

Biodiversity

Fish & Amphibians

Ocean Explorer



Bayworld Centre for Research & Education





Overview

- 1 - What is a fish/amphibian ?
- 2 - Fish classification
- 3 - How can fish breathe under water ?
- 4 - From fish to amphibian
- 5 - Amphibian classification
- 6 - Activity : Where to place this animal ?

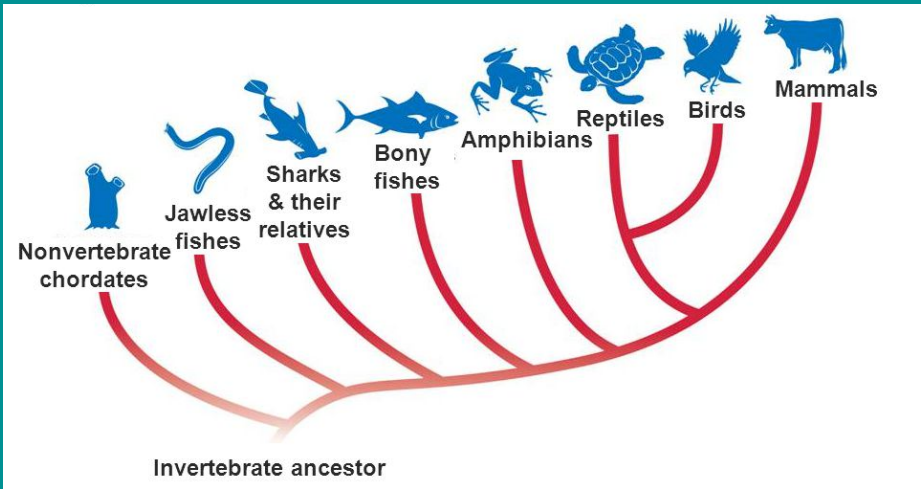


1 - What is a fish/amphibian ?

Fish and amphibians are part of the phylum chordata, which also includes mammals, birds and reptiles. Chordates are animals that possess a chord, the precursor to our spine. They also have the following characteristics :

- Triploblastic
- Definite head and brain (Cephalisation)
- Bilateral symmetry
- Advanced organ systems
- Coelomate with through gut with specialised regions
- Muscular system
- Endoskeleton of bone and cartilage
- Closed blood system with heart
- Specialised gaseous exchange organs (e.g. lungs)

Chordata phylogeny

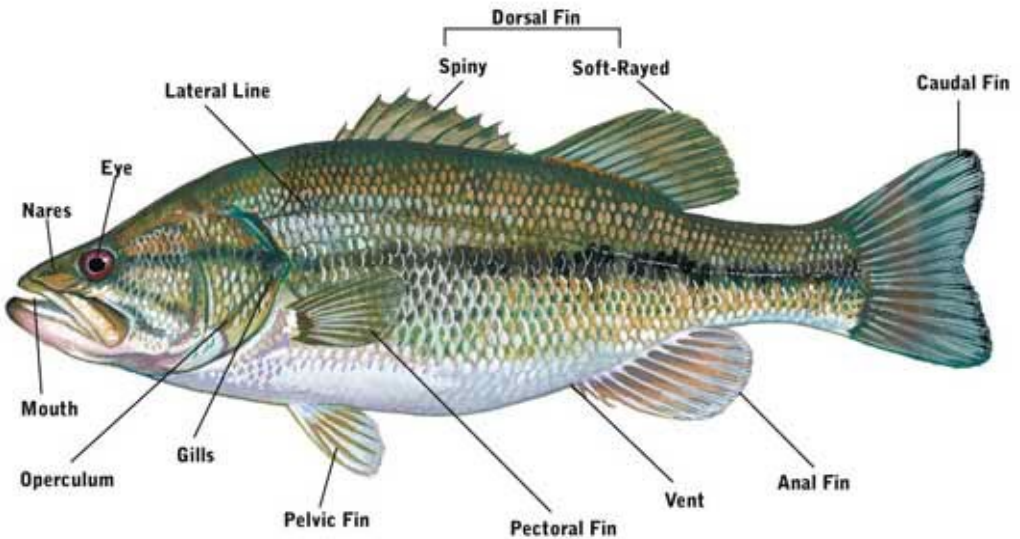


Under the denomination "Fish", we regroup 3 different phyla : Jawless fishes, Cartilaginous fishes (sharks, rays and relatives), and Bony fishes.

