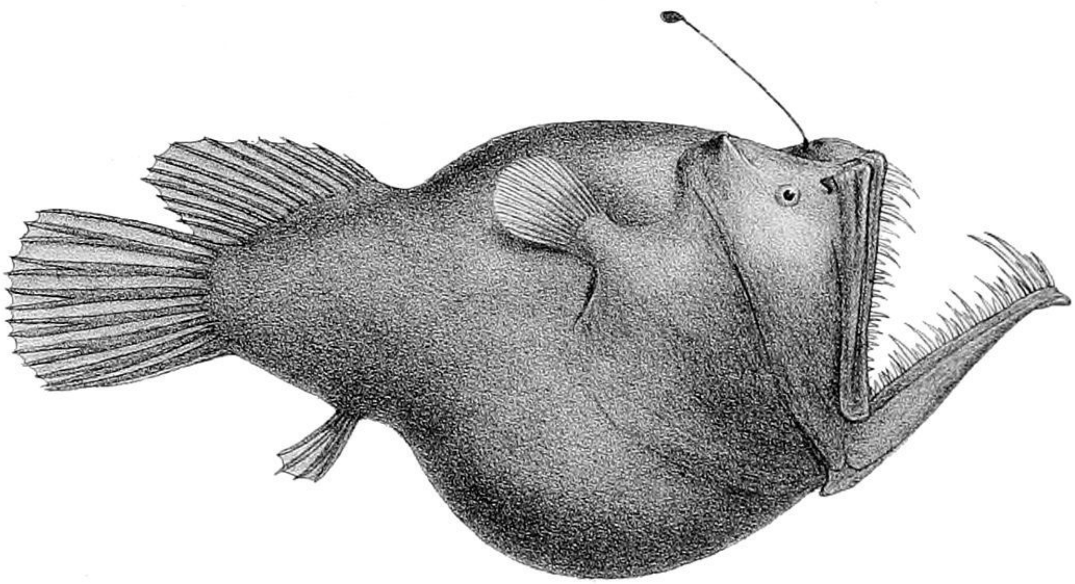
Anglerfish



Anatomy

All anglerfish are carnivorous and are thus adapted for the capture of prey. Ranging in color from dark gray to dark brown, deep-sea species have large heads that bear enormous, crescent-shaped mouths full of long, fang-like teeth angled inward for efficient prey grabbing. Their length can vary from 2.0 cm (0.8 in) to 18.0 cm (7 in), with a few types getting as large as 100cm (3.3 feet) but this is variation is largely due to sexual dimorphism with females being much larger than males. Frogfish and other shallow-water anglerfish species are ambush predators, and often appear camouflaged as rocks, sponges or seaweed.

Most adult female ceratioid anglerfish have a luminescent organ called the **esca** at the tip of a modified dorsal ray (the **illicium**, or "fishing rod"). The organ has been hypothesized to serve the obvious purpose of luring prey in dark, deep-sea environments, but also serves to call males' attention to the females to facilitate mating.

The source of luminescence is symbiotic bacteria that dwell in and around the esca, enclosed in a cup-shaped reflector containing crystals, probably consisting of guanine. In some species, the bacteria recruited to the esca are incapable of luminescence independent of the anglerfish, suggesting they have developed a symbiotic relationship and the bacteria are unable to synthesize all of the chemicals necessary for luminescence on their own. They depend on the fish to make up the difference. Electron microscopy of these bacteria in some species reveals they are Gram-negative rods that lack capsules, spores, or flagella. They have double-layered cell walls and mesosomes. A pore connects the esca with the seawater, which enables the removal of dead bacteria and cellular waste, and allows the pH and tonicity of the culture medium to remain constant. This, as well as the constant temperature of the bathypelagic zone inhabited by these fish, is crucial for the long-term viability of bacterial cultures.

The light gland is always open to the exterior, so it is possible that the fish acquires the bacteria from the seawater. However, it appears that each species uses its own particular species of bacteria, and these bacteria have never been found in seawater. Haygood (1993) theorized that esca discharge bacteria during spawning and the bacteria are thereby transferred to the eggs.

In most species, a wide mouth extends all around the anterior circumference of the head, and bands of inwardly inclined teeth line both jaws. The teeth can be depressed so as to offer no impediment to an object gliding towards the stomach, but prevent its escape from the mouth. The anglerfish is able to distend both its jaw and its stomach, since its bones are thin and flexible, to enormous size, allowing it to swallow prey up to twice as large as its entire body.

Swimming

In 2005, near Monterey, California, at 1474 metres depth, an ROV filmed a female ceratioid anglerfish of the genus *Oneirodes* for 24 minutes. When approached, the fish retreated rapidly, but in 74% of the video footage, it drifted passively, oriented at any angle. When advancing, it swam intermittently at a speed of 0.24 body lengths per second, beating its pectoral fins in-phase. The lethargic behaviour of this ambush predator is suited to the energy-poor environment of the deep sea.

Another in situ observation of three different whipnose anglerfish showed unusual inverted swimming behavior. Fish were observed floating inverted completely motionless with the illicium hanging down stiffly in a slight arch in front of the fish. The illicium was hanging over small visible burrows. It was suggested this is an effort to entice prey and an example of low-energy opportunistic foraging and predation. When the ROV approached the fish, they exhibited burst swimming, still inverted.

The jaw and stomach of the anglerfish can extend to allow it to consume prey up to twice its size. Because of the small amount of food available in the anglerfish's environment this adaptation allows the anglerfish to store food when there is an abundance.

Predation

The name "anglerfish" derives from the species' characteristic method of predation. Anglerfish typically have at least one long filament sprouting from the middle of their heads, termed the illicium. The illicium is the detached and modified first three spines of the anterior dorsal fin. In most anglerfish species, the longest filament is the first. This first spine protrudes above the fish's eyes and terminates in an irregular growth of flesh (the esca), and can move in all directions. Anglerfish can wiggle the esca to make it resemble a prey animal, which lures the anglerfish's prey close enough for the anglerfish to devour them whole. Some deep-sea anglerfish of the bathypelagic zone also emit light from their esca to attract prey.

Because anglerfish are opportunistic foragers, they show a range of preferred prey with fish at the extremes of the size spectrum, whilst showing increased selectivity for certain prey. One study examining the stomach contents of threadfin anglerfish off the Pacific coast of Central America found these fish primarily ate two categories of benthic prey: crustaceans and teleost fish. The most frequent prey were pandalid shrimp. 52% of the stomachs examined were empty, supporting the observations that anglerfish are low energy consumers.

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