*November 2002*

# Pennsylvania Amphibian and Reptiles: A CURRICULUM GUIDE SAMPLER

Here is a 'taste' of the Pennsylvania Fish and Boat Commission s newest curriculum available to Pennsylvania educators. Included in this sampler is the table of contents of the entire curriculum, samples of 4 lessons (one from each of the units) and other important resource information.

Educators will only be able to obtain a copy of the complete curriculum through a Pennsylvania Fish and Boat Commission training workshop. A workshop schedule is posted on our web site, www.fish.state.pa.us. Click on Education from the PFBC home page. Complete the enclose application and return it to the Commission, you will be added to a mailing list for future workshops.

**What is the Pennsylvania Amphibians and Reptiles Curriculum guide?**
It is a multi-disciplinary curriculum guide designed for classroom educators, K-12. The module is divided into four units:

1. Awareness (basic biology)
2. Habitat
3. Identification (includes information on adaptations)
4. Responsible Human Actions

The curriculum is designed to assist Pennsylvania educators in teaching concepts from the standards in the Ecology and Environment and Science and Technology subject areas. Lessons were designed, developed and tested by classroom educators.

**What is included in the Curriculum?**
The Curriculum includes lessons and background information support materials such as fact sheets, worksheets and lists of resources available from the PFBC. The training workshop is designed to provide background information on Pennsylvania's amphibians and reptiles, as well as some experience with the lessons in the curriculum.

The PFBC is an approved provider for Act 48-Hours from the PA Department of Education.

*November 2002*

# HERP CURRICULUM WORKSHOP APPLICATION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Name of Educator** | | | | | | | |
| **Address** | City State Zip | | | | | | |
| | | | | | | | |
| **Daytime Phone #** | | | | **FAX #** | | | |
| **e-mail** | | | | | | | |
| **County** | | | | | | | |
| **School District** | | | | | | | |
| **Name of Institution** | | | | | | | |
| ✓ **Grade(s) Taught** | | **K-4** | | **5-7** | | **8-10** | | **11-12** |
| **Subject(s) Taught** | | | | | | | |

Please list your experience teaching about PA's amphibians and/or reptiles. Include such information as the number of class periods each year, on average spent teaching about amphibians & reptiles, years teaching this subject, other related activities.

Use a separate sheet, if needed

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Please mail or fax to:
PA Amphibian and Reptile Curriculum
PA Fish and Boat Commission
PO Box 67000
Harrisburg, PA 17106-7000
Fax 717-705-7831

# Pennsylvania

## AMPHIBIANS & REPTILES

PENNSYLVANIA FISH & BOAT COMMISSION

## A Curriculum Guide

Carnegie Museum of Natural History™

One of the four Carnegie Museums of Pittsburgh

# Pennsylvania

## AMPHIBIANS & REPTILES

### A Curriculum Guide

**A cooperative project of the Pennsylvania Fish and Boat Commission and Powdermill Nature Reserve, Carnegie Museum of Natural History**

Carnegie Museum of Natural History™
One of the four Carnegie Museums of Pittsburgh

**This project was funded by the Pennsylvania Wild Resource Conservation Fund**

Do Something WILD!

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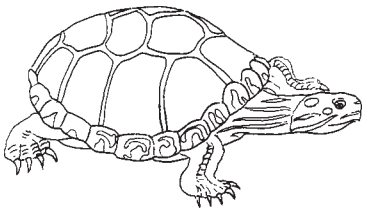
# Contents

**IDENTIFICATION**

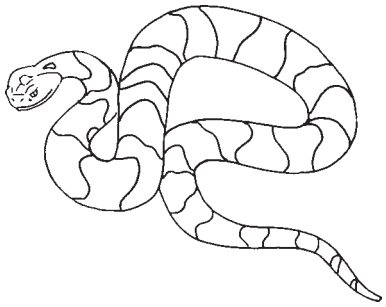
*From field guides and replicas to live field specimens, students observe Pennsylvania's amphibians and reptiles and discover the uniqueness of each species.*



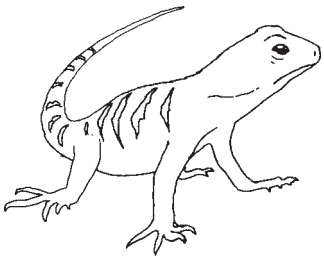
# Hooray for Herpetologists

*by Mark Jackson*

**H**ooray for herpetologists,
the people who all study
turtles, snakes and lizards,
and puppies that are muddy.

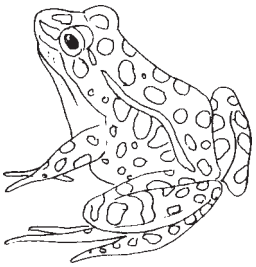


Hooray for salamanders
breathing through their skin,
and humble old box turtles,
whose head and legs tuck in.

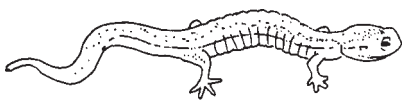


Three cheers for great green garter snakes,
spring peepers all in chorus,
for stinkpot turtles, wood ones too,
out crawling in our forests.

All hail the mighty hellbender,
his bite will never pain ya.
All hail the skinks,
coal and five-lined,
lizards in Pennsylvania.



Applause to herpetologists,
and may their tribe increase.
Learn through their strife
respect for life,
so all may live in peace.



# *Format of the Activities*

*(See explanation of sidebar information on p.xvi)*

- **GRADE LEVELS:**
- **SUBJECT AREAS:**
- **DURATION:**
- **SETTING:**
- **SKILLS:**
- **STUDENT VOCABULARY:**
- **CHARTING THE COURSE:**
- **"HERP" HAPPENINGS:**

An attempt has been made to create titles that are appealing to both student and teacher. If an activity has been based on an activity from another curriculum guide, the original activity and guide are acknowledged under the main title.

## Summary

A concise description of what the activity entails.

## Objectives

Lists the skills and knowledge that students will achieve by participating in the activity.

## Materials

Lists the supplies that are needed to do the activity. In many cases, there is more than one option listed, and, when necessary, there is a list of resources for obtaining certain materials.

In some activities, optional materials are listed; these are not necessary but will enhance the lesson. If there is a data sheet or diagram that is needed for the activity, it is also listed under materials, giving a title and page number. Any pages that need to be photocopied are found at the end of the lesson.

## Background

There is extensive scientific background information included with each activity. Some material is repeated in more than one lesson so that the teacher has each activity's information at his or her fingertips. It may be necessary to explain some of this background to the students prior to performing the activity, but in most cases the information has been included for the teacher's benefit and understanding.

Note that in the background certain words are in boldface type and others are italicized. A **boldface** word is a vocabulary word that students should be able to define by the end of the lesson. An *italicized* word is often from scientific jargon and the teacher may need to understand the word to complete the lesson. Both boldface vocabulary words and italicized words and their definitions can be found in the glossary at the back of the activity guide, beginning on page 435.

## Preparation

Some activities include a preparation section. Here the teacher will find a description of any involved set up that must be done prior to the activity. Sometimes a suggestion for classroom discussion as a preview to the lesson is also included.

## Procedure

The procedure is presented in numbered steps. Some activities are divided into separate parts which may be done on their own. Some activities also have optional alternatives described in the procedure section.

## Conclusions

A short statement that summarizes what the students should have learned by doing the activity.

## Assessments

Options for evaluating student performance are listed. Most activities have more than one assessment option.

## Extensions

Opportunities for further investigation and learning are listed in the extension section. Many include research and reading on the topic, a hands-on field experience, or a creative writing experience.

## Tadpole Option

Many activities offer a Tadpole Option for grade levels that are lower than those suggested in the sidebar. This simplified version of the activity introduces the given concepts to younger students.

## Resources

All references used to create the activity and develop the background information are included under resources. Teachers may want to review some references for further information. Resources may include related or similar activities from other teacher's guides.

## Notes

A space has been provided for the teacher to make notes that pertain to the activity.

## Sidebar Information

The gray sidebar provides information the teacher needs to know at a glance before choosing the activity. The icon at the top represents the section of the book in which the activity is found.

### *Grade Level*

This curriculum guide has been developed for grades K through 12. However, not all of those grade levels pertain to each lesson plan. The appropriate grade levels are stated in this section, but the teacher may be able to adjust an activity for a lower or higher grade level. Grade levels were assigned according to the skills used by students while doing the activity.

### *Subject Areas*

Lists disciplines to which the activity applies. Due to the subject matter, environmental studies and science pertain to most lessons. In addition, an attempt has been made to develop interdisciplinary activities that may include art, language arts, math, physical sciences, physical education, and social studies.

### *Duration*

Estimates the time it will take to do the activity. Duration is given by the number of sessions. A session is approximately 30 – 40 minutes. The duration includes the time it will take to introduce the activity and provide necessary background information to the students.

### *Setting*

Suggest the most appropriate setting for the activity. Some times more than one option is listed. Most activities could be adapted to different settings. Both indoor and outdoor activities have been included in the guide.

### *Skills*

Lists the skills and thinking processes students will employ while participating in the activity.

### *Vocabulary*

Lists the vocabulary words that students will be able to define after completing the activity. All vocabulary words are defined in the glossary beginning on page 435. In addition, the vocabulary words are found in bold within the background of the activity.

### *Charting the Course*

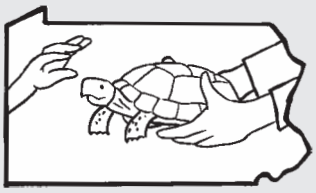
A list of other activities in the guide that are directly related to the activity. A teacher could develop a unit using an activity with those listed in its Charting the Course section.

### *"Herp" Happenings*

For some activities, a list of "Herp" Happenings is also included. These one or two page readings are designed to be photocopied and given to students as additional reading material. Each "Herp" Happening has been written in language easily understood by children in grades K through 12, and should be both enjoyable and informative to the student.

# Getting in Touch with "Herps"

Adapted from "Hands-On Herps," *Ranger Rick's NatureScope: Let's Hear It for Herps!* (Washington, D.C.: National Wildlife Federation, 1987). Adapted with permission of the McGraw–Hill Companies.



