

National Garden Clubs, Inc.
2015-2017 President's Project - The Frightened Frog
Amphibian Awareness Lesson Plan for Elementary School Children
National Science / Life Science Education Standards K-4

Key Concepts In Lesson Plan

1. Introduce the characteristics. (what makes an animal an amphibian?)
 2. How are amphibians grouped? (orders & characteristics)
 3. What are the structures and functions of each part of the life cycle?
(example organism: Frog)
 4. What are the important functions of amphibians in the ecosystem and to man?
 5. What are the threats to extinction of amphibians?
 6. What are some things you can do to help save amphibians?
-

Activities For Students

ACTIVITY 1 - IDENTIFYING CHARACTERISTICS OF ORGANISMS

1. Using photographs, or if possible life organisms, for demonstration:
show characteristics of the three orders
2. Have students identify, on a diagram using matching (for younger students) visible differences (e.g. 4 legs, rough warty skin, smooth skin, external eardrum (tympanic membrane), parotid glands, no legs, external segmentation)
3. Using a matching worksheet, or cut and paste labels, have students put names on a toad, salamander, frog and caecilian.

ACTIVITY 2 - EXPLORE LIFE CYCLES OF ORGANISMS

1. If possible use life organisms for demonstration. Show pictures of tadpoles, adult frog, toad, mud puppy and salamander.
2. Using worksheet diagram of circular lifecycle: Color the stages of the lifecycle.
3. Have students cut out labeled diagram of life cycle and paste on white paper in the order they occur (egg, tadpole with legs, adult).
4. Show salamanders with external gills and describe how they can live in water and sometimes reproduce as a larval stage.

ACTIVITY 3 - ORGANISMS AND THE ENVIRONMENT

1. Make a list with the students of the reasons frogs and other amphibians are important to the environment (they may need coaching).
2. Have students look at a paper divided with the following images: a farmer spraying crops; someone filling in a pond with a bulldozer; someone gigging frogs; a pet frog in a tank. Ask students how each of these activities could endanger frog populations.
3. Work out a maze that shows how a tadpole can become a frog if he avoids the troubles on the maze.
4. Have students make posters or signs that explain the frogs problems and the student's feelings.
5. Read stories about frogs and toads or other organisms who are threatened by extinction.
6. Small groups might get together to go to another class to tell about the plight of these organisms.
7. Go over some animals that have gone extinct long ago, and recently. Be sure they understand it's a loss.
8. Remind them what the word STEWARDSHIP means, and ask them how each day they might do one thing that would make them good stewards of the Earth.

EVALUATION: DIAGRAMS, MATCHING EXERCISES, POSTERS, MAZE, CUT AND PASTE

Three Orders of Amphibians

Class: AMPHIBIA, 6000 species (approximately), Amphibia meaning "Double Life":
1/2 on land, 1/2 in water (with some exceptions).

Order *Anura* (without a tail) : **Frogs & Toads**

- Frogs have smooth, moist skin
- Toads have dry, bumpy skin
- Frogs have longer legs and more tapered bodies
- As adults, Toads return to water only to reproduce

Order *Urodela* (visible tail): **Salamanders and Newts**

- Are often brightly colored and vary in length from a few centimeters to about 1.5 meters
- Long body, long, tail and two pairs of legs. Some remain aquatic their entire life cycle by maintaining gills and are able to reproduce from the larval stage depending upon their environment.

Order *Apoda* (no legs): **Caecilians**

- Blind, burrowing animals, smooth skin, no limbs
- Look like earthworms but have vertebrae like other chordates
- Reside in S. America, Africa and Southeast Asia
- About 30 cm in length

Characteristics of Amphibians

1. Unshelled Egg: mostly jelly, most lay in water, some on land. Some lay eggs in leaves over water in rainforests: they hatch and fall into the water. In terrestrial species, metamorphosis occurs in the egg before hatching. Some have adapted to staying in the larval stage and can reproduce: mud puppies are an example of this characteristic.
2. Permeable Skin: substances move across it easily. Caecilians (a legless amphibian) have some scales. Most are aquatic in nature or dry out. Some have fatty secretions that help to keep from drying out. Some live in the desert and can form a cocoon underground to protect themselves from drying out. Some salamanders, like the Hellbender, spends its life in water.
3. Carnivorous Adults: Some tadpoles and larval salamanders are filter feeders that eat plants. All adults are carnivores. Most eat spiders, insects, earthworms, and some small vertebrates. Bullfrogs and bigger frogs eat snakes, fish, rodents and other frogs.
4. Great Diversity: They are found in many regions: Central and South America, West Africa and the Southern United States are very rich in fauna.
5. Courtship Rituals: All species have these. Some males call, females do not. Salamanders do not vocalize but many have complex dances and rituals.
6. Poikilothermic: They are unable to control their body temperature internally, so they match the temperature of their environment. They use basking in the sun and burrowing to help. Some people refer to animals of this type by the term “cold blooded”.

