

Amphibians

Did you know that some animals are able to breathe through their skin? Do these animals live on land or in the water? Actually, they live both on land and in the water.

About 350 million years ago, fishes lived wherever there was water. But no vertebrates lived on land. The land had many resources for vertebrates. It had plants and insects for vertebrates to eat, and there were few predators. But to live on land, vertebrates needed lungs for breathing and legs for walking.

What You Will Learn

- Explain how amphibians breathe.
- Describe amphibian metamorphosis.
- Describe the three groups of amphibians, and give an example of each.
- Explain why amphibians are ecological indicators.

Vocabulary

lung
tadpole
metamorphosis

READING STRATEGY

Reading Organizer As you read this section, create an outline of the section. Use the headings from the section in your outline.

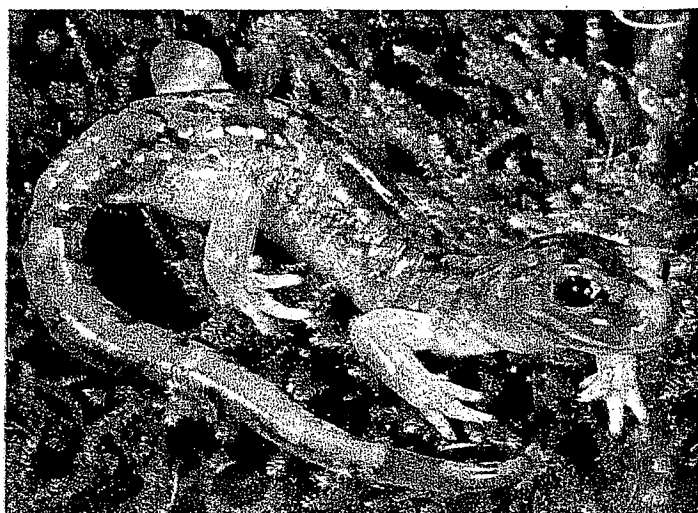
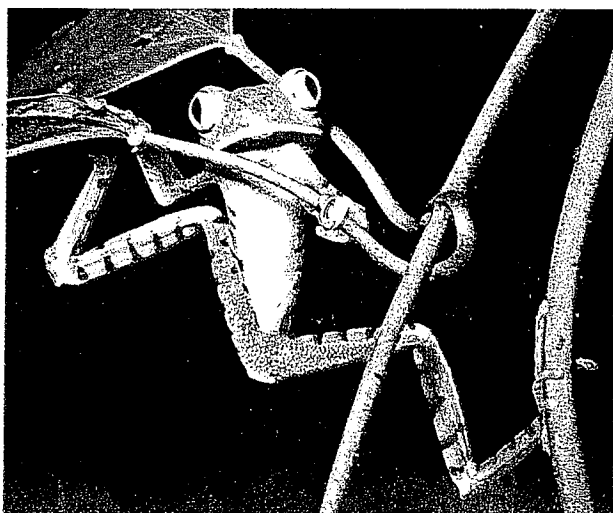
Moving to Land

Amphibians (am FIB ee uhnz) are animals that can live in water and have lungs and legs. Scientists think that amphibians evolved from the ancestors of lungfish-like fishes. These ancient fishes developed lungs that got oxygen from the air. A **lung** is a saclike organ that takes oxygen from the air and delivers oxygen to the blood. These fishes also had strong fins that could have evolved into legs.

Most of today's amphibians are frogs or salamanders, such as those in **Figure 1**. But early amphibians looked different. Fossils show that the first amphibians looked like a cross between a fish and a salamander. Many were very large—up to 10 m long. Early amphibians could stay on dry land longer than today's amphibians can. But they still had to return to the water to keep from drying out or overheating. They also returned to the water to mate and to lay eggs.

Reading Check How do amphibians get oxygen from the air?
(See the Appendix for answers to Reading Checks.)

Figure 1 Frogs and salamanders are two kinds of the amphibians on Earth today.



Characteristics of Amphibians

Amphibian means "double life." Most amphibians live part of their lives in water and part of their lives on land. Amphibian eggs do not have a shell or a membrane that prevents water loss. For this reason, embryos must develop in a wet environment. Most amphibians live in the water after hatching and then later develop into adults that can live on land.

