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Fishes



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Defining Fishes

How do we know a fish when we see one? Not as simple a question as you might think!

Fishes are animals that live and swim in the water (although you might see a fish like a mudskipper or walking catfish crawling on land), are cold-blooded (except for tunas and marlins and mako sharks that are warmer than the water), breathe using gills (usually, but lungfish and some others have lungs), have backbones (but not always of bone, such as in sharks, which are cartilage), have a scaly skin (except for eels, which are scale-less), and have various fins instead of limbs (except for a few that do actually have limbs, like lungfish and coelacanth). So, we usually know a fish when we see one, but there are lots of exceptions to our fishy definitions. Most people will recognize a "typical" fish like a goldfish, bass, bluegill, snapper, or grouper because of experience with aquariums, going fishing, or enjoying fish for dinner. And most people know that lampreys, sharks, rays, eels, seahorses, and other strange-looking aquatic creatures are fishes, while shellfish, cuttlefish, starfish, crayfish, and jellyfish (despite their names) are not fishes. But some fish species are weird enough, and look enough like salamanders or other animals, that it is not always easy to be sure that one is looking at a fish.

There are more than 32,000 described species of fishes, more than all the amphibians, reptiles, birds, and mammals combined. Fishes are an important food resource worldwide, and fishing pressure has caused many fish stocks to crash or be at risk. Both commercial fishermen and sport fishermen exploit coastal marine fish throughout the world, and fish farming is becoming more common, particularly for high-priced food fish such as salmon. Fishes are also popular as pets, with the aquarium trade in live fishes caught from the wild and being raised in captivity growing ever more popular. Fishes have had a strong role in human activities across many cultures, serving as deities, subjects of art and sculpture, legend and story, and more recently as the main characters in books and movies.

The main groups of extant fishes

Lampreys and hagfish (superclass Cyclostomata) are a group of jawless fishes at the base of the vertebrate tree of life, whose adults are characterized by a toothed, funnel-like sucking mouth and horny (not bony) teeth. Lampreys are best known for species like the marine lamprey, which bore into the flesh of other fish to rasp their flesh and suck their blood, although most species of lamprey are not parasitic. Hagfishes are also delightfully interesting creatures, capable of producing copious amounts of thick mucous, able to tie themselves in knots, and often found burrowed into the bodies of large fish that may still be alive. Biologists debate whether lampreys and hagfishes are closely related at the root of the vertebrates, or whether lampreys are more closely allied with other vertebrates than are hagfishes.

Cartilaginous fishes (class Chondrichthyes) are the chimeras, sharks, skates and rays. They have skeletons made of calcified cartilage rather than bone. Cartilage is tough and flexible, and can be just as hard and strong as bone, providing enough structural support to enable many sharks and rays to grow to very large sizes (the whale shark is the largest fish). This group includes the largest, fiercest, and most famous marine predators alive today. Most cartilaginous fishes live in marine habitats all their lives, but a few species of sharks and rays live in fresh water during all or part of their lives. All cartilaginous fishes are carnivorous and most species feed on live prey. There are some species that feed on the remains of dead animals and still others that are filter feeders. The class Chondrichthyes is further divided into subgroups, with Holocephali containing chimeras, and Elasmobranchii containing sharks (Selachii) as well as skates and rays (Batoidea).

Ray-finned fishes (Actinopterygii) are the most diverse of the major groups of fishes, containing more than 25,000 species such as gars, bowfin, eels, salmon, trout, catfish, piranhas, lanternfish, cods, anglerfish, tarpon, basses, cichlids, butterflyfish, wrasses, parrotfish, and many others. Ray-finned fishes share a set of basic characteristics, including a skeleton made up of true bone (although cartilage is also present in many places), an upper jaw that consists of two bones (the maxilla and premaxilla), and fins that are supported by a set of bony spines and rays covered with a thin layer of skin. The skull of ray-finned fishes is extremely diverse and highly adaptable. It contains a large number of different mechanisms for enhancing bite force and jaw protrusion, resulting in a wide range of feeding adaptations and ecological roles for the actinopterygian fishes.

Lobe-finned fishes (class Sarcopterygii) are a very special group of bony fishes with limb-like fins that are fleshy at the base and bones connected in series that look and function much like limb bones. The living sarcopterygians include lungfishes (which have both lungs and limb-like fins) and coelacanth, both of which are living representatives of diverse fossil groups. Lobe-finned fishes hold special interest to evolutionary biologists because members of this group gave rise to the first four-legged land vertebrates (tetrapods). In fact, all amphibians, reptiles, birds, and mammals are included as descendants in the tree of life of sarcopterygians—from that point of view, we are all just fancy terrestrial lobe-finned fishes!

Some of the major groups of ray-finned fishes (roughly in order of origin on the family tree) are:

Holostei: the gars and bowfins

Osteoglossiformes: the bony-tongued fishes

Elopomorpha: tarpon, bonefishes, eels, and gulpers

Clupeomorpha: herrings, anchovies

Ostariophysi: milkfishes, carp, danios, goldfishes, loaches, minnows, characins, piranhas, tetras, knifefishes, and catfishes

Salmoniformes: salmon and trout

Esociformes: pike and pickerel

Osmeriformes: smelts and galaxiids

Stomiiformes: bristlemouths and marine hatchetfishes

Myctophiformes: lanternfishes

Lampriformes: oarfish, opah, and ribbonfishes

Polymixiiformes: beardfishes

Percopsiformes: including cavefishes and trout-perches

Batrachoidiformes: toadfishes

Lophiiformes: anglerfishes

Gadiformes: cods

Ophidiiformes: pearlfishes

Mugiliformes: the mullets

Atheriniformes: silversides and rainbowfishes

Beloniformes: flyingfishes

Cetomimiformes: whalefishes

Cyprinodontiformes: livebearers, killifishes

Stephanoberyciformes: ridgeheads

Beryciformes: fangtooths and pinecone fishes

Zeiformes: dories

Gobiesociformes: clingfishes

Gasterosteiformes: sticklebacks

Syngnathiformes: seahorses and pipefishes

Synbranchiformes: swamp eels

Tetraodontiformes: triggerfishes, filefishes and pufferfishes

Pleuronectiformes: flounders and flatfishes

Scorpaeniformes: scorpionfishes and sculpins

Perciformes: 40% of all fishes including anabantids, basses and sunfish, cichlids, gobies, gouramis, mackerel, tuna, perches, scats, whiting, wrasses