

MYSTERIES OF THE OCEANS: DEEP-SEA LIFE

Life in the deep, dark, highly-pressurized ocean zones (the abyssal and hadal zones, 1600-20,000 feet below sea level) is often very bizarre. Because food is scarce in this region, creatures living here have evolved unusual shapes and lifestyles to maximize their chances of surviving.

CHAPTER 7



Deep-Sea Fish

IN THE DEEPEST parts of the sea, some of the strangest of all fish are to be found. The strangeness of these fish is directly connected with the environment in which they live. They have had to develop their peculiar traits in order to live in the darkness and the cold of the deep sea.

The region where the strangest deep-sea fish are to be found is in the "abyss" of the ocean, below 200 meters (656 feet) in depth. In the abyss, there is no sunlight, so no plant life can grow. But all living things depend on plant life. The hunting animals of land, sea and air feed upon plant-eating animals—or they feed upon other hunting animals—but at the beginning of the energy chain, there must be plants that are fed directly by air, water, minerals and sunlight.

Then how do the deep-sea creatures survive? Actually,

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Deep-Sea Fish

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They too are fed (indirectly) by the plants far above them. This happens in two ways. First, some organic materials from the plant-rich upper waters drift downward, finally reaching the sunless depths. Second—and more important—many small sea creatures wander up and down, rising to the surface to feed, then swimming far downward to escape from the busy hunters of the surface waters, to hide in the deserted depths. There, these migrating creatures form the main food supply for the deep-sea fish. Even so, the migrants survive better against the deep-sea hunters than they do against the surface hunters.

What are these deep-sea hunters like? To begin with, their meals are few and far between, so they generally have big mouths and very small bodies. The big mouths enable them to gulp large meals. The small bodies mean that since there is not much flesh to feed, they can get by without eating very often.

But there is a penalty for carrying around a big mouth full of teeth on a small, frail body. These deep-sea hunters are slow movers. In fact, they are just the opposite of birds. In order to be able to fly swiftly and lightly, birds have given up teeth and jaws (which are heavy structures) and settled for light beaks.

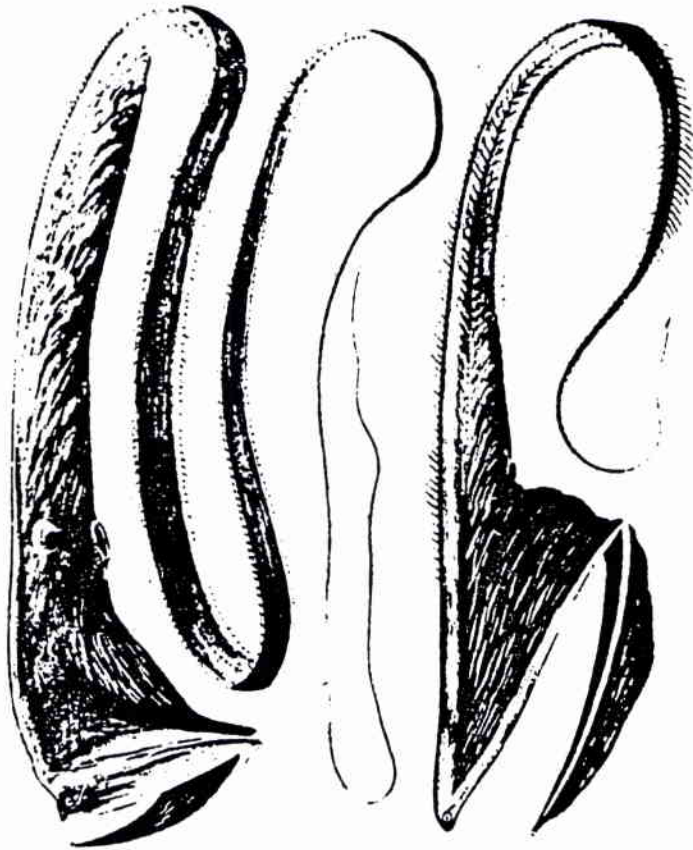
The most dramatic example of the big-mouthed, small-bodied breed of fish is seen in the "gulpers," also known as "pelican eels." The gulpers would be fairly ordinary-looking eels if it were not for their huge sac-like mouths. To see what they would look like without their exaggerated mouths, cover the whole lower sac-like portion of the bottom eel on page 53 with your hand or a sheet of paper. Out pops a trim, ordinary eel shape. This is probably