Fish characteristics

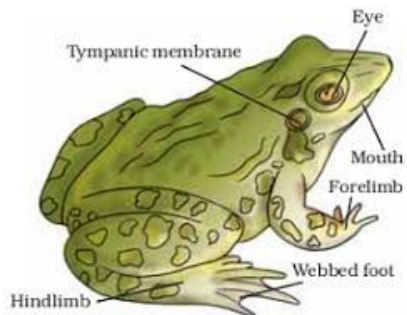
- Endoskeleton of bone and/or cartilage
- External scales
- Gills
- Operculum
- Tails and fins
- Lay eggs
- Cold-blooded

Operculum : the piece of cartilage and skin covering the gills on a fish



Amphibian characteristics

- Simple lungs - Breathe with lungs and gills
- Thin moist skin - no hair/fur
- Live in moist habitats
- Breed in water
- Lay many eggs
- Cold-blooded





2 - Fish classification

Info +

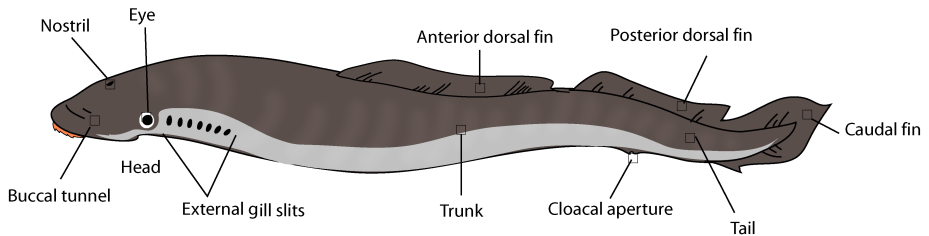
As previously said, there are 3 different groups of fish : Jawless fishes, Cartilaginous fishes (sharks, rays and relatives), and Bony fishes.

A group of fish of the same species is called a "school" of fish.

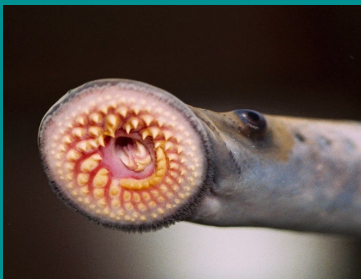
Jawless fishes

There are 2 types of jawless fishes : Lampreys and Hagfish. As their name suggest, they do not have proper jaws, nor a proper skull. But they do have teeth !

- Slimy skin, no scales
- Long snake-like body
- Cartilage skeleton
- No jaws

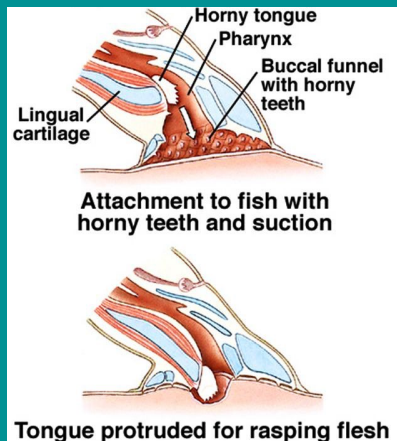


How do lampreys feed ?



The mouth of a lamprey, with several rows of small teeth

Without jaws, lampreys can't masticate or even bite as we do. They have to rely on a suction process to keep themselves attached to their prey and use their tongue to rasp the flesh.