- **GRADE LEVELS:**
  4 – 8
- **SUBJECT AREAS:**
  Environmental Science, Language Arts, Reading, Science
- **DURATION:**
  1 – 2 sessions
- **SETTING:**
  Classroom
- **SKILLS:**
  Analyzing, classifying, collaborating, comparing, comprehending, cooperating, interpreting charts and graphs, demonstrating, following directions, generalizing, interpreting, observing, reading, reasoning, visualizing
- **VOCABULARY:**
  Adaptation, amphibian, ectotherm, endotherm, metamorphosis, reptile, scute, tympanum
- **CHARTING THE COURSE:**
  "Herp" Words; Body Work; Puzzles; Looking for Differences; Class Field Guide; "Herp" Field Trip; Replica Round Up; What Do You Know About "Herps?"; "Herp" Prints; A Tadpole's Tale
- **"HERP" HAPPENINGS:**
  What's So Important About Museums and Specimens?; Croaky Crooners


## Summary

Work stations, each focusing on an organ or system, provide students with a chance to compare and contrast adaptations of amphibians and reptiles. In some cases, common materials demonstrate or represent these organs.


## Objectives

Students will

- compare and contrast the adaptations and characteristics of amphibians and reptiles.
- demonstrate how to use these different adaptations to classify animals as amphibians or reptiles.

## Materials

One copy of each task card from pages 57–58; plastic wrap; vegetable oil; index cards; clay (modeling clay, homemade clay, Play-doh, or silly putty); seeds (watermelon, sunflower, pumpkin, or similar large, flat seeds); rubber gloves, preferably the heavy, textured ones used for handling hazardous materials, one pair; cotton gloves (or any gloves that are not waterproof), enough for one per group; a large pan (a dishpan works well) full of water; two plastic margarine tubs; tapioca; sand; grapes or small mushrooms; tuning fork; plastic wrap; empty coffee can; small plastic beads; rubber band; cymbal or metal lid from a garbage can or large pot; mallet; temperature cards; skeleton cards; "herp" development cards; Getting in Touch with "Herps" Worksheet (page 65), one per student. *Optional:* models or samples of amphibian and reptile skeletons.

## Background

Although amphibians and reptiles appear very similar, looking closer at their anatomy reveals differences among them. These different **adaptations** are an important aid to the classification of **amphibians** and **reptiles**.

All reptiles have skin that is covered with scales; their skin is dry to the touch. Their thick, scaly skin protects them not only from injury, but from desiccation. This ability to conserve water has allowed the reptiles to inhabit a variety of habitats including deserts. On the contrary, the skin of amphibians is scaleless and smooth, often slippery or even slimy to the touch. (Amphibians secrete mucous through their skin; this makes some of them very slimy. A good example is the aptly named slimy salamander.) Of course, not all amphibians have very smooth, slimy skin; toads and newts, for example, have dry, somewhat bumpy skin. Unlike reptile skin, this thin, scaleless skin is permeable to water. While nearly all adult amphibians can live on land, most species are still found near a body of water or in a damp or humid environment (i.e., forest, rain forest). There are toads that live in the desert; they accomplish this by retaining urea in their bodies, creating an *osmotic gradient* that forces water retention. Some terrestrial frogs have a specialized skin patch in the pelvic region for absorbing water. This area is rich in blood vessels that lie close to the surface. In addition, many tree frogs have fatty secretions that they wipe over their skin surface; these fats prevent the evaporation of water. Other terrestrial frogs, as well as some salamanders, can retreat from dry conditions by forming a cocoon of their own shed skin.

The toes of amphibians and reptiles are another distinguishing feature. Reptiles have clawed toes (with the exception, of course, of the snakes and legless lizards) while amphibian toes are clawless, covered by the same smooth skin that covers the rest of the body.

The eggs of amphibians and the eggs of reptiles differ in many respects. Some amphibians deposit their eggs in water; others deposit eggs on land but select very moist areas (such as under rocks or in rotting logs). Certain frogs place their eggs on vegetation that overhangs water (where the larvae, upon hatching, fall into the water), while others actually carry the eggs with them on their backs or in a specialized pouch, moving them to water at the time of hatching. None of Pennsylvania's frogs exhibit these behaviors; all our frogs deposit eggs in a body of water. We do, however, have salamanders that lay their eggs on land; these belong to the family Plethodontidae (pleth-oh-DAHN-tih-dee). Note that not all Plethodontids have terrestrial eggs. Many species in this family deposit eggs in flowing water.

Close observation of amphibian eggs makes clear their dependence on water — they are covered only by a gelatinous material that allows movement of water into and out of the egg. In many cases, water is necessary for mating to occur, because many amphibians have external fertilization. The gelatinous coating on the eggs allows sperm to pass into the eggs and join the *ovum*. Upon hatching, most amphibians must remain in water until they undergo **metamorphosis**, or change from larvae to adult form. (See figures for station #3, page 59.) Most amphibians emerge from the egg as a gilled aquatic larva that will develop into an adult with no gills. There are, of course, exceptions to this. Some will retain gills throughout life — the mudpuppy is one example found right here in Pennsylvania. Others will complete development while still inside the egg, such as the terrestrial frogs mentioned earlier, and salamanders in the genus Plethodon (a common genus in Pennsylvania). In these cases, the embryos lose their gills before hatching so that they are born looking like miniature adults.

The majority of amphibians hatch as tadpoles with long flat tails and no legs. Very young tadpoles have external gills for respiration. In the case of frogs, a small mouth is found on the ventral side of the tadpole's head; it is adapted for scraping algae and other vegetation from rocks and similar surfaces. As the tadpole matures, the external gills are replaced by lungs. The hind legs appear, followed by the forelimbs. In frogs, the tail is slowly reabsorbed, the intestines shorten, and the mouth is altered to be used for predation. The changes that occur and the length of time necessary for metamorphosis vary among species.

The reptiles, on the other hand, have internal fertilization and eggs with a tough "shell" which may be leathery (as is the case with snake eggs) or hard and calcified (tortoise eggs). This outer covering slows evaporation and eliminates the need for an aquatic or damp environment. All reptiles, even the aquatic turtles, deposit their eggs on land, and the young hatch fully developed, miniature likenesses of the adults. The only exceptions are those snakes and lizards that bear live young.

All reptiles breathe with lungs, including those that have adapted to life in aquatic environments. The snakes actually use just one lung; the other lung is still present but is small and nonfunctional. This is due to their unique anatomy. Amphibians begin their lives with gills, but some lose these gills before leaving the egg. With the exception of salamanders in the family Proteidae (pro-TEE-ih-dee) (i.e., mudpuppies) and certain Ambystomatids (AM-biss-toh-MAT-ids) known as axolotls (AK-soh-lot-l), the gills are lost when the adult stage is reached. At this point, many amphibians — frogs, toads, and some salamanders — will breathe with lungs. However, the lungless salamanders, known as the family Plethodontidae, have no lungs, as their name implies. They respire by cutaneous respiration; in other words, they absorb oxygen through their thin skin. Their skin is moist and permeable, containing many blood vessels. In the case of the hellbender, an aquatic salamander and Pennsylvania's largest amphibian, the adult can absorb oxygen through its skin — in fact the many folds in its skin provide more surface area for absorption. If oxygen levels are low in its aquatic habitat, the hellbender can rise to the surface and breathe air using its lungs.

Both amphibians and reptiles are vertebrates with similar skeletons. In fact, amphibians and reptiles are some of the oldest living vertebrates. Some reptiles have evolved remarkable skeletal adaptations. Snakes have not only lost their limbs; most have also lost their pelvic and shoulder girdles. In addition, the lower jaw is not fused in front so that it can stretch to swallow prey. The shell of the turtle is actually part of the skeletal system; the backbone and ribs are fused to the inner shell, and bony plates underlie the **scutes** which compose the outer part of the shell. (See "Body Work.")

All amphibians and reptiles are **ectotherms**, or what is commonly known as "cold-blooded." This

means that they do not maintain a constant internal body temperature like **endotherms** (birds and mammals). Instead, their body temperature fluctuates with the temperature of their environment. This does not mean that their temperature is exactly the same as the temperature outside. The body temperature may be slightly raised by the metabolic processes going on within, and amphibians and reptiles have ways of adjusting body temperature. Lying on a rock in the morning sun is one way to raise temperature, and finding a damp shady place is a way to stay cool on a hot day. Some lizards will even elevate body temperature to fight an invading organism, much like humans and other mammals will get a fever. (Endotherms get fevers in response to infection because the increased body temperature is often effective in killing the invading organism. The body temperature is raised by increased heat production, such as shivering, and by increased heat conservation, such as *vasoconstriction*, which results in the skin and extremities feeling cold.)

Use of the senses also differs among the amphibians and reptiles. Some can hear just as humans do — by detecting airborne sound waves. Others rely on feeling vibrations in the ground. Pennsylvania lizards have ears that can detect sound waves; in fact their external ear openings are an important characteristic for identification. However, the lizards also can detect vibrations moving from the ground through their forelegs and into a small bone in their inner ear.

Snakes and turtles depend on feeling vibrations because their sense of hearing is not well developed. Of all amphibians and reptiles, frogs may be the most dependent upon hearing. They use calls for a variety of reasons; the most important is to attract mates. Most frogs and toads have large external **tympanums**, or eardrums, located just behind the eyes. Like the human eardrum, the tympanum vibrates when sound waves reach it.

## Preparation

**1.** The materials needed for this lesson are generally not found in the science classroom and may require extra effort to obtain. Below, listed by station, are hints for obtaining and storing the required materials.

**SKIN:** The "reptile skin" made of clay and seeds can be assembled on a piece of heavy cardboard. After the activity, cover tightly with plastic wrap to protect it, so that it can be stored for reuse. Play-doh is likely to crumble when it dries, but if modeling clay is used it should harden and remain intact. To avoid confusion, instead of an ordinary rubber glove, use the type designed for handling hazardous materials. Students may think the smooth rubber glove represents an amphibian skin. The heavier, textured gloves may be available in your chemistry department, or purchase them in a store that sells men's work clothes. They will be located with the work gloves.

**EGGS:** You may find pearl tapioca in your grocery store or at a specialty foods store. If you cannot find it, regular tapioca works fine. You will not need much for the activity, so store what remains of the dry tapioca in an air-tight container; it will keep indefinitely. When setting up the activity, allow plenty of time for the tapioca to soak and absorb the water. It is easiest to soak it the day before and let it set overnight. For the reptile eggs, if you wish to use a non-food item that you can reuse year after year, try Ping-Pong balls or large bath beads.