Water Monsters

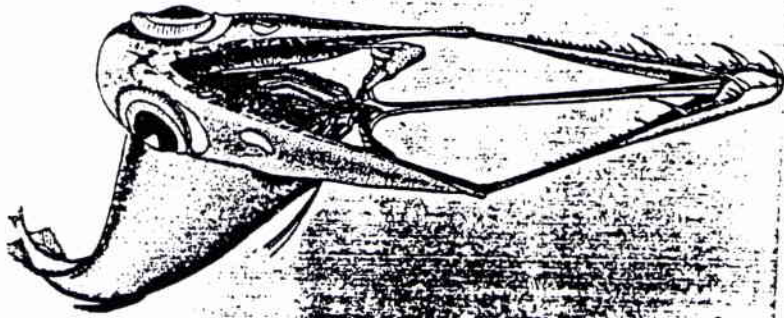
a fairly good picture of some earlier species of eel that lived in shallower waters and was the ancestor to the gulpers. But, as these eels gradually moved into deeper waters, they began to develop their specialized mouths.

The individual eels did nothing to develop their specialized mouths. Rather, in each generation, eels born with slightly larger mouths would survive better than those which did not have the larger mouths. In this way, bit by bit, mouths in the deep-sea eel population kept growing bigger, and the penetration of even greater depths became possible. The survival of certain strains of some animal stock as a result of the conditions of life is known as "natural selection." The idea of natural selection was developed mainly by the great 19th century naturalist, Charles Darwin. Through natural selection, purely accidental changes in some creatures give those creatures advantages enabling them to survive. According to natural selection, the gulpers did not develop big mouths in order to survive in the depths; rather, the gulpers are able to survive in the depths because they happened to develop big mouths.

Other deep-sea fishes have developed other kinds of mouths and, as a result, have survived and prospered in the abyss. The deep-sea anglers, for example, use bait to attract smaller fish into their very toothy jaws. The deep-sea anglers are nightmarish-looking creatures, but they are no bigger than a man's fist. The bait that they use are luminous blobs on the end of long, flimsy stalks that stick up from the angler's snout. The victim is some creature



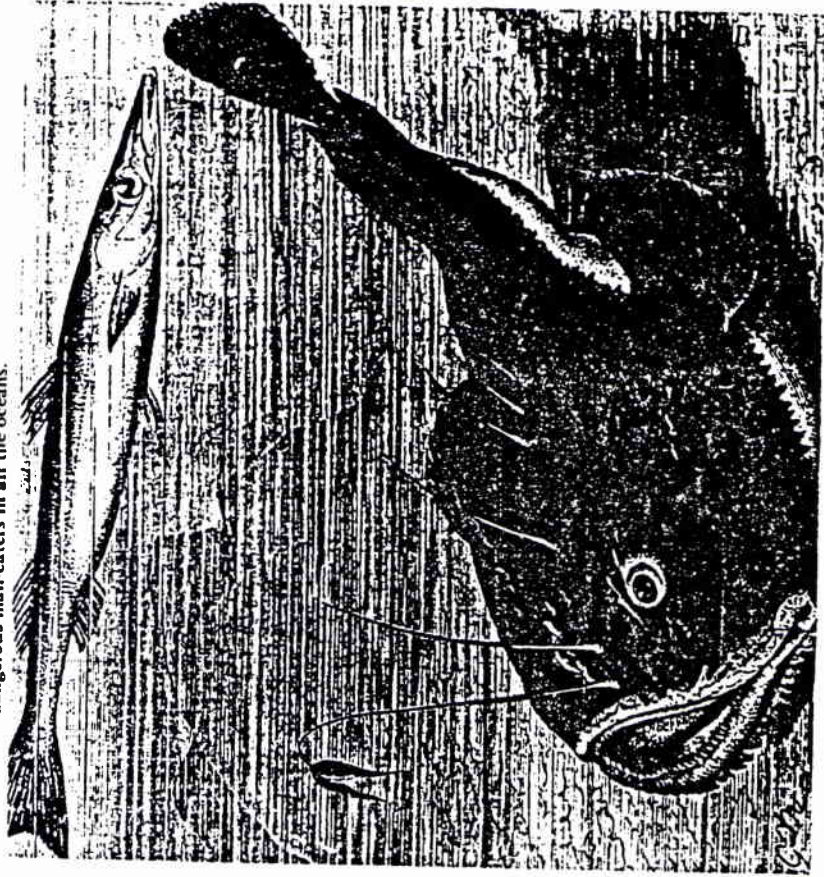
These are two species of gulper eels found in the deep sea. (Bottom) "Eurypharynx" (wide-throat) grows to a length of about two feet. (Top) "Saccopharynx" (sack-throat) is several feet long—the exact length depending on just how far along the tail you measure before you decide you have come to the end of the animal. Gulpers have extremely small eyes and brains for their sizes, and are of extremely low intelligence even for abyssal fish. Their mouths are loose sacks with very little muscular action. The gulper doesn't exactly bite—it wraps its loose mouth around its prey.