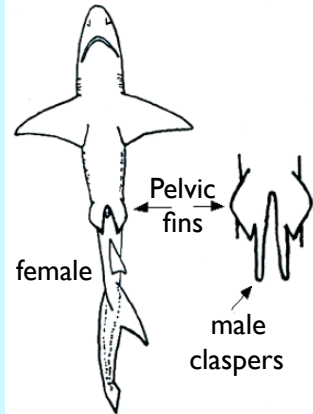
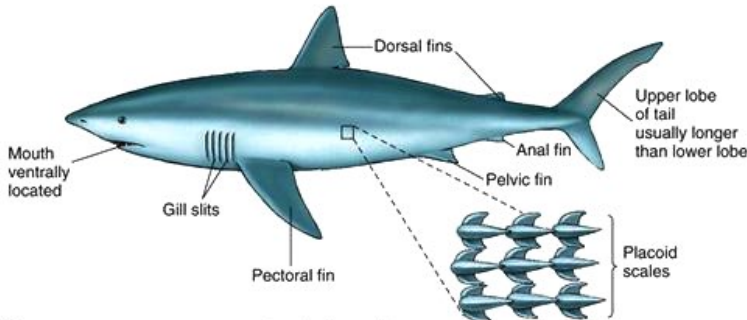


Cartilaginous fishes

Also called Chondrichthyes, cartilaginous fishes are represented by sharks, rays and chimeras. Contrary to the previous phylum of jawless fishes, cartilaginous fishes have strong jaws, often with a multitude of teeth. They are also marine animals

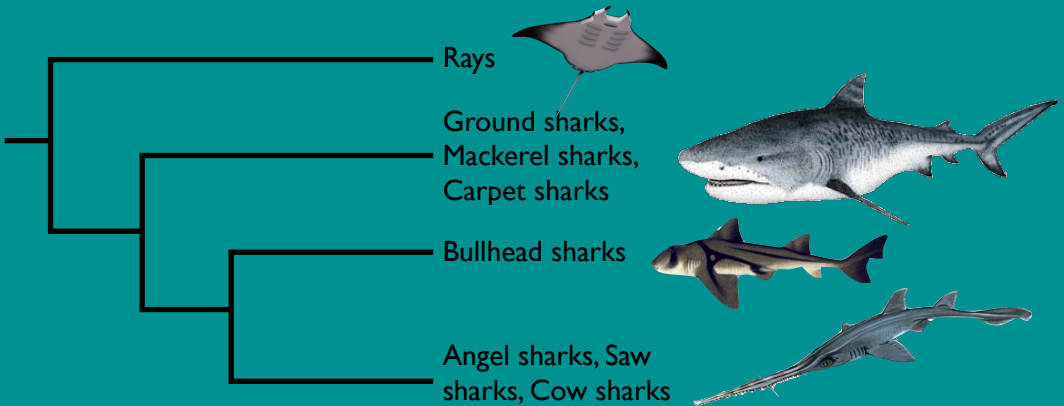
- Skeleton made of cartilage (no bones)
- Jaws
- Paired fins for efficient swimming
- Claspers (Pelvic fins modified)
- Placoid scales

Similar to a penis, **claspers** are an external appendage found on male sharks, skates, and rays that are designed to deliver sperm inside of a female.



Shark classification

Cartilaginous fishes contain sharks and rays. These animals have evolved to adapt to various marine environments and thus display very diverse morphologies.

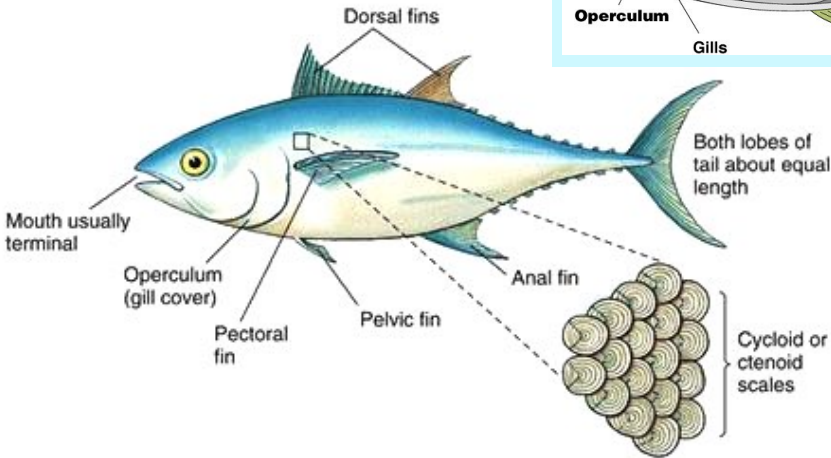
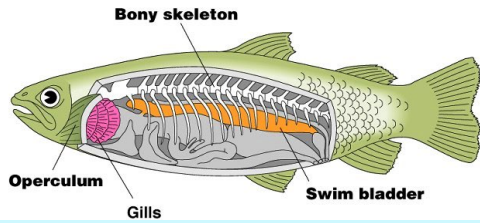