Examples of Amphibians

<p>FROG</p>	<p>TOAD</p>
	
<p>SALAMANDER</p>	<p>CAECILIAN</p>
	

Amphibian Life Cycle

Metamorphosis: Change in Structure from Larva to Adult

Some toads can complete their entire metamorphosis in 8 days. Bullfrogs can take two to three years to go through the change. **The average is somewhere between 6 and 21 days.**

Fertilization In Frogs and Toads Is External

Stage 1 - Eggs

- **Fresh laid eggs look like a mass of tapioca pudding.** They are mostly jelly and covered in a gelatinous substance that not only helps protect the egg but also provides some nourishment.
- **Most frogs and toads do not protect eggs.** They are eaten by fish, snakes and birds.
- **However, some do guard their eggs.** The poison arrow frog lays her eggs in the rainforest. When they hatch, the tadpole wiggles up onto her back and she carries it to water. The female Australian gastric-brooding frog swallows her eggs which develop in her stomach. Her digestive system shuts down, and 5 weeks later froglets emerge. The Asian tree frog secretes a small amount of fluid which she whips into a foam, and lays her eggs in a foam nest that hangs from a tree. When tadpoles hatch, the foam disappears and the tadpoles fall into the water below.

Stage 2 - Larvae

- **Eggs hatch into Tadpoles.** Depending upon the species and the environment it may take a few days to years for this to happen. The tadpole is adapted to living in the water. It has gills and a small hole on the side of the face to allow water to pass in and out through it called an “operculum”. It also has a lateral line system, like a fish, to detect changes in the surrounding water. It has a snout appendage on its face to eat plant matter and plankton.
- **Changes in development are triggered by a hormone called thyroxine.** Genes in the frog make it sensitive to the thyroxine at the appropriate times.
- **As the larvae develops its tail is absorbed.** The lateral line system disappears. The back two legs form followed by the front legs. As the front legs form, the “operculum” (hole in the face) closes and the gills form. The mouth becomes less beak-like, and the digestive tract shortens to change from herbivore to carnivore. The two chambered heart becomes three chambers. Eyelids develop to protect the eye. Caecilians are blind, but they can tell dark from light - they just can't see images.

- **Some aquatic salamanders remain in the larval stage.** They maintain gills and are able to reproduce without maturing into an adult first. This is called Pedomorphosis. The mud puppy of the southeast United States has both gills and lungs.
- **Some salamanders have different stages in development but are the same organism.** The red spotted newt and the red eft salamander are different stages of the same species. The newt spends most of its life in water, but becomes terrestrial during the mating season.

Stage 3 - Adulthood

- Frogs and toads have powerful leg muscles for movement. Toads have shorter legs and hop shorter distances.
- Salamanders move from side to side like a fish. They are very good swimmers due to their long tails.
- Caecilians have no legs and burrow (and move) like earthworms.

Frogs and toads **absorb oxygen** from their lungs, skin and the roof of their mouth. They all **need to stay moist**: toads have a dryer skin. Amphibians can **secret mucous from their skin**. It protects them from drying out and is often **poisonous to predators**. People who eat frogs must remove the skin first.

Frogs and toads hear very well. They have large tympanic membrane on the side of their head and can **hear very well both above and below water**. Male frogs have pouches in their throat to make **calling sounds**. Salamanders do not make calls, but make **squeaky sounds** instead.

Frogs and salamanders return to the same body of water every year to reproduce. This often involves a very **strong homing instinct** triggered by their response to the Earth's magnetic field and polarized light from the sun.

How Frogs Protect Themselves Naturally

- They are slimy or slick, making them hard to catch or hold onto
- They secrete substances that make them taste bad
- They secrete poisonous substances
- They use camouflage and blend into their environment
- They swim very well - however, they're not very mobile on land
- They use aposematic coloration to warn predators of poisons in their body

Ecological Significance

Amphibians have been around since the Devonian period (the Carboniferous period is known as the Age of the Amphibians). They have overcome major ecological changes and still managed to carry on. Normally an amphibian is lost to extinction 1/500 years. The rate now has gone to the loss of 200 species in 35 years. EXTINCTION IS FOREVER. If not protected, the genetic makeup of an important species will be forever gone.