This is a view of *Malacosteus* (loosejaw) as it might look to its prey just before the prey is swallowed. When the loosejaw snaps, its jaw goes through a wide, sweeping motion, at great speed. This motion would be slowed by water pressure against the floor of the fish's mouth—if the fish had a floor to its mouth.

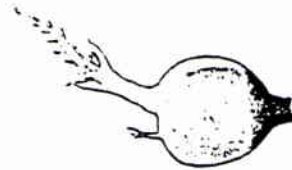
Notice the single strand of muscle running the length of the mouth that operates the jaw. Also notice the teeth halfway down the loosejaw's throat. This fish jerks its head backward at the same time that it makes the ferocious snap of its jaw. The forward end of the backbone of *Malacosteus* is made of cartilage, and bows into an S-shape to make room for all this head motion. The whole terrible, swift machinery of *Malacosteus* is one of the most exaggerated hunting devices in the entire animal kingdom.

A large relative of the deep-sea anglers, the anglerfish (genus name "Lophius") grows to four feet long. Its fishing rod is the first ray of its dorsal fin. *Lophius* lives on the sea floor, in either deep or off-shore waters, half covered by sand. It waits in this camouflaged position with its enormous saclike mouth gaping open and its luminous lure wiggling above to attract smaller fish. *Lophius* also eats crabs, diving birds, and almost anything it can lure into its wide mouth. Sometimes called "goosefish," from its habit of eating wild geese, one angler, caught in the 1800s, had seven wild ducks in its stomach. In the background of the picture is a more ordinary-looking fish, with a jutting jaw. It is a barracuda—one of the most dangerous man-eaters in all the oceans.





Deep Sea Anglers



Deep-sea angler and enlarged view of its phosphorescent lure.



The basket-jawed angler has gone further than most of the other deep-sea anglers in developing its fishing gear. It not only has a fishing "line"—it also has a fishing "rod." The first ray of the dorsal fin has developed into the rod and is eighty per cent as long as the fish itself. This rod can be swivelled to different positions. For instance, the fish can hold the rod straight up instead of pointing it forward as it is doing here. Notice the float, close to the end of the "line," and the luminous lure at the very end. It has another fishing device available—its basket-like upper jaw. This jaw is very loose, with teeth that form a sort of net. (The teeth of the upper jaw obviously do not meet the teeth of the small lower jaw for any biting or chewing action.) When the angler closes its mouth, its loose jaw and its upper teeth act as a net to surround small sea creatures. With its rod and its net, this creature has practically become a fisherman.

that tries to eat the luminous blob, mistaking it for a brightly lit deep-sea shrimp or some other bright deep-sea creature.