Bony fishes

Also called Osteichthyes, bony fishes are jawed fish with bone skeletons

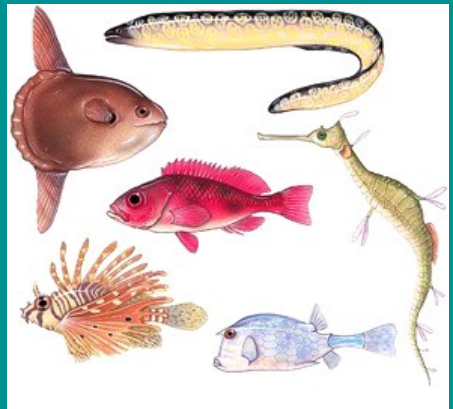
- Swim bladder
- Scales
- Bony skeleton
- Jaws
- Cycloid or ctenoid scales
- Operculum (gill cover)

Swim bladder : buoyancy organ. The swim bladder is located in the body cavity. It contains gas (usually oxygen) and functions as a hydrostatic, or ballast, organ, enabling the fish to maintain its depth without floating upward or sinking.



What do bony fishes look like ?

Bony fishes are the most diverse of all fishes. They can be as huge as the sunfish (2m long for a weight of 1ton) or as small as a pygmy seahorse (16mm !). Some of them don't have fins, such as eels, or are armed with dangerous venomous spines such as the lionfish. All morphologies are possible under the sea !



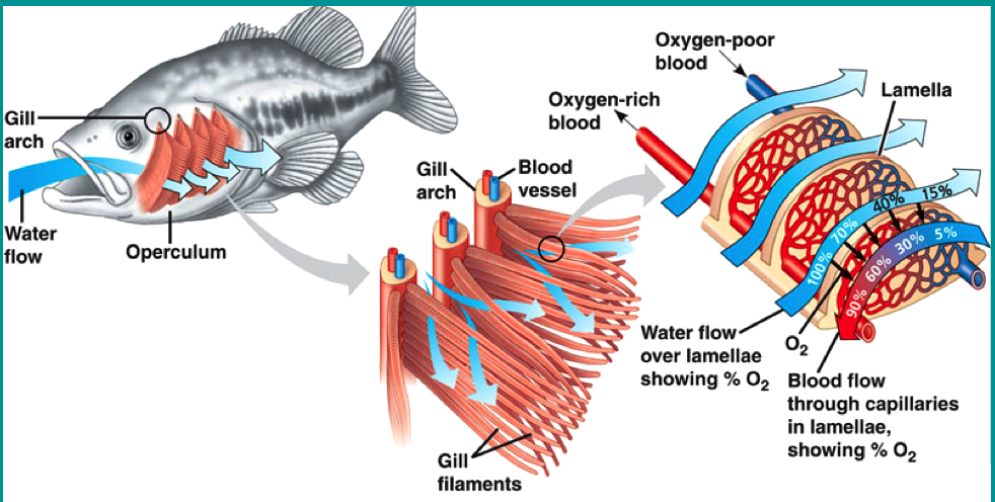


3 - How can fish breathe under water ?

Just as we do, fish need oxygen to breathe too. In order to remove oxygen from the water, they rely on special organs called **gills**.

Gills are feathery organs full of blood vessels. All fish have at least three gill arches on each side, but some fish have up to seven. Attached to the gill arches are gill filaments. The filaments are bendable and wave around in the water. These filaments have many functions including the transfer of ions and water, as well as the exchange of oxygen, carbon dioxide, acids and ammonia.

A fish breathes by taking water into its mouth and forcing it out through the gill passages. As water passes over the thin walls of the gill's filaments, dissolved oxygen moves into the blood and travels to the fish's cells.



Gill filaments work like our lungs : the oxygen transfer between the water and the blood inside the gills can be done thanks to the very thin membrane covering the gills. If the membrane was thicker, the diffusion could not happen !

