

Teacher Resource Guide: Amphibians



What is an amphibian?

The root of the word “amphibian” means “both kinds of life,” because many amphibians need both water and land to complete their life cycle. Amphibians were the first group of vertebrates to make the transition from the water to life on land, and they have retained a connection to water in all aspects of their lives, from breathing to breeding. All amphibians breathe through their **skin**, so it is moist, smooth, and thin compared to the thick, tough, dry skin of reptiles. This type of skin is the

best way to identify an animal as an amphibian. Other characteristics of most amphibians include:



- **Ectothermic** body temperature regulation, meaning they need external sources of heat to stay warm, because they can't produce their own heat
- Wet, **shell-less eggs** that are laid in water (Exception: some species give birth to live young!)
- **Aquatic larvae and metamorphosis** (Exception: “direct developer” amphibians hatch as miniature adults, without ever passing through a larval stage!)

Is that a Worm?

There are **three major groups** of amphibians: frogs, salamanders, and caecilians. Frogs and salamanders are well-known and relatively easy to find, but **caecilians** are less common and very often misidentified. They are completely limbless, and at first glance, they look like an earthworm or a snake. However, their smooth, moist skin and distinctive sensory



Earthworm



Caecilian



Snake

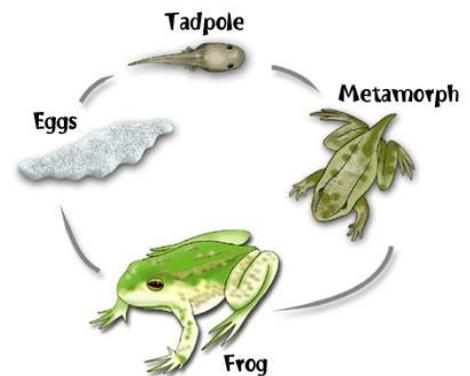
tentacles give them away upon closer examination. Most are burrowers that live underground, although some are aquatic.

While they are the least common amphibians, they serve a special purpose from an educational standpoint, especially for teaching about amphibian characteristics, co-evolution, and biodiversity.

Life as an Amphibian

One of the coolest characteristics of amphibians is that they do most of their breathing through their skin. If their skin becomes too dry, it becomes very difficult for them to take up oxygen across it, so they can actually suffocate. This is why you are most likely to find frogs near lakes and salamanders hiding in the moist dirt underneath rocks.

Amphibians also need water to breed. Most of them, especially salamanders, come out to breed on rainy nights. Reptile eggs have a shell to keep moisture in and protect the embryo, but amphibians do not. Their eggs have no shell and *must* be laid in a very moist environment, or they dry out before they can hatch. When they do hatch, the babies are usually fully aquatic and must spend part of their lives in water before metamorphosing into an adult. Aquatic young frogs are called **tadpoles** and look very different from the adults. Young salamanders and caecilians are also often aquatic, but look more similar to the adults and have no special name. Often, after metamorphosis, amphibians move onto land permanently. However, some remain aquatic for their entire lives or, in the case of newts, return to the water after a terrestrial phase.



Surviving and Thriving

Most adult amphibians are the perfect snack-size for a wide variety of animals, including large mammals, birds, reptiles, and even other amphibians. They have evolved ways to protect themselves from these predators, and coloration is a big part of defense. The simplest examples are amphibians with great **camouflage**, like



Spot both Mossy Frogs!

the mossy frog. These animals blend in with their environments so well that it is difficult for predators to even find them, much less catch them.

Every amphibian also produces some kind of **toxin**, but these toxins vary



widely in how potent they are and what predators they affect. Generally, they are only toxic if you try to eat them, so you don't have to worry about poison when handling most amphibians. Amphibians with particularly strong poisons often have bright colors and patterns to warn predators that eating them is a bad idea. This is called **aposematic** coloration. A

particularly beautiful example is the critically endangered Panamanian Golden Frog.

Amphibians face threats not just from predators, but also from their environment. As adults, many amphibians in temperate areas cannot survive winters above-ground. Therefore, some species hibernate, spending their winters dormant underwater or underground (depending on whether they are terrestrial or aquatic). These amphibians have a high glucose concentration in their vital organs, which acts as an antifreeze to prevent damage and death. Prolonged dry seasons can be equally dangerous to an animal that depends so heavily on moisture. Some amphibians in these environments estivate, entering a dormant state similar to hibernation.



Super-Moms (and Dads)

We think of mammals as masters of parental care, but amphibians are pretty impressive too. The female Surinam toad, for example, incubates her eggs *in* the skin of her back until they hatch. But dads go above and beyond too! The male Darwin's frog "swallows" his tadpoles and lets them develop in his vocal sacs until metamorphosis.



Caecilians are also known for being super-parents. They care for their young underground, feeding their babies with a special nutritious secretion and sometimes even a layer of their own skin. Parental care, especially after hatching, is less common in salamanders, but it does occur. The Italian Cave Salamander spends almost 90% of her time with her newly hatched young.

Amphibian Declines

Despite some great survival mechanisms, amphibians around the world are declining. **One third** of all known species are already threatened or extinct! Many factors are contributing to this, including infectious diseases, habitat loss and fragmentation, invasive species, climate change, and chemical contaminants in the environment. The effect that each of these factors alone is having on amphibians is complex, but several traits make amphibians in particular extremely sensitive to environmental changes. The permeability of their skin makes them susceptible to pollutants and diseases, especially the fungus chytridiomycosis, which can infect their skin. Their need for moisture and aquatic habitats also makes them vulnerable to habitat change affecting access to or quality of water. Because amphibians feel the effects of environmental change sooner



than many other animal groups, they are considered **bioindicators**, species that can give us information on the health of a community or ecosystem. The loss of amphibians would be devastating to the world's ecosystem on so many levels, and it is important that we appreciate what makes them special while we still have a chance to save them.

Additional Resources

- Amphibiaweb: <http://www.amphibiaweb.org/>
- IUCN Amphibian Specialist Group:
<http://www.amphibians.org/> (Biology and Conservation)
- <http://www.biology-resources.com/amphibia.html> (Characteristics with good illustrations)
- Amphibian Ark: <http://www.amphibianark.org/> (Conservation)
- AZA: <http://www.aza.org/amphibian-education-resources/> (Games & Activities)
- Berkeley Lab: <http://froggy.lbl.gov/virtual/> (Virtual Frog Dissection)



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