**DEVELOPMENT:** You may want to enhance this station with plastic mounts that show the life cycle of an amphibian and that of a reptile. Such models are available from Carolina Biological (800-334-5551.)

**HEARING:** The tuning fork and cymbal may be available from your school's music department. If not, tuning forks are inexpensive and are available at music stores. Music stores also carry cymbals, but they are rather expensive. If you cannot borrow one, you may want to improvise with a metal garbage can lid or something similar. The beads must be lightweight, such as plastic. Some dry tapioca also works well.

**BONES:** Skeleton models are available in science catalogues.

**2.** Make copies of the Getting in Touch with "Herps" Worksheet and of the task and station cards. You may want to enlarge the task and station cards for your students. You may also want to laminate these cards to protect them.

**3.** Set up stations around the room. Make sure there is enough room at each station for a small group to work together. You will find that the set up does take some time, especially the first time you do the activity. The set up is described below.

### *Station 1 - Skin*

**Materials:** A piece of plastic wrap glued to an index card and coated with vegetable oil (labeled A); clay with seeds stuck in it in an overlapping

manner to resemble the skin of a reptile (labeled B); rubber gloves; cotton gloves; a large pan of water.

**Directions:** Touch A and B. Which do you think is like the skin of an amphibian? Which do you think is like the skin of a reptile?

Put a rubber glove on one hand and a cotton glove on the other hand. Immerse both hands in the water. Which hand got wet? Which glove represents the skin of an amphibian, and which represents the skin of a reptile? Which is more likely to lose water through its skin if it is in a dry environment — an amphibian or a reptile? Which would need to live near water?

### *Station 2 - Eggs*

**Materials:** A plastic tub containing one tablespoon of tapioca (large or pearl tapioca works best) that has been soaked in a quarter cup of very hot water (container A); a second tub containing sand with grapes or small mushrooms resting on top (container B). Alternative: Use Jello for amphibian eggs and Ping-Pong balls for reptile eggs.

**Directions:** Touch the contents of container A and container B. Which represents the eggs of an amphibian and which represents the eggs of a reptile? What would happen if we emptied the containers and let the contents sit out overnight? Which animals — amphibians or reptiles — deposit their eggs on dry land? Which eggs are dependent on water?

### *Station 3 - Development*

**Materials:** Cards showing the developmental stages of amphibians (A) and reptiles (B), photocopied from page 59.

**Directions:** Study cards A and B. Which hatchlings — amphibian or reptile — are more likely to need a wet or moist environment? Which hatchlings are more likely to live in a habitat that differs from that of their parents?

### *Station 4 - Respiration*

**Materials:** Cards showing the snake lung (A) and a gilled salamander (B), photocopied from page 60.

**Directions:** Study the cards. How do reptiles breathe? How do amphibians breathe? Do all salamanders have gills? Do young amphibians breathe the same way their parents do? Besides getting oxygen through their lungs or gills, how else might amphibians absorb oxygen?

### *Station 5 - Feet*

**Materials:** Cards showing the foot of a lizard (A) and that of a salamander (B), photocopied from page 61.

**Directions:** Study the cards. What is the difference between the two feet pictured? Which belongs to an amphibian and which belongs to a reptile? How might reptiles use these special feet? How might an amphibian use its special feet?

### *Station 6 - Hearing*

**Materials:** Tuning fork, plastic wrap, empty coffee can, small plastic beads, rubber band, a cymbal or metal lid from a garbage can or large pot, a mallet.

Stretch the plastic wrap tightly over the open end of the coffee can and hold it in place with the rubber band. Place beads (or dry tapioca if you don't have beads) on top of the plastic.

**Directions:** Strike the tuning fork against the table and hold it up to your ear. What do you hear? Strike the tuning fork again, but this time hold the base of it against your chin. What do you hear? What do you feel? Which time were you "hearing" like a snake?

Hold the cymbal about one foot above the coffee can and strike the cymbal with the mallet, creating a loud noise. Observe the beads while you do this. Why do the beads move? Which amphibians and reptiles have a tympanum (or eardrum) that works the same way as the plastic?

### *Station 7 - Body Temperature*

**Materials:** Cards showing temperature charts labeled A and B, photocopied from page 62.

**Directions:** Study the cards. Which card illustrates the likely body temperature of an amphibian or reptile? Name an animal that would have a body temperature illustrated by chart A. Name an animal that would have a body temperature illustrated by chart B.

### *Station 8 - Bones*

**Materials:** Cards showing skeletons of amphibians and reptiles, photocopied from page 63; models or samples of amphibian and reptile skeletons (optional).

**Directions:** Study the skeletons. Do amphibians and reptiles have endo-skeletons or exoskeletons? Are "herps" vertebrates or invertebrates?

## Procedure

**1.** Discuss the adaptations of amphibians and reptiles with your class. Stress that, although there are similarities between the two groups,

they are two separate classes of animals. Emphasize the differences between amphibians and reptiles and how these different adaptations relate to habitat, life cycle, and diet.

**2.** Divide students into groups of two or three. Give each student a copy of the Getting in Touch with "Herps" Worksheet. Groups visit each station, spending three or four minutes reading and following the directions on the card. They should write their answers to the questions at each station in the appropriate place on the worksheet.

## Conclusions

Amphibians and reptiles are ectothermic vertebrates. Despite these similarities, there are distinct differences between these two classes of animals.

## Assessments

**1.** Evaluate completed worksheets.

**2.** Give each student a piece of paper that has a line dividing it into two columns. Have them write "amphibians" at the top of one column and "reptiles" at the top of the other. Then have students list the adaptations of each in the appropriate column.

## Extensions

**1.** Place frog eggs or tadpoles in an aquarium in your classroom. Have students observe their development. Ask questions that require students to recall what they learned in this lesson about amphibian life cycles.

**2.** Explain that there are some "herps" that give birth to live young instead of laying eggs. Define and discuss the terms *oviparous*, *viviparous*, and *ovoviviparous*. Have students research amphibian and reptile species that do not lay eggs.

**3.** Discuss endotherms and ectotherms and their temperature charts. Is an ectotherm's body temperature equal to the air temperature? Why would it differ from the air temperature? (They can modify their behavior, or sometimes even change color, to increase or decrease body temperature.) Does an endotherm's body temperature always remain constant? Why would it fluctuate? (An endotherm could have a fever, or become hypothermic. Also, some mammals hibernate, dropping their temperature far below normal.)

## Tadpole Option

**1.** Discuss the similarities and differences between amphibians and reptiles. Name some animals that are amphibians and some that are reptiles. Hold up pictures or toys such as Beanie Babies that represent amphibians or reptiles. Ask the students, "Is this an amphibian or reptile?" Place amphibians in one pile and reptiles in another.

**2.** Set up the stations as described, but do not put out the task cards. You may want to eliminate stations that seem too complex in concept, such as the hearing or body temperature stations.

**3.** In small groups, have the students visit the stations. Have them pick which "skin" is like an amphibian's and which is like a reptile's. Do the same for eggs, development, respiration, feet, and bones. It may help to have a picture of an amphibian and a reptile at each station.

## Resources

Gans, Carl; A. d'A. Bellairs; and Thomas S. Parsons. *Biology of the Reptilia*, Vol. 1, *Morphology.*. New York: Academic Press, 1969.

Guyton, Arthur C. *Textbook of Medical Physiology.* Philadelphia, Pa.: W.B. Saunders Company, 1986.

Halliday, Tim R., and Kraig Adler. *The Encyclopedia of Reptiles and Amphibians.* New York: Facts on File, 1986.

Pritchard, Peter C. H. *Living Turtles of the World.* Jersey City, N.J.: T.F.H. Publications, 1967.

*Ranger Rick's NatureScope: Let's Hear It for Herps!* Washington, D.C.: National Wildlife Federation, 1987.

Shaffer, Larry L. *Pennsylvania Amphibians and Reptiles.* Harrisburg, Pa.: Pennsylvania Fish Commission, 1991.

## ▼ Notes

# Getting in Touch with "Herps" Task Cards

## STATION 1 – SKIN

Touch A and B. Which do you think is like the skin of an amphibian? Which do you think is like the skin of a reptile?

Put a rubber glove on one hand and a cotton glove on the other hand. Immerse both hands in the water. Which hand got wet? Which glove represents the skin of an amphibian, and which represents the skin of a reptile? Which is more likely to lose water through its skin if it is in a dry environment — an amphibian or a reptile? Which would need to live near water?

**Pennsylvania Amphibians and Reptiles**
GETTING IN TOUCH WITH "HERPS" TASK CARD

## STATION 2 – EGGS

Touch the contents of container A and container B. Which represents the eggs of an amphibian and which represents the eggs of a reptile? What would happen if we emptied the containers and let the contents sit out overnight? Which animals — amphibians or reptiles — deposit their eggs on dry land? Which eggs are dependent on water?

**Pennsylvania Amphibians and Reptiles**
GETTING IN TOUCH WITH "HERPS" TASK CARD

## STATION 3 – DEVELOPMENT

Study cards A and B. Which hatchlings — amphibian or reptile — are more likely to need a wet or moist environment? Which hatchlings are more likely to live in a habitat that differs from that of their parents?

**Pennsylvania Amphibians and Reptiles**
GETTING IN TOUCH WITH "HERPS" TASK CARD

## STATION 4 – RESPIRATION

Study the cards. How do reptiles breathe? How do amphibians breathe? Do all salamanders have gills? Do young amphibians breathe the same way their parents do? Besides getting oxygen through their lungs or gills, how else might amphibians absorb oxygen?

**Pennsylvania Amphibians and Reptiles**
GETTING IN TOUCH WITH "HERPS" TASK CARD

# Getting in Touch with "Herps" Task Cards

## STATION 5 – FEET

Study the cards. What is the difference between the two feet pictured? Which belongs to an amphibian and which belongs to a reptile? How might reptiles use these special feet? How might an amphibian use its special feet?

**Pennsylvania Amphibians and Reptiles**
GETTING IN TOUCH WITH "HERPS" TASK CARD

## STATION 6 – HEARING

Strike the tuning fork against the table and hold it up to your ear. What do you hear? Strike the tuning fork again, but this time hold the base of it against your chin. What do you hear? What do you feel? Which time were you "hearing" like a snake?