But even adult amphibians are only partly adapted to life on land. Amphibians are ectotherms. So, their body temperature depends on the temperature of their environment. Water helps amphibians keep their bodies at a stable temperature. Also, water helps adults keep from losing too much moisture through their skin.

Thin Skin

Amphibian skin is thin, smooth, and moist. The skin is so thin that amphibians absorb water through it instead of drinking. But they can also lose water through their skin and easily become dehydrated. Their thin skin is one reason that most amphibians live in water or in damp habitats.

Amphibians can breathe by gulping air into their lungs. But many also absorb oxygen through their skin, which is full of blood vessels. In fact, a few amphibians, such as the salamander in **Figure 2**, breathe only through their skin.

Many amphibians also have brightly colored skin. The colors often warn predators that the skin contains poison glands. These poisons may simply be irritating, or they may be deadly. The skin of the poison arrow frog, shown in **Figure 3**, has one of the most deadly toxins known.



Figure 3 The skin of this poison arrow frog is full of poison glands. Hunters in South America rub the tips of their arrows in the deadly toxin.

lung a respiratory organ in which oxygen from the air is exchanged with carbon dioxide from the blood



Figure 2 The four-toed salamander has no lungs. It gets all of its oxygen through its skin.

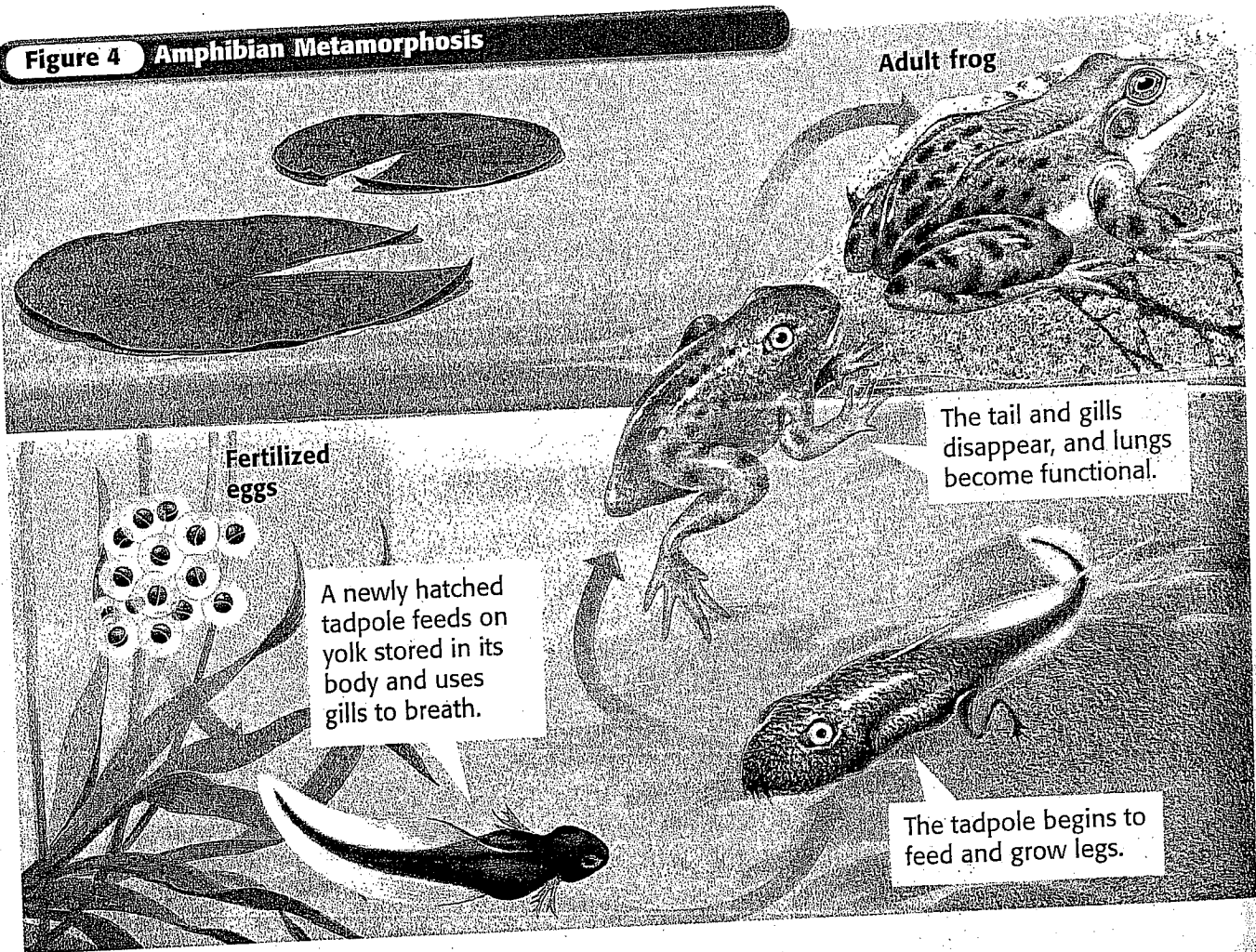
CONNECTION TO Social Studies

WRITING SKILL

Troublesome Toads

In the 1930s, cane toads were shipped from Hawaii to Australia to eat cane grubs that were destroying sugar cane crops. But the toad populations grew out of control, and the toads did not eat the grubs. Native species that ate the toads were killed by the toads' poison glands. Research another animal that has caused disastrous effects in a new environment. In your **science journal**, write three paragraphs about this animal.

Figure 4 Amphibian Metamorphosis



tadpole the aquatic, fish-shaped larva of a frog or toad

metamorphosis a phase in the life cycle of many animals during which a rapid change from the immature form of an organism to the adult form takes place