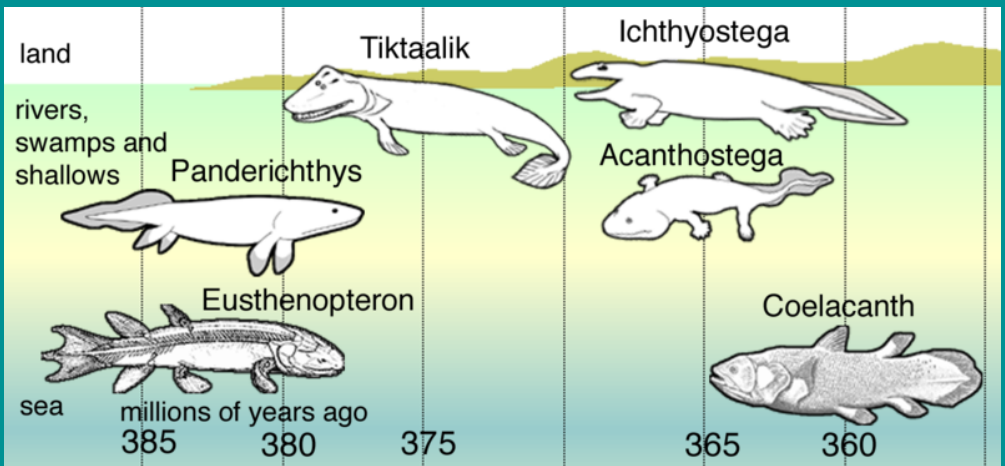


4 - From fish to amphibian

Around 395 million years ago (Devonian period), the first amphibians evolved from fish species. At this time, there were no mammals, reptiles or birds on land, only plants and insects. Amphibians were the first tetrapods (four-legged animals) to walk on solid ground.

The transition was a long process. Over millions of years, a group of bony fish started to evolve basic legs from their fins. At first, it was no more than a stronger fin (called a "flesh fin"), with a larger base, to be able to stand on it. Then it started to increase in size and develop digits, 7 digits to be exact ! Little by little, the amount of digits reduced to end with our 5 fingers.

At the same time the legs evolved, the pre-amphibians started to develop new features : a neck (to turn your head independently from your body), lungs and internal nostrils (for the sense of smell).



The evolution of amphibians started in shallow rivers and swamps, where the water was drying out during a period of the year. Animals adapted to these conditions by evolving new features to be able to survive on land when the water was lacking.

Today, 2 species of flesh fin fish remain : the 2 coelacanths species. They live in the deep seas of the Indian Ocean and hide in sea caves during the day, hunting at night.

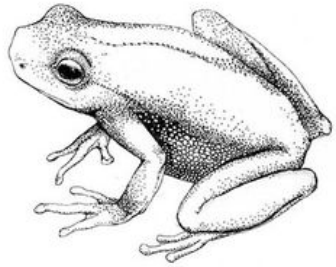


5 - Amphibian classification

Amphibians are animals usually living near a fresh water body, or in very humid environments. There are 3 modern orders of amphibians : Anura (the frogs and toads), Urodela (the salamanders), and Apoda (the caecilians). The number of known amphibian species is approximately 7,000, of which nearly 90% are frogs or toads !

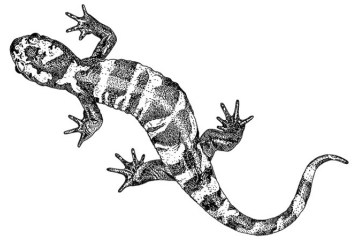
Anura (frogs/toads)

- Tail absent in adult
- Vocal sacs for males (make sounds)
- Tadpole larva (aquatic)
- Leaping locomotion (jumps)



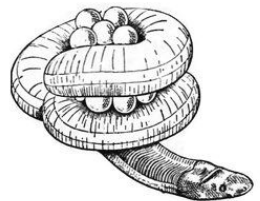
Urodela (salamanders - Also called Caudata)

- Lizard-like morphology (long tail)
- Tadpole larva (aquatic)
- Larva breaths through gills, gills lost in adult
- 4 legs