Bright lights are common at these sunless depths, and are used for a variety of purposes. Some creatures use them as headlights to find their way through the darkness. Others light up in sudden bursts of brightness, in order to dazzle the eyes of an enemy while they make their escape. Still others use their lights as beacons to signal their mates—which otherwise would have trouble finding them in the utter darkness.

Page 54 (top) shows deep-sea anglers brought to the surface in the trawls of the Dana expedition in the 1920s. The angler's fishing line or "illicitum," growing out of the top of the angler's head, is the first ray of the fish's dorsal fin. But this fin ray has evolved into a new form to carry out a special function.

At the end of the fishing line is the lure, otherwise known as the "esca." The skin of the lure is transparent, and flickering patterns of orange, yellow and blue-green light shine out of it into the water. The lights that flash inside the lure are caused by luminous bacteria. These flashings look like the lights of smaller sea creatures such as deep-sea shrimp, and some small fish are lured into attacking the light, whereupon the angler promptly swallows them.

Only the female angler develops a fishing line and lure. The male angler is a much smaller fish, without a fishing line, which attaches itself to the female.

When the male and female anglers are newly hatched, they look very much alike, except that the female already

shows signs of growing her fishing line. The young anglers have a thick gelatin-like outer skin that gives them buoyancy so that they float to the surface, where they feed upon the swarms of plankton. The gelatinous layers wear off finally, and the maturing anglers descend into the depths of the sea, the female developing her fishing equipment at that time.

The male angler has no way to feed himself in the deep sea. In order to survive, he must find a female. He has special powers that help him to find a female angler in the dark abyss. He has extremely powerful, long distance eyesight, that enables him to detect the flashing lights of the female; he is very fast swimming; and, finally, he has an enormously keen sense of smell to help him to track the female angler. In fact, the smell centers in the male angler's brain occupy a bigger fraction of the brain than in any other vertebrate animal.

The male starts this quest while he is still very young. However, he searches for a much older female which has had time to grow much larger than he is. When he finds her, he bites into her side with specially formed, outward-pointing teeth; and he hangs on. Gradually, the male angler loses his powerful eyesight entirely. He loses his digestive system. The skin of the female grows over his mouth, so that he becomes permanently attached. Her blood flows through his body and nourishes him. The male spends the rest of his life as a part of the female, and his only activity is to fertilize the female's eggs, in order to start another strange cycle in the history of deep-sea anglers.

The reason that the anglers have developed this

peculiar form of mating is that it is hard for creatures to find their mates in the darkness of the abyss. Also, food is scarce, and with this arrangement the female can find food both for herself and (at very little extra cost) for the male—or for several males, because female anglers have been found with several attached males.

Notice, in the drawing on page 54 (third from top), that the male (attached to the underside of the female) is smaller than the line and lure on the top of the female's head.

The species of deep-sea angler shown on page 54 (bottom) is especially interesting because of the "barbel" beneath its lower jaw. While female anglers generally have barbels (see picture above), none of them can match this fantastic branching structure. Barbels on the jaws of fish generally are used as sense organs. The branching barbels of this angler probably pick up vibrations from the slightest motions of other fish in the surrounding waters, to tell the angler whether an enemy, a dinner, or a mate is approaching.

Still another approach to mouth design is seen in the viper fish. These are fierce little creatures with needlelike teeth and jaws that can gape open to enormous widths in order to swallow their prey. The most exaggerated of the viper fish is *Malacosteus*, the "loosejaw" (see page 56). The loosejaw has, over many thousands of generations, lost the flesh of its lower jaw. Nothing remains of the lower jaw but an arc of bone and a muscle that operates it. The result is that the fish can snap with great speed, moving its skeletal jaw through the water with very little resistance from the water. With its rapid action skeleton-

jaw, the loosejaw cannot catch very small fish—they would slip out between the bones. But somewhat larger victims can be trapped and flipped down the throat of the loosejaw by the swift mousetrap action of the jaw.

So, in the abyss, different specimens of fish have made different kinds of special use of their mouths. There is an exaggerated quality to the mouths of these animals that gives them an especially hungry, savage expression—at least to our eyes—because we are not used to seeing animals that are mostly mouth.