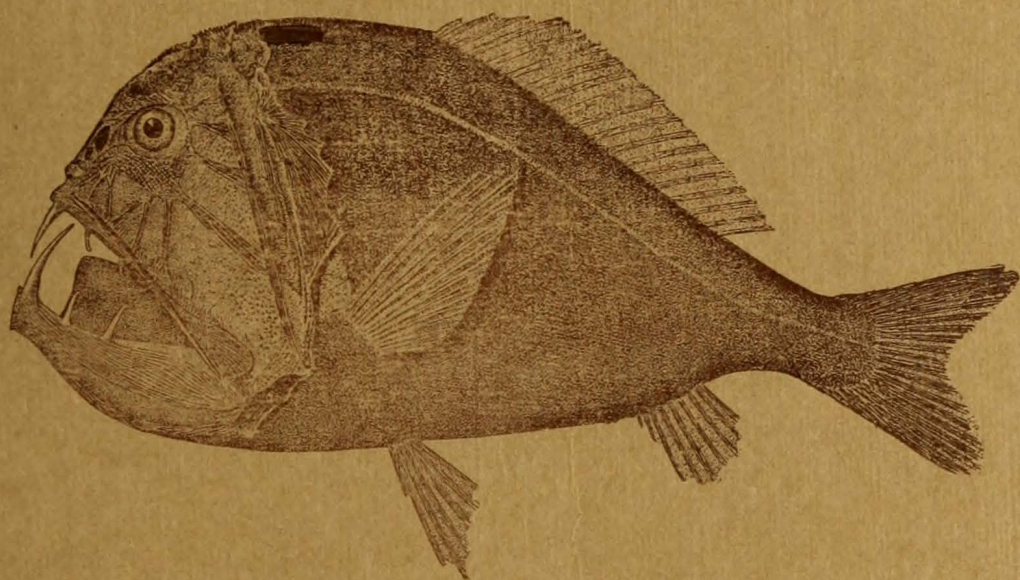
This strange deep-sea fish (*Gigantura chuni*) is known by only a single specimen dredged from a depth of four-fifths of a mile, in the Gulf of Guinea on the west coast of Africa. The body of the fish is a shimmering glow of iridescence, while the protruding eyes shine like automobile headlights. The formidable teeth mark it as a ferocious carnivore

known from a single specimen, which was dredged in the Indian Ocean at a depth of a little over four-fifths of a mile. The model of it is one and one-half times the natural size. The phosphorescent fish with the curious long tail (at the right) is *Gigantura chuni*. It, also, is known by only a single specimen. This was brought up from a depth of four-fifths of a mile in the Gulf of Guinea, on the west coast of Africa. The model is twice the natural size.

The two dark fishes with enormous gaping mouths (near the top, at the right) are *Gastrostomus bairdi*. This species is commoner than some of the others, a number of specimens being in several museums. The models of it in the group are copied life-size from

that the eyes are perched on long slender tentacles. The species ranges from a depth of a little less than a mile to two and one-half miles. Another form with tentacles is *Gigantactis vanhoeffeni*, a species typical of many deep-sea fishes which have a tentacle, terminating in a luminous organ, attached to the head. This tentacle serves as a lure for attracting prey. The present species is known by only two specimens which were found in the Indian Ocean at a mile and a mile and a half from the surface. The creature is a very small fish, the model being enlarged six times.

Besides this group, enlarged representations of twenty other species are shown in a case at one end of the systematic series of fishes.





FOR THE PEOPLE

FOR EDUCATION

FOR SCIENCE