Apoda (caecilians - Also called Gymnophiona)

- Snake-like morphology (no legs)
- Blind
- Burrowing animals (usually found in moist forest soil in the tropics)
- Dermal scales

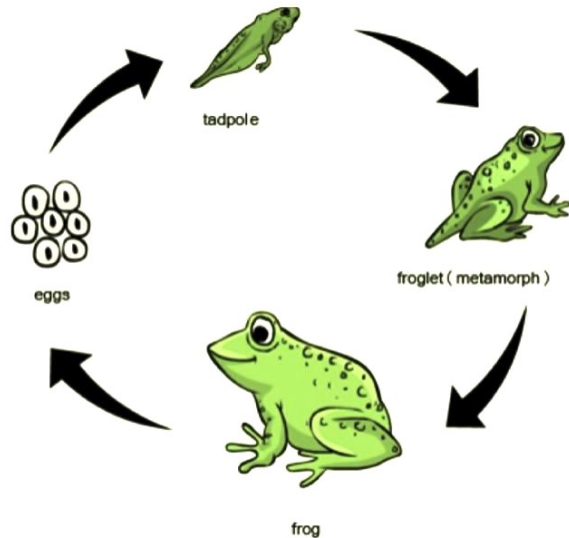


Amphibian life cycle

Frogs, toads and salamanders lay eggs into the water. Sometimes the parent frogs will keep watch over those eggs, but they are often left alone and need to fend for themselves. These will hatch into tadpoles or aquatic larvae then go through metamorphosis to obtain the adult morphology.

Caecilians do not go through the same process. The mother will

lay eggs, keep watch over them and even offer them her own skin to eat when the young hatch ! Also, young caecilians do not go through metamorphosis. They hatch inside a hole on the ground, not in water. And they already look like miniature adult caecilians !



Poison dart frogs

Toads and frogs don't have scales. Their body is covered of mucus which keeps the the skin moist, but also can serve another purpose : defend themselves against predators. Some frogs, such as the poison dart frogs from South America, secrete a dangerous neurotoxin inside the mucus covering their body. The slightest touch to this mucus provoques convulsions, paralysis and sometimes death !



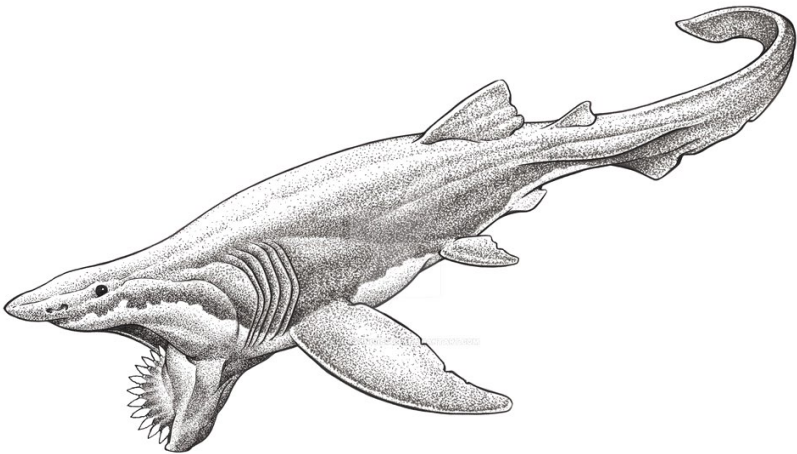
Dendrobates leucomelas, one of the dangerous poison dart frogs from the Amazonian green forest



6 - Activity : Where to place this animal ?

Questions

- 1 - Observe the drawing on this page. Try to find the characteristics we discussed during this lesson. Into which group of animals would you place it ? Sharks, fishes or amphibians ?
- 2 - Would you say this animal is a carnivore, an herbivore or something different ?
- 3 - According to your classification, what type of scales would you find on its skin ?
- 4 - Do you think this animal really existed ?
- 5 - Do some research and find its name. Write a small paragraph about its biology.



Some animals might seem strange, but it is simply a matter of getting use to them. We do not see the life forms from the abyss very often, and because of that they look very bizarre to our human eye. Just like this blobfish from the deep waters around Australia and New Zealand !