Hold the cymbal about one foot above the coffee can and strike the cymbal with the mallet, creating a loud noise. Observe the beads while you do this. What happened and why? Which herps have a tympanum (or eardrum) that works the same way as the plastic?

**Pennsylvania Amphibians and Reptiles**
GETTING IN TOUCH WITH "HERPS" TASK CARD

## STATION 7 – BODY TEMPERATURE

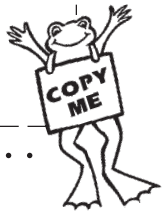
Study the cards. Which card illustrates the body temperature of an amphibian or reptile? Which illustrates the body temperature of an animal that is not an amphibian or reptile? Name an animal that would have a body temperature illustrated by Chart A. Name an animal that would have a body temperature illustrated by Chart B.

**Pennsylvania Amphibians and Reptiles**
GETTING IN TOUCH WITH "HERPS" TASK CARD

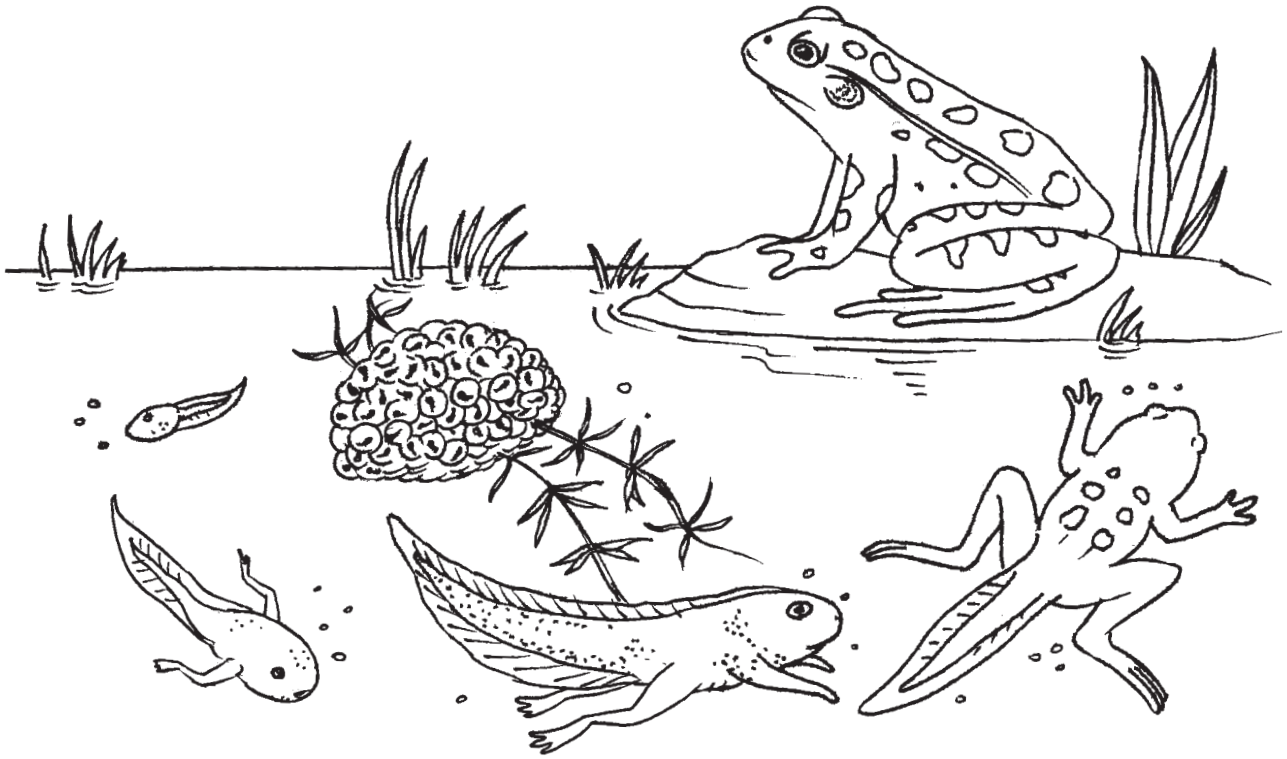
## STATION 8 – BONES

Study the skeletons. Do herps have endoskeletons or exoskeletons? Are herps vertebrates or invertebrates?