Important Functions Of Amphibians In The Ecosystem

1. Their skin is permeable and works as a lung and a kidney. They are susceptible to environmental changes and are known as BIOINDICATORS or ECOLOGICAL INDICATORS.
2. They are an important ally in the control of insects. Many of their prey destroy crops or carry diseases. Grasshoppers, crickets, mosquitos, biting flies, etc.
3. They are important in both freshwater and terrestrial ecosystems. They remain an important food source for snakes, birds, monkeys, fish and humans.
4. They have provided a long list of medical advances. Maganin from the African clawed frog is a natural antibiotic and is used to treat diabetic foot problems. The chemistry of the waxy monkey frog was used in the development of Dermaseptin which treats antibiotic resistant Staphylococcus. Caerin is a drug from White's tree frog that blocks HIV transmission. Bradykinin , which is used to lower blood pressure, comes from the Fire Bellied toad and works by enlarging blood vessels as well as relaxing smooth muscles. Epibatidine is a painkilling substance developed from poison dart frogs that is 200 times more potent than morphine. Their poisons show promise as muscle relaxants and stimulants as well as appetite suppressants.

Threats to Amphibian Populations World Wide

Pollution

Frogs need clean water to extract oxygen. They are sensitive to chemical changes in the water because their skin is so permeable. Thermal pollution is a problem: their internal temperature is controlled by their environment. In the United States near agro-ecosystems we are experiencing Eutrophic Conditions in the water sources: higher ph, higher water temperature, un-ionized ammonia. All of these things can lead to frog embryo mortality and malformations. Herbicides and pesticides have a dramatic effect on frog mortality. Atrazine, a commonly used herbicide, is especially damaging as it interferes with hormone function, leading to a variety of malformations and death.

Habitat Loss

This is a serious issue world wide. The world's population is growing. There are more people who need and to live on and grow food. This is a serious problem for frogs. Their environmental needs are very specific and they can't just move somewhere else. The recent drought in California and the southwest United States has hurt the amphibian populations.

Climate Change

The ozone hole has increased in size allowing for more ultraviolet radiation in the environment. This effects the developing embryos in the egg.

Invasive Species

Introducing organisms that fed on amphibians. Example: There were lakes in the mountains with no trout. The state introduced trout to the lakes. There was a large population of yellow legged frogs. The trout ate the eggs, tadpoles and adults. The population dropped by an estimated 90%. They removed the fish from the environment.

Road Mortality

This comes with habitat loss. Expanding road systems to give people better access to aquatic ecosystems.

Overharvesting

Eating frogs has been a part of cultures for centuries. However, with expanding populations, the same aquatic systems can't supply the people with organisms. Amphibians are often collected for the pet trade. This collection is putting added stress on an already troubled group of organisms.

Chytrid Fungus: *Batrachochytrium dendrobatidis* (BD)

It is a pandemic. This fungus is found all over the world, attacking the skin cells making the skin thick and heavy. Frog skin is a very important organ allowing the frog to absorb water and oxygen. It regulates salts and wastes through it's skin. This is a fatal infection. "Worse infectious disease ever recorded in Vertebrates". (Gascon et al, 2007)

What We Can Do To Help

1. When using chemicals on the garden, be aware of runoff patterns. Do not use more than the recommended amount on the package. Be aware of wind patterns. Don't put old medicines on the ground or in situations where they could become part of the water source. Be aware of climate changes: if a drought occurs in your area for a short time, they will recover. However, if you find tadpoles or eggs in a drying puddle, you might move them to a safer place.
2. Don't move amphibians from one ecological place to another. They carry diseases to new populations. It's better to protect them where they are living.
3. Don't capture amphibians for pets. They have very specific needs for their skin and food source. They become stressed and that can lead to disease.
4. Support conservation groups. Tell your friends about the problems of the frog.
5. Stop eating frog legs. They are disappearing in the wild and the ones that are commercially grown in wetlands help spread frog disease. Support groups who are doing research on an antidote to Chytrid fungal infections. Antibiotics are being studied as is the genetics of small resistant populations

You and I have a responsibility to care for all we are given.

Leap Into Action!