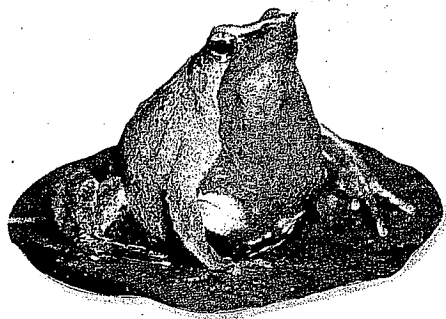


Figure 5 Darwin's frogs live in Chile and Argentina. A male frog may carry 5 to 15 embryos in its vocal sacs.

Leading a Double Life

Most amphibians don't just get bigger as they grow into adults. They change form as they grow. After hatching, a frog or toad embryo becomes a tadpole. A **tadpole** is an immature frog or toad that must live in the water. It gets oxygen through gills and uses its long tail to swim. Later, the tadpole loses its gills and develops structures such as lungs and limbs that allow it to live on land. This change from an immature form to an adult form is called **metamorphosis** (MET uh MAWR fuh sis) and is shown in **Figure 4**. Most adult amphibians can live on land. However, they still need to keep their skin moist.

A few amphibians develop in other ways. Some do not go through full metamorphosis. They hatch as tiny versions of adults, but they have gills. Some develop on land in wet places. For example, Darwin's frogs lay eggs on moist ground. When an embryo begins to move, an adult male Darwin's frog takes it into his mouth and protects it inside his vocal sacs. When the embryo has finished developing, the adult opens his mouth and a tiny frog jumps out. **Figure 5** shows a Darwin's frog

Kinds of Amphibians

More than 5,400 species of amphibians are alive today. They belong to three groups: caecilians (see SIL' ee uhnz), salamanders, and frogs and toads.

Caecilians

Most people are not familiar with caecilians. However, scientists have discovered more than 160 species of caecilians. These amphibians live in tropical areas of Asia, Africa, and South America. They look like earthworms or snakes, but they have the thin, moist skin of amphibians. Several traits distinguish caecilians from other amphibians. For example, caecilians do not have legs, as shown in **Figure 6**. And unlike other amphibians, some caecilians have bony scales in their skin.

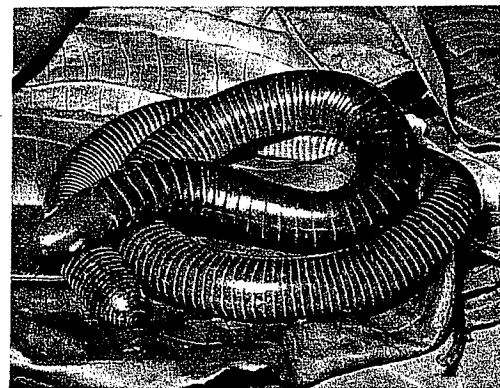


Figure 6 Caecilians do not have legs. They live in damp soil in the Tropics and eat small invertebrates in the soil.