**Pennsylvania Amphibians and Reptiles**
GETTING IN TOUCH WITH "HERPS" TASK CARD

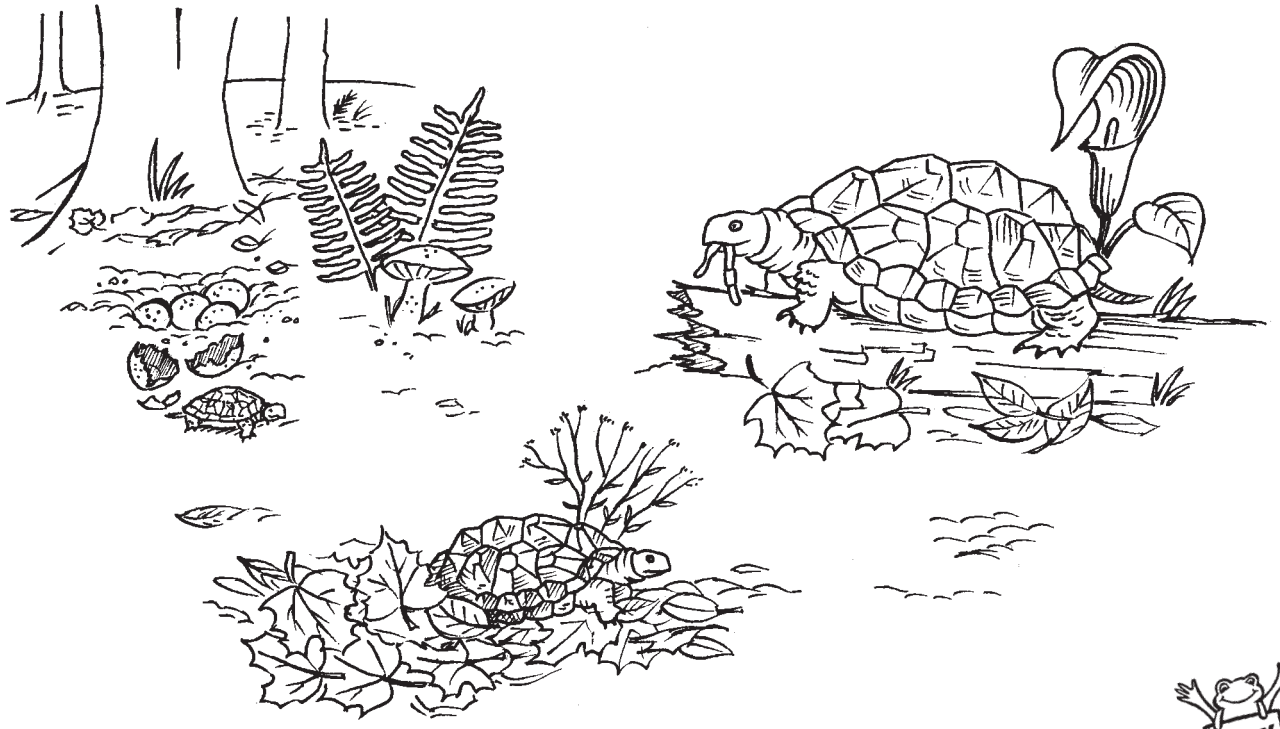


## STATION 3 – DEVELOPMENT – A



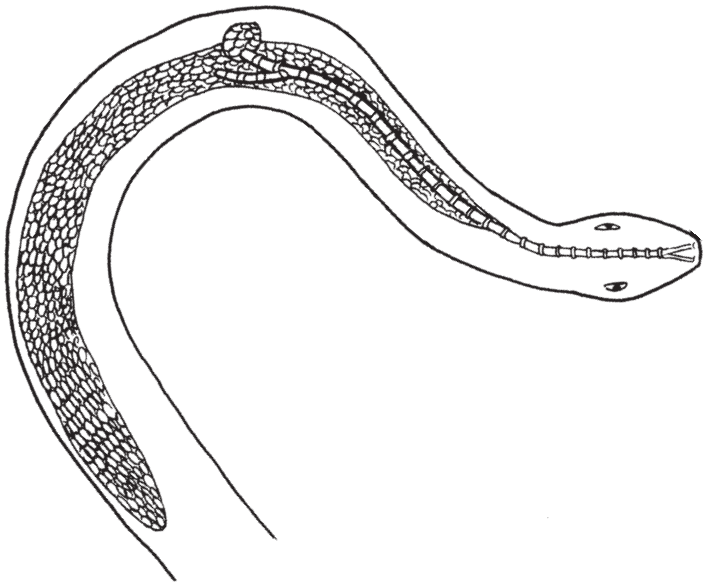


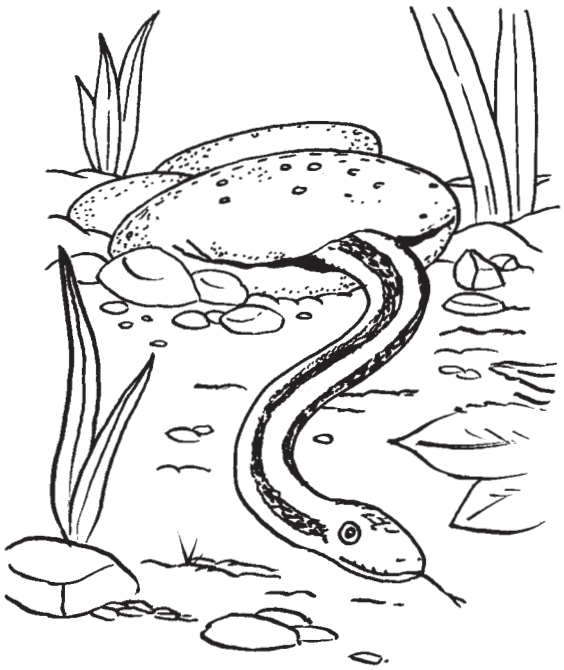
## STATION 3 – DEVELOPMENT – B





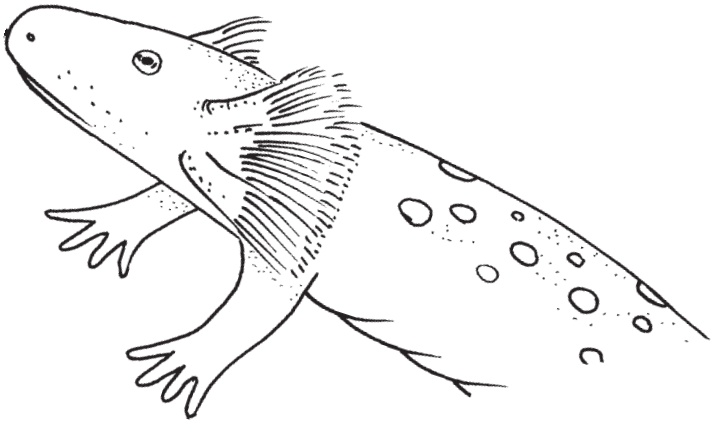
## STATION 4 – RESPIRATION – A

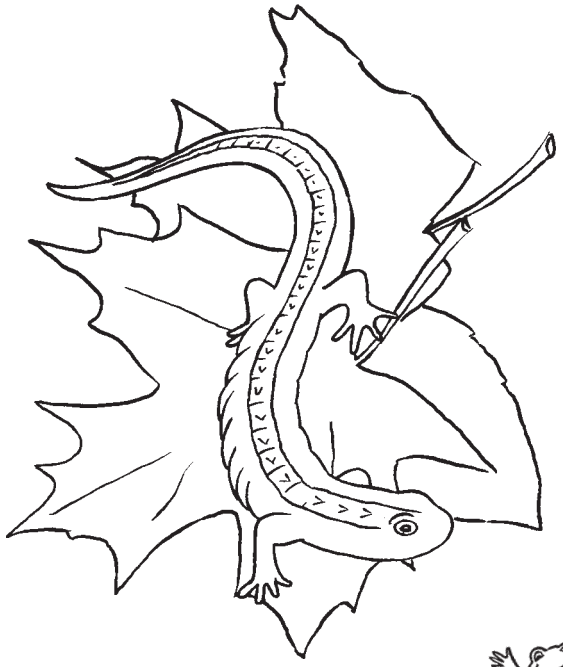




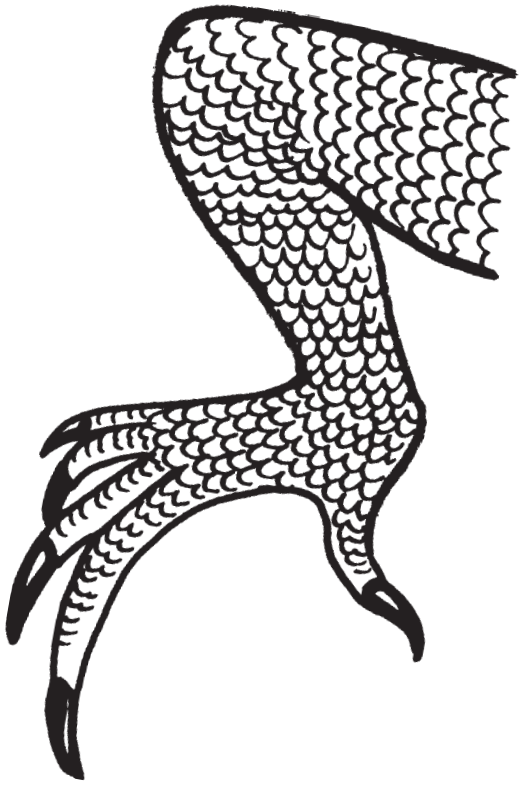


## STATION 4 – RESPIRATION – B





## STATION 5 – FEET – A

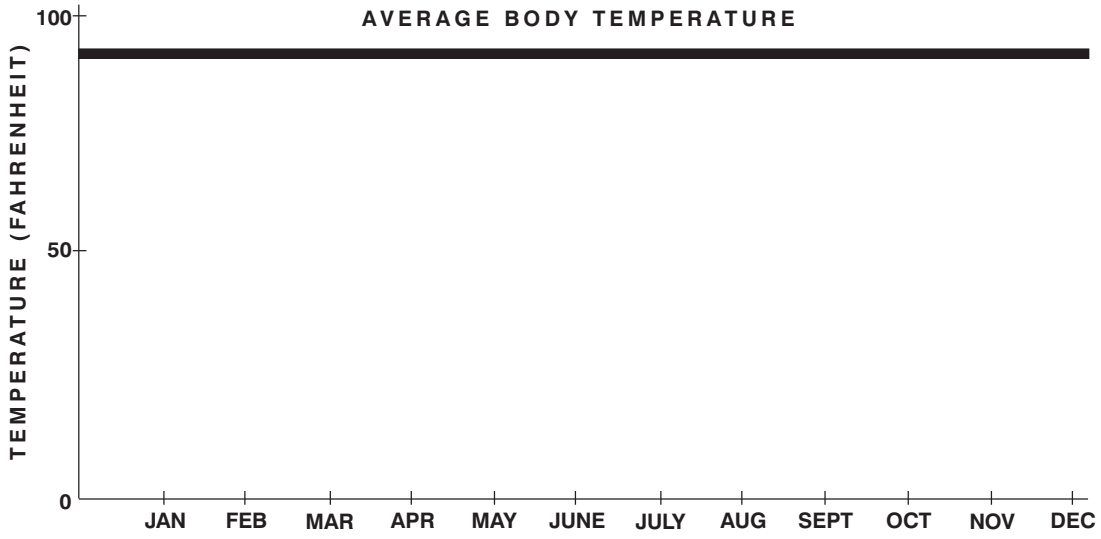


**Pennsylvania Amphibians and Reptiles** • GETTING IN TOUCH WITH "HERPS"

## STATION 5 – FEET – B

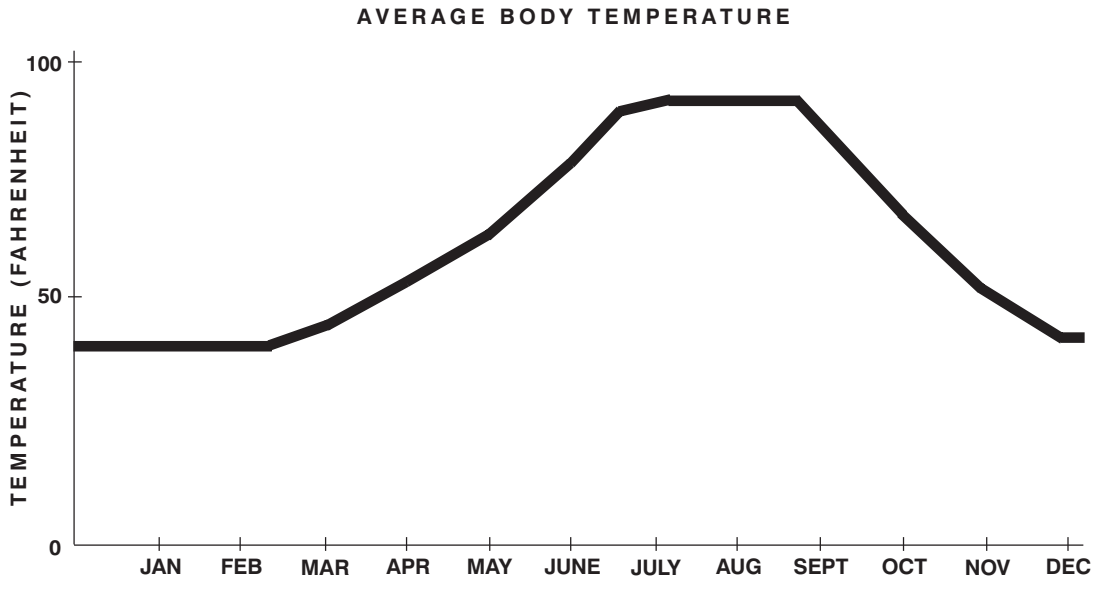
**Pennsylvania Amphibians and Reptiles** • GETTING IN TOUCH WITH "HERPS"

