[Adaptive Morphology](http://deepsealife.net/adaptations/adaptive-morphology/)

Organisms that live in the deep sea have to adapt to the various conditions they find there. The shape and structure of the body of deep sea creatures is adapted to those conditions.

**Scarce food affects body structure**

Because food can be scarce, deep sea fish tend to conserve as much energy as possible. The energy they have must be allocated between growth, maintenance and reproduction. Deep sea fish have lowered their energy use by

* having weak muscles
* bones that are less dense
* lower metabolic rate
* slower breathing rate (respiration)
* very reduced swim bladder

Energy derived from food is stored because meals are irregular. Keeping the metabolic rate low and keeping muscles and bones less dense keeps more energy available for survival, growth and reproduction. The swim bladder is also often reduced because of the high pressure and to decrease energy investment.

The eyes are often also smaller and have slower growth. Again this will decrease energy investment and also eyes on prey often help predators recognize prey. Smaller eyes may help escape predator detection. In the total darkness smaller eyes should still be able to detect bioluminescence due to higher contrast and detection of light in the blue-green spectrum.

**Adaptations for feeding**

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Deep sea fish need to take full advantage of any potential prey they might encounter so they tend to have large mouth, jaws and teeth and highly extendible stomachs so they can handle large prey or carcass. Many predatory deep-sea fishes show highly specialized modifications of their feeding apparatus, e.g., elongate jaws studded with long dagger-like teeth, often combined with a very distensible stomach, to be capable of swallowing relatively large prey. These striking features can be observed in members of the marine teleost family Stomiidae. These can also be seen in *Chiasmodon niger*, the Black swallower shown on the diagram on the right. This fish can extend its stomach up to three times its size swallowing much bigger prey.

**Adaptations of the lateral line**

The lateral line in fish is used to detect movement around them. It consists of neuromasts, mechanosensory cells with cilia (hairs) that can detect water displacement and therefore movement. Because the upper ocean has currents, the detection system is located in closed or open pits. In the deep sea, fish do not need to worry about strong currents therefore their lateral line is located on the surface or even on stalks.

For example *Phrynichthys wedli*, a deep-sea ceratioid anglerfish, has no canal organs. These are replaced by many neuromasts placed on prominent papillae (stalks) in rows which cover much of the head and body. In *Melanonus zugmayeri*  (Pelagic cod, arrowfish) the head is covered in free neuromasts in short ridges.

**Body size in deep sea fish**

In early studies of demersal deep sea fish, increasing body size was been reported and this became known as the Heincke’s Law. Later studies however appear conflicting with increases or decreases in body size with increasing depth reported. The differing trends between different groups of deep sea fauna may be due to their behavior and ecology. Because variables such as pressure, light, temperature and food availability change with depth, it is hard to identify which variable drives changes in body size. It has been proposed that scavangers have an increase in body size with depth whereas predators less so or even a decrease in body size with depth. Better control of body temperature in larger animals has also been proposed as an explanation for an increase in body size with increasing depth.

**Body size in other deep sea fauna**

In Cephalopods (squid), the giant squid (*Architeuthis*) and the colossal squid (*Mesonychoteuthis*) are two massive examples of deep sea squid. The giant squid can reach sizes of 13 m (42 ft) and the colossal squid 14m (45 ft). It has been proposed that these large squid are ambush predators and are not as active as squid in upper waters.

Isopods

The isopods constitute one of the most primitive orders of arthropods, and *Bathynomus giganteus* is its largest known species, reaching a length of up to 37 cm. It is found at depths of 310–2140 m throughout the Gulf of Mexico, Caribbean Sea, and the Indo-Pacific region

Examples of larger size include elongation of appendages in the pycnogonid ‘spiders’; flattening that increases the effective surface area in some isopods such as *Serolis*; and general increases in bulk in the giant isopod, *Bathynomus giganteus* and giant ostracod, *Gigantocypris aggassizii*.

Other deep water animal groups show dwarfism. The smallest ascidiacean (sea squirt), *Minipera pedunculata*, with a width of only 0.5 mm, is a deep-sea endemic. It is suggested that scare food supply may explain dwarfism in some taxa (groups) of deep sea animals.

**References**

Proc Biol Sci. 2005 October 7; 272(1576): 2051–2057.

<http://deepsealife.net/adaptations/adaptive-morphology/>