Salamanders

There are about 500 known species of salamanders. As adults, most salamanders live under stones and logs in the woods of North America. Two salamanders are shown in **Figure 7**. Of modern amphibians, salamanders are the most like prehistoric amphibians in overall form. Although salamanders are much smaller than their ancestors, they have a similar body shape, a long tail, and four strong legs. They range in size from a few centimeters long to 1.5 m long.

Salamanders do not develop as tadpoles. But most of them do lose gills and grow lungs during their development. A few species, such as the axolotl (AK suh LAHT'l), never lose their gills. These species live their entire life in the water.

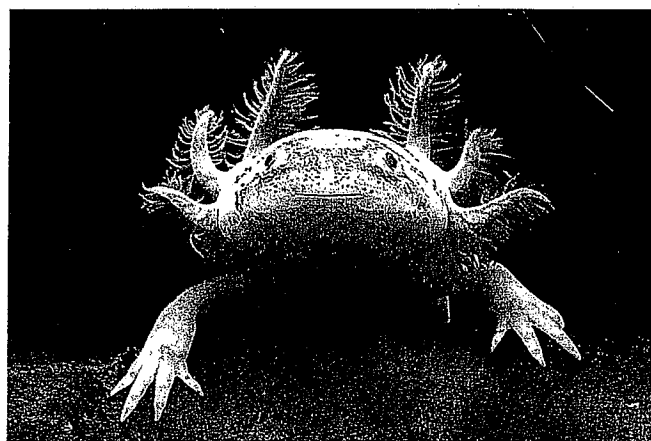
✓ Reading Check How does a salamander's body change during development?

Figure 7 Salamanders

▼ The **marbled salamander** lives in damp places, such as under rocks or logs or among leaves.



▼ This **axolotl** is an unusual salamander. It keeps its gills and never leaves the water.



SCHOOL to HOME

Looking for Locals

Talk with your family about whether amphibians might live near your home. Are there any ponds, streams, or lakes nearby? Do moist leaves cover the ground outside? Then, go outside to look for amphibians around your home. Be careful not to disturb any animals that you find. Were your predictions correct? Record your observations in your **science journal**.

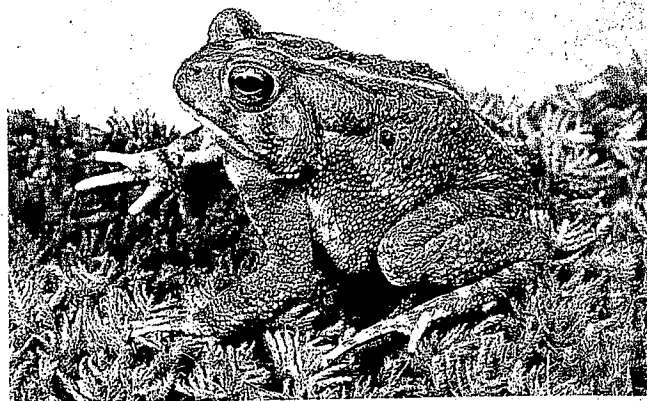
ACTIVITY

Figure 8 Frogs and Toads

▼ Frogs, such as this **bull frog**, have smooth, moist skin.



▼ Toads, such as this **Fowler's toad**, spend less time in water than frogs do. Their skin is drier and bumpier.



Frogs and Toads

About 90% of all amphibians are frogs or toads. Frogs and toads are very similar. In fact, toads are a type of frog. You can see a frog and a toad in **Figure 8**.

Frogs and toads live all over the world, except for very cold places. They are found in deserts and rain forests. They are highly adapted for life on land. Adults have strong leg muscles for jumping. They have well-developed ears for hearing and vocal cords for calling. They also have a long, sticky tongue. The tongue is attached to the front of the mouth so that it can be flipped out quickly to catch insects.

Singing Frogs

Frogs are well known for their nighttime choruses, but many frogs sing in the daytime, too. Like humans, they force air from their lungs across vocal cords in the throat to make sounds. But frogs have something we lack. A thin-walled sac of skin called the *vocal sac* surrounds their vocal cords. When frogs sing, the sac inflates with vibrating air. The frog in **Figure 9** has an inflated vocal sac. The sac increases the volume of the song so that the song can be heard over long distances.

Frogs sing to communicate messages that help in attracting mates and marking territories. Usually, frogs sing songs that they know without having to learn the songs. But some frogs can change the notes they sing. For example, to make its voice louder, one frog uses a tree's acoustics. It sits in a hole in a tree trunk and tries many notes until it finds the loudest one. Then, it sings this note repeatedly to be as loud as possible.