## STATION 7 – TEMPERATURE – A




**Pennsylvania Amphibians and Reptiles** • GETTING IN TOUCH WITH "HERPS"

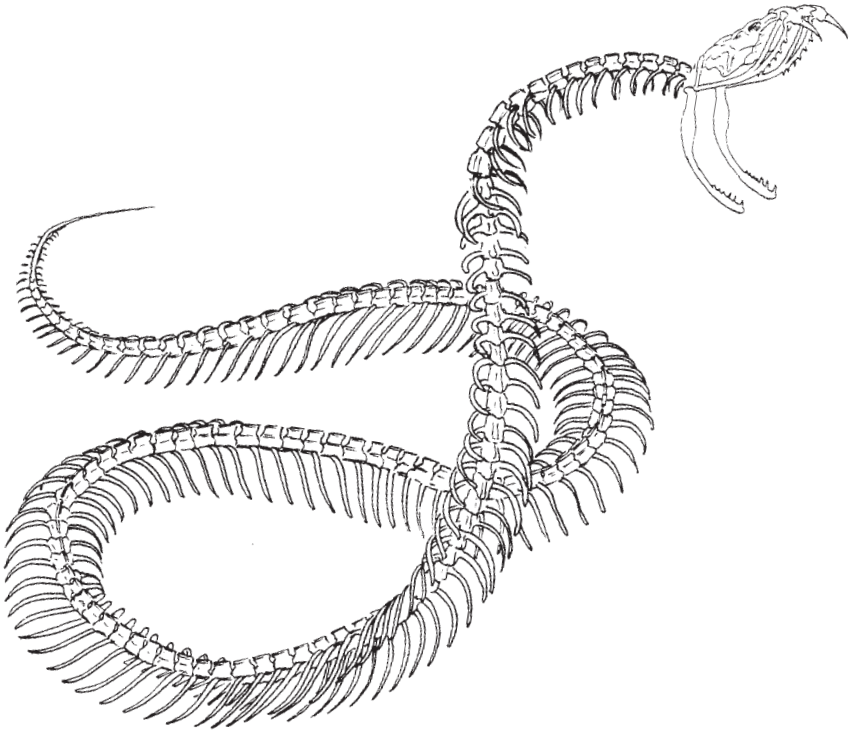
## STATION 7 – TEMPERATURE – B





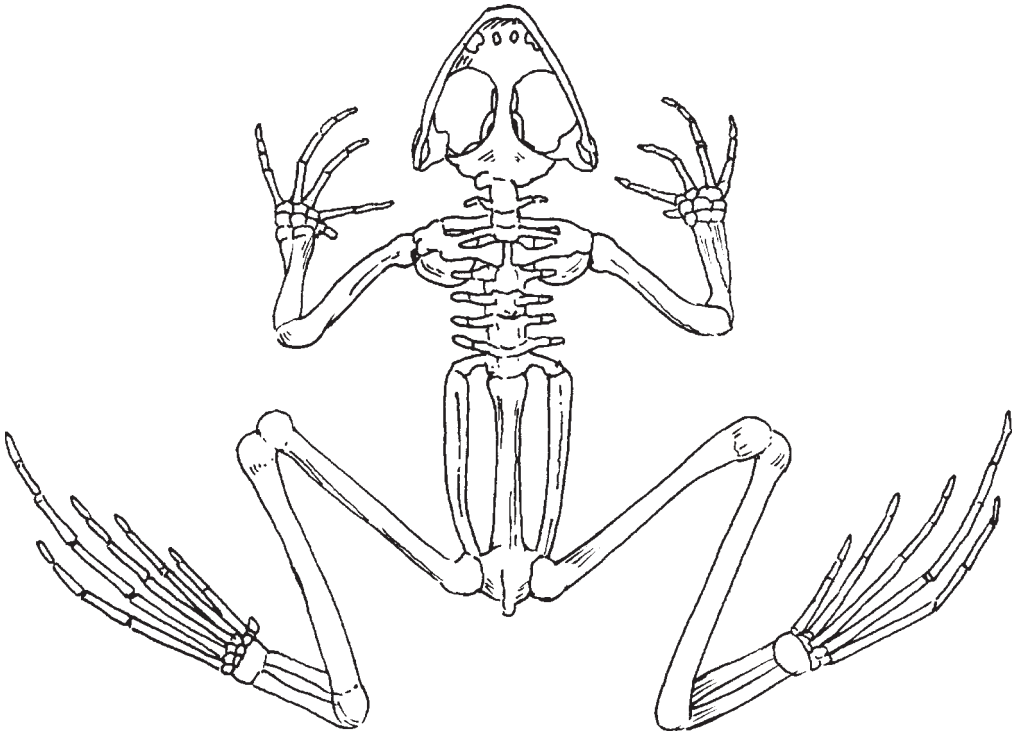
**Pennsylvania Amphibians and Reptiles** • GETTING IN TOUCH WITH "HERPS"

## STATION 8 – BONES – A

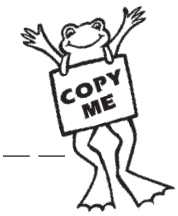


**Pennsylvania Amphibians and Reptiles** • GETTING IN TOUCH WITH "HERPS"

## STATION 8 – BONES – B



**Pennsylvania Amphibians and Reptiles** • GETTING IN TOUCH WITH "HERPS"



# Getting in Touch with "Herps" Worksheet

**STATION 1 — SKIN**

Which do you think is like the skin of an amphibian? _____

Which do you think is like the skin of a reptile? _____

Which hand got wet? _____

Which glove represents the skin of an amphibian? _____

Which glove represents the skin of a reptile? _____

Which is more likely to lose water through its skin? _____

Which would need to live near water? _____

**STATION 2 — EGGS**

Which represents the eggs of an amphibian? _____

Which represents the eggs of a reptile? _____

What would happen if we emptied the containers and let the contents sit out overnight? _____

_____

_____

Which animals, amphibians or reptiles, deposit their eggs on dry land? _____

Which eggs are dependent on water? _____

**STATION 3 — DEVELOPMENT**

Which hatchlings, amphibian or reptile, are more likely to need a wet or moist environment? _____

Which hatchlings are more likely to live in a habitat that differs from that of their parents? _____

**STATION 4 — RESPIRATION**

How do reptiles breathe? _____

How do amphibians breathe? _____

Do all salamanders have gills? _____

Do young amphibians breathe the same way as their parents do? _____

Besides getting oxygen through their lungs or gills, how else might amphibians absorb oxygen? _____

_____

*Worksheet continues on other side*

**STATION 5 — FEET**

What is the difference between the two feet pictured?_____

Which belongs to an amphibian and which belongs to a reptile?_____

How might reptiles use these special feet?_____

How might an amphibian use its special feet?_____

**STATION 6 — HEARING**

What do you hear when you hold the tuning fork to your ear?_____

What do you hear when you hold the tuning fork to your chin?_____

What do you hear when you hold the tuning fork against your chin?_____

Which time were you "hearing" like a snake?_____

What happened and why?_____

_____

Which "herps" have a tympanum (or eardrum) that works the same way as the plastic?_____

_____

**STATION 7 — BODY TEMPERATURE**

Which card illustrates the likely body temperature of an amphibian or reptile?_____

Which illustrates the body temperature of an animal that is not an amphibian or reptile?_____

Name an animal that would have a body temperature illustrated by chart A._____

Name an animal that would have a body temperature illustrated by chart B._____

**STATION 8 — BONES**

Do "herps" have endoskeletons or exoskeletons?_____

Are "herps" vertebrates or invertebrates?_____

# Getting in Touch with "Herps" Worksheet

**STATION 1 — SKIN**

Which do you think is like the skin of an amphibian? *A. The oil-coated plastic.*

Which do you think is like the skin of a reptile? *B. The seeds representing scales.*

Which hand got wet? *The one wearing the cotton glove.*

Which glove represents the skin of an amphibian? *The cotton glove.*

Which glove represents the skin of a reptile? *The rubber glove.*

Which is more likely to lose water through its skin? *Amphibian.*

Which would need to live near water? *Amphibian.*

**STATION 2 — EGGS**

Which represents the eggs of an amphibian? *A. The tapioca soaked in water.*

Which represents the eggs of a reptile? *B. The mushrooms, grapes, or bath beads in sand.*

What would happen if we emptied the containers and let the contents sit out overnight? *The "amphibian eggs," or tapioca, would dry up. The "reptile eggs" would remain the same.*

Which animals, amphibians or reptiles, deposit their eggs on dry land? *Reptiles.*

Which eggs are dependent on water? *Amphibians.*

**STATION 3 — DEVELOPMENT**

Which hatchlings, amphibian or reptile, are more likely to need a wet or moist environment? *Amphibians.*

Which hatchlings are more likely to live in a habitat that differs from that of their parents? *Amphibians, because the young usually live in water and the adults on land.*

**STATION 4 — RESPIRATION**

How do reptiles breathe? *With lungs.*

How do amphibians breathe? *With gills (according to the picture on the card.)*

Do all salamanders have gills? *No. Most have gills only when in the larval stage.*

Do young amphibians breathe the same way as their parents do? *No, not in most cases.*

Besides getting oxygen through their lungs or gills, how else might amphibians absorb oxygen? *Through their skin.*

**STATION 5 — FEET**

What is the difference between the two feet pictured? *The foot pictured on card A has claws.*

Which belongs to an amphibian and which belongs to a reptile? *A is the reptile, B is the amphibian.*

How might reptiles use these special feet? *For digging, for climbing trees and rocks.*

How might an amphibian use its special feet? *For swimming, for climbing trees and plants if the toes are like suction cups.*

**STATION 6 — HEARING**

What do you hear when you hold the tuning fork to your ear? *A musical note.*

What do you hear when you hold the tuning fork to your chin? *The same musical note, but louder.*

What do you hear when you hold the tuning fork against your chin? *The jawbone feels the vibration of the tuning fork.*

Which time were you "hearing" like a snake? *When the tuning fork was held against the jaw.*

What happened and why? *Sound waves travelled through the air from the cymbal causing the plastic to vibrate, moving the beads.*

Which "herps" have a tympanum (or eardrum) that works the same way as the plastic? *Frogs have a large tympanum that is important for hearing the calls of other frogs.*

**STATION 7 — BODY TEMPERATURE**

Which card illustrates the likely body temperature of an amphibian or reptile? *B, the one that varies.*

Which illustrates the body temperature of an animal that is not an amphibian or reptile? *A, the one that stays the same throughout the year could only be an endotherm.*

Name an animal that would have a body temperature illustrated by chart A. *A bird or mammal.*

Name an animal that would have a body temperature illustrated by chart B. *An amphibian, reptile, fish, or invertebrate.*

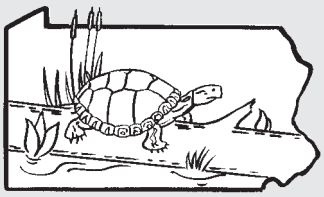
**STATION 8 — BONES**

Do "herps" have endoskeletons or exoskeletons? *Endoskeletons.*

Are "herps" vertebrates or invertebrates? *Vertebrates.*

# "Herp" Sweet Home

Adapted from "Water, Water Everywhere," in *Living in Water*, Edition 1 (Baltimore, Md.: National Aquarium, 1987).



- **GRADE LEVELS:** 6 – 12
- **SUBJECT AREAS:** Environmental Studies, Science
- **DURATION:** 2 sessions
- **SETTING:** Classroom
- **SKILLS:** Classifying, comparing, concluding, describing, developing vocabulary, following directions, interpreting, reading, reasoning
- **VOCABULARY:** Biome, bog, deciduous forest, dichotomous key, habitat, marsh, swamp, vernal pool, wetland, wet meadow
- **CHARTING THE COURSE:** Class Field Guide; Herpetology Field Trip; "Herp" Habitat Haggle; Park It Here!; Before the Well Runs Dry; Carry On!; What Every "Herp" Needs; Froggy Swamp; What Do You Know About "Herps?"; Oh "Herps!"; Isn't That Special?
- **"HERP" HAPPENINGS:** A Tiny Turtle in Danger of Disappearing; Leave No Stone Unturned; Sandstone and Salamanders; Swamp Rattlers


## Summary

Students use a dichotomous key and a flow chart to classify common Pennsylvania habitats. Each of these habitats is a potential home to many species of amphibians and reptiles.


## Objectives

Students in grades 6 through 8 will
- define habitat.
- use a flow chart and a dichotomous key.
- name and describe three different Pennsylvania habitats.