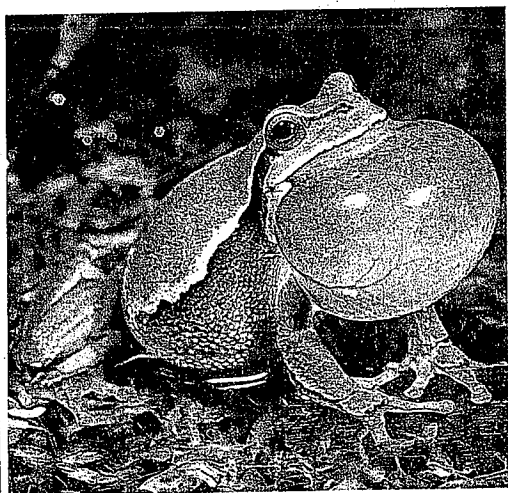


Figure 9 Most frogs that sing are males. Their songs communicate messages to other frogs.

Reading Check How does a frog use its vocal sac?

Amphibians as Ecological Indicators

Amphibians are often called *ecological indicators*. In other words, unhealthy amphibians can be an early sign of changes in an ecosystem. When large numbers of amphibians begin to die or show deformities, a problem with the environment may exist. For example, the disappearance of the golden toad, shown in **Figure 10**, caused concern about the toad's environment.

Amphibians are ecological indicators because they are very sensitive to changes in their environment. Their thin skin absorbs any chemicals in the water or air. And their lungs take in chemicals from the air. Climate change is another factor that may affect amphibians. As ectotherms, their body temperature depends on the temperature of their environment.

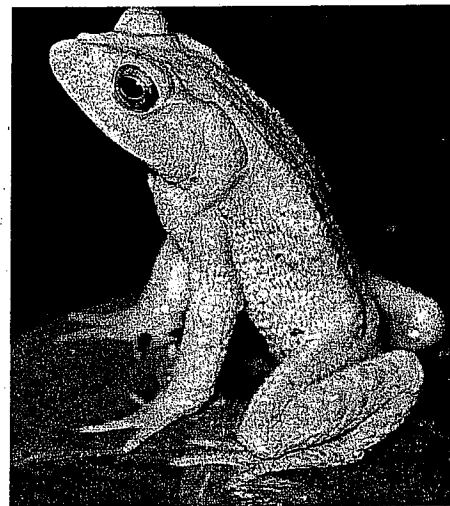


Figure 10 Golden toads were seen regularly in Costa Rica until 1989. After that year, they disappeared.

SECTION Review

Summary

1. Amphibians were the first vertebrates to live on land.
2. Amphibians breathe by gulping air into the lungs and by absorbing oxygen through the skin.
3. Amphibians start life in water, where they use gills to breathe. During metamorphosis, they lose their gills and grow legs that allow them to live on land as adults.
4. The three groups of amphibians are caecilians, salamanders, and frogs and toads.
5. Because amphibians are very sensitive to environmental changes, they are sometimes called *ecological indicators*.

Using Vocabulary

1. Use each of the following terms in a separate sentence: *lung*, *tadpole*, and *metamorphosis*.

Understanding Key Ideas

2. The first vertebrates to live on land were
 - a. fish.
 - b. dinosaurs.
 - c. amphibians.
 - d. reptiles.
3. Many adult amphibians breathe by using
 - a. only their gills.
 - b. only their lungs.
 - c. only their skin.
 - d. their lungs and skin.
4. Describe metamorphosis in amphibians.
5. Why do adult amphibians have to live near water or in a very wet habitat?
6. Why are amphibians sometimes called *ecological indicators*?
7. Name the three types of amphibians. How are they similar? How are they different?
8. How are frogs and toads similar? How are they different?

Math Skills

9. A certain toad species spends 2 months of its life as a tadpole and 3 years of its life as an adult. What percentage of its life is spent in the water? What percentage is spent on land?

Critical Thinking

10. **Analyzing Relationships** Describe the relationship between lungfishes and amphibians. How are these animals alike? How are they different?
11. **Evaluating Conclusions** Scientists think that climate change may have caused the golden toad to become extinct. What other causes are possible, and how could scientists test these ideas?

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