Students in grades 9 through 12 will
- analyze the usefulness of dichotomous keys to scientific investigation.
- describe several habitats, listing the typical vegetation and other defining properties.
- given a habitat type, name two amphibians or reptiles that live in that habitat.

## Materials

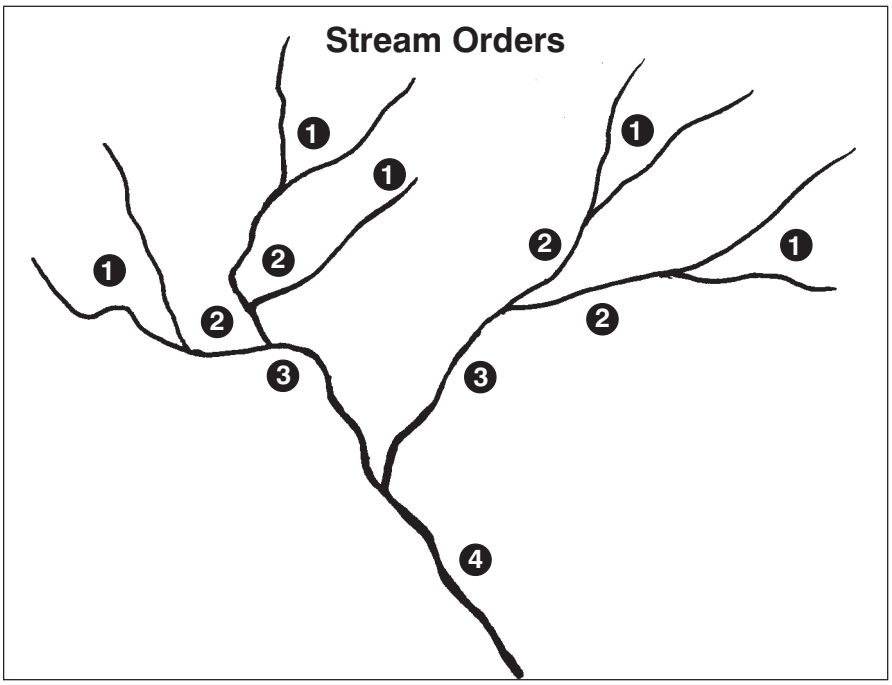
Copies of Key to Pennsylvania Habitats (page 147); copies of Pennsylvania Habitat Flow Charts (pages 149–151); copies of habitat cards (pages 153–167), one per student.

## Background

**Dichotomous keys** are used in science to classify many types of things, usually living organisms. The user is offered two choices at each step, and by choosing between the two the user is led to an answer or to another choice. These keys can seem daunting at first due to their minute detail. Introducing students to a simple key allows them to become accustomed to the concept without being overwhelmed. A flow chart offering two choices at each step is essentially the same as a key, but the layout of the flow chart can help children visualize how a dichotomous key works.

The entire state of Pennsylvania is part of a temperate **deciduous forest biome**, a biome characterized by mid-range temperatures and high levels of precipitation. The final stage of *ecological succession* in Pennsylvania is a deciduous forest dominated by large hardwood trees such as oak, maple, and beech. Before the European settlement of this state, about 98 percent of it was covered by forest. Today, only small, inaccessible patches of old growth forest remain, notably in Cook Forest State Park, Susquehannock State Forest, and Bald Eagle State Forest. Second and third growth forests now cover approximately 60 percent of the state. A major part of Pennsylvania has been cleared for agriculture, the number one industry in the Commonwealth. As the population grows, more and more land is becoming residential, and wildlife and humans must share backyard **habitats**. In rural areas, and even in some suburbs, small stands of second growth trees dot the landscape. These woodlots are home to many species, including several amphibians and reptiles.

The forest was not the only habitat found in Pennsylvania before colonial times. There were naturally occurring meadows or prairies (the result of pond or lake succession), and the mountainous regions of the state contained rocky outcrops that still exist today. Aquatic habitats abounded, including over 50,000 miles of flowing water. (In fact, Alaska is the only place in the United States that has more miles of rivers and streams than Pennsylvania.) Unfortunately, some of this flowing water has been degraded by human activities like farming, industry, and mining. Abandoned mine drainage is the primary pollutant, impacting more than 3,000 miles of Pennsylvania streams. It may come as a surprise that there were far fewer lakes and ponds in Pennsylvania prior to the




immigration of Europeans, but most of the lakes and ponds we have today are artificial. Of course, Lake Erie existed, holding a wealth of species before an influx of sewage and agricultural fertilizer led to it being declared biologically dead in the 1960s. (Today, Lake Erie is recovering and is once again home to many species, although some, such as the blue pike, are now extinct.) Excluding Lake Erie, Pennsylvania's two largest lakes — Raystown Lake and Lake Wallenpaupack — are both artificially created. In addition, Pennsylvania once had an abundance of **wetlands**, including **swamps**, **bogs**, **marshes**, **wet meadows**, and **vernal pools**. Today, 56 percent of those wetlands have been eradicated by human activities like filling and flooding, and we are still losing wetlands each year.

The dichotomous key and flow chart used in this activity distinguish between different habitats by using distinctive characteristics like the amount of water or the type of vegetation. Also, since some habitats are created by human activity, human impact and the proximity of homes and other buildings are also considered.

Terrestrial habitats are those which are not covered with water for a significant amount of time, although they may be covered with water immediately after a rainfall or when snow melts. These include forests, both old growth and second growth; woodlots, which are small wooded areas surrounded by other, usually human habitats; rocky outcrops that have occurred naturally in mountainous areas or have been exposed by human activities; meadows, or open areas of land that have been cleared of trees by fire or other natural occurrences; farmland that may be cultivated for crops or cleared for pasture; and backyards, those areas immediately surrounding residences.

Pennsylvania has a diversity of aquatic habitats that are covered by water for all or part of the year. This water can be flowing, as in a river or stream. Rivers and streams are formed by the runoff of precipitation or by water coming up from underground. When groundwater reaches the surface, it forms a spring. Streams and rivers are classified by order. A first-order stream has no tributaries; it is formed directly from runoff or a spring at its headwaters. When two first-order streams join, they form a second-order stream. It remains a second-order stream, even when other first-order streams converge with it. However, when it meets with another second-order stream, it becomes a third-order stream. The designation "river" is somewhat arbitrary and is based primarily on the size of the body of water. However, most flowing bodies of water with an order of five or above are considered rivers. It is very rare for a river to reach the tenth order, but the Mississippi River is twelfth order. (See diagram.)

Size is the only real difference between lakes and ponds, and these two habitats share many characteristics. They have open water and are not dominated by emergent vegetation, although plants may grow around the periphery. Algae, duckweed, and lilies may, however, appear throughout a lake or pond. Lakes and ponds in temperate climates will also have a temperature gradient. In general, the surface water will be coldest in winter and in fact may be frozen, while the water at the bottom will be 4° Celsius. (Water is densest at 4° Celsius, and therefore this heavier water will sink to the bottom.) In warm months, the top layer will be warmest due to the sun, the bottom layer will be coldest, and the area in

the middle will have a *thermocline* or marked decrease in temperature from top to bottom. At some point in both spring and autumn, all the water in the lake or pond reaches the same temperature and, therefore, the same density. At this point, the water mixes freely.

There are five habitat types in Pennsylvania that are described as wetlands. A wetland is an area that is underwater for at least part of the year and contains *hydric soils* (soils that are saturated with water and show signs of anaerobic conditions) and *hydrophytic* plants (plants that grow in water). The type of vegetation is important to distinguishing among different wetland habitats. The predominant vegetation in a bog is moss; bogs tend to have low (acidic) pH and are usually found at high elevations. Swamps are characterized by trees that grow in standing water; species found in Pennsylvania swamps include willows, red maples, and sycamores. A marsh has grasses and shrubs growing in it. A wet meadow resembles a marsh, but this wetland looks like a meadow or pasture. Upon close inspection, it becomes obvious that the ground is very wet, at times with a few inches of water on the surface, and the soil is saturated. Another wetland type found in Pennsylvania is a vernal pool. These tiny pools, often found in forests and woodlots, are formed in winter or spring. In most years, the water evaporates or is absorbed into the soil by late summer.

For a list of Pennsylvania amphibians and reptiles and the habitats in which they live, see Appendix I.

## Preparation

Copy the Key to Pennsylvania Habitats and the Pennsylvania Habitat Flow Chart. (You can copy one per student or allow two or three students to share.) Copy and cut out the Habitat Cards. You can glue these to poster board or index cards and laminate them for future use. Gather pictures, drawings, or photographs of the habitats used in this activity. These can be glued to the back of the appropriate habitat card. Good sources include nature magazines and posters. The following habitats are included in this activity: forest; vernal pool; marsh; woodlot; pond; wet meadow; rocky outcrop; lake; bog; meadow; brook; swamp; farmland; spring; stream; backyard; river.

## Procedure

**1.** Lead a class discussion. Have students define "habitat." Ask them to name some habitats. What are some major differences in the habitats they have named?

**2.** Pass out one Habitat Card to each student. (You may wish to have younger students color the cards first so they are more familiar with the habitat.) Distribute the Pennsylvania Habitat Flow Chart and the Key to Pennsylvania Habitats. Explain to students how to use a dichotomous key.

**3.** Have each student use the flow chart to name the habitat on his or her assigned Habitat Card. Once they have done this, they can use the dichotomous key to name the same habitat.

**4.** Have students trade cards, then have them try using the key to name their new habitats. If they have trouble using the key, they can return to the flow chart to find the answer.

## Conclusions

A dichotomous key works in the same manner as a flow chart, using a series of choices to arrive at a final category. These tools can be used to classify a variety of things, including habitats. Even a small state like Pennsylvania has a diversity of habitats.

## Assessments

**1.** Have students define "habitat," then ask them to name some of the categories of habitats found in Pennsylvania (aquatic, terrestrial, flowing water, standing water, wetlands).

**2.** Have each student list three Pennsylvania habitats and describe each one. Have them name one or two amphibians or reptiles that live in each habitat. For older students, have them describe the habitat in detail, including the vegetation found there.

**3.** Watch a nature video and have students identify the habitats they see.

**4.** For older students, discuss the use of dichotomous keys. For what other categories might dichotomous keys be useful? (They are frequently used for identifying plant and animal species.) Why would a key be more accurate than a field guide? Are there any drawbacks to using dichotomous keys?

## Extensions

**1.** Take students outside and have them name the habitats in the area around the school, or have them make a list of all the habitats they see on their way to school.

**2.** Have students search for newspaper articles about Pennsylvania habitats being degraded or saved.

How might human activities affect "herp" species in these areas?

**3.** Have students (alone or in groups) create their own dichotomous key for any category they choose.

## Tadpole Option

Give each student a habitat card to color. Have them draw in the "herps" mentioned in the description. You may want to enlarge the cards for this activity.

## Resources

"Acid Mine Drainage/Abandoned Mine Land Fact Sheet." Pottsville, Pa: Eastern Pennsylvania Coalition for Abandoned Mine Reclamation, 1997.

Bier, Charles. "Patterns of Biogeography in Watersheds." *Allegheny Watershed Network Notes*. November 1997.

Cole, Gerald A. *Textbook of Limnology.* Prospect Heights, Ill.: Waveland Press, 1983.

*Endangered and Threatened Species of Pennsylvania.* Harrisburg, Pa.: Wild Resource Conservation Fund, 1995.

*Facts about Wetlands 5.* Washington, D.C.: U. S. Environmental Protection Agency, February 1995.

Miller, G. Tyler. *Living in the Environment.* Belmont, Calif.: Wadsworth Publishing, 1994.

Shaffer, Larry L. *Pennsylvania Amphibians and Reptiles.* Harrisburg, Pa.: Pennsylvania Fish Commission, 1991.

"Water, Water, Everywhere." In *Living in Water,* Edition 1. Baltimore, Md.: National Aquarium, 1987.

*The Wonders of Wetlands.* Bozeman, Mont.: The Watercourse, 1995.

**HERP JOKE**

How many spotted salamanders does it take to screw in a light bulb?

*None. They're nocturnal.*

# Key to Pennsylvania Habitats

1. a. Terrestrial habitat.....2
   b. Aquatic habitat.....7

2. a. Covered densely with trees.....3
   b. Open land (trees sparse or absent).....4

3. a. Large tract of land with few or no buildings present.....Forest
   b. Small area surrounded by developed or agricultural land.....Woodlot

4. a. Rocky, with little or no vegetation, usually in a mountainous region.....Rocky Outcrop
   b. Covered with vegetation.....5

5. a. Human impact minimal.....Meadow
   b. Area impacted by humans.....6

6. a. Cultivated land or pasture.....Farmland
   b. Part of a residential area.....Backyard

7. a. Standing water.....8
   b. Flowing water.....14

8. a. Open water.....9
   b. Water with emergent vegetation.....11

9. a. Very large body of standing water.....Lake
   b. Smaller body of standing water.....10

10. a. Temporary, arising in late winter or spring.....Vernal Pool
    b. Permanent, not seasonal.....Pond

11. a. With trees.....Swamp
    b. Without trees.....12

12. a. With mosses and bushes.....Bog
    b. With grasses and shrubs.....13

13. a. Open water more prominent than grasses.....Marsh
    b. Grasses more prominent than open water.....Wet Meadow

14. a. Small body of flowing water, low order.....15
    b. Large body of flowing water, high order.....River

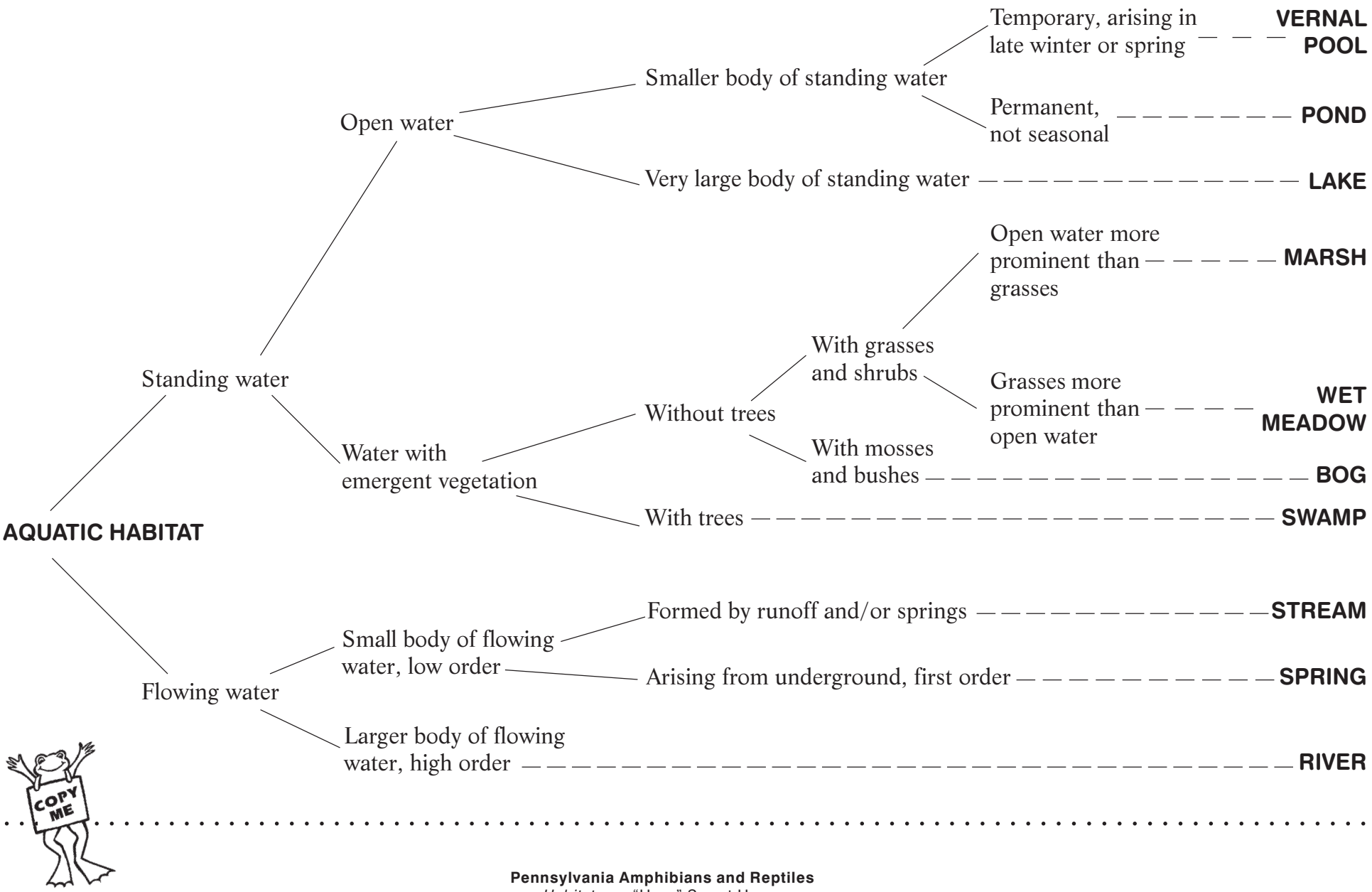
15. a. Arising from underground.....Spring
    b. Formed by springs or runoff.....Stream

# Pennsylvania Habitat Flow Chart

**TERRESTRIAL HABITAT**

- Covered densely with trees
  - Large tract of land with few or no buildings present — **FOREST**
  - Small area surrounded by developed or agricultural land — **WOODLOT**
- Open land (trees sparse or absent)
  - Rocky, little vegetation, in mountainous region — **ROCKY OUTCROP**
  - Covered with vegetation
    - Human impact minimal — **MEADOW**
    - Area impacted by humans
      - Cultivated land or pasture — **FARMLAND**
      - Part of a residential area — **BACKYARD**

# Pennsylvania Habitat Flow Chart



# "Herp" Sweet Home Habitat Clue Cards

A Jefferson salamander spends most of its time deep in the soil, while a wood turtle walks along the leaf-covered surface. Small mammals hide among the many trees, often falling prey to copperheads and milk snakes.

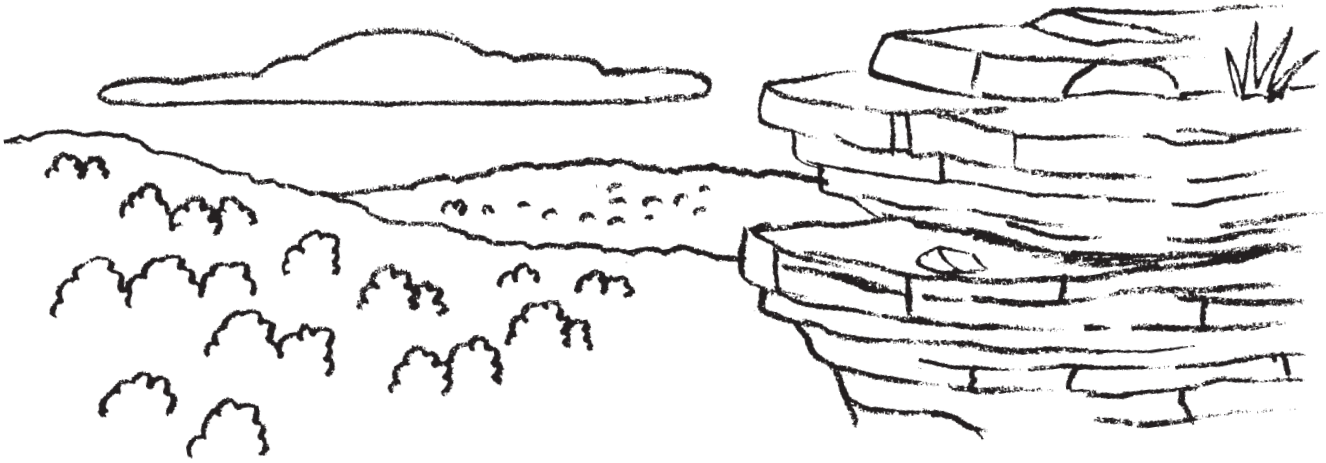
**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

Under small rocks and damp leaf litter, slimy and redback salamanders abound. A tiny smooth earth snake competes with them for earthworms, oblivious to the nearby cars and homes.

**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

# "Herp" Sweet Home Habitat Clue Cards

High on an Appalachian ridge, a timber rattlesnake rests on the protruding rocks. The bluish tail of a young coal skink is barely visible between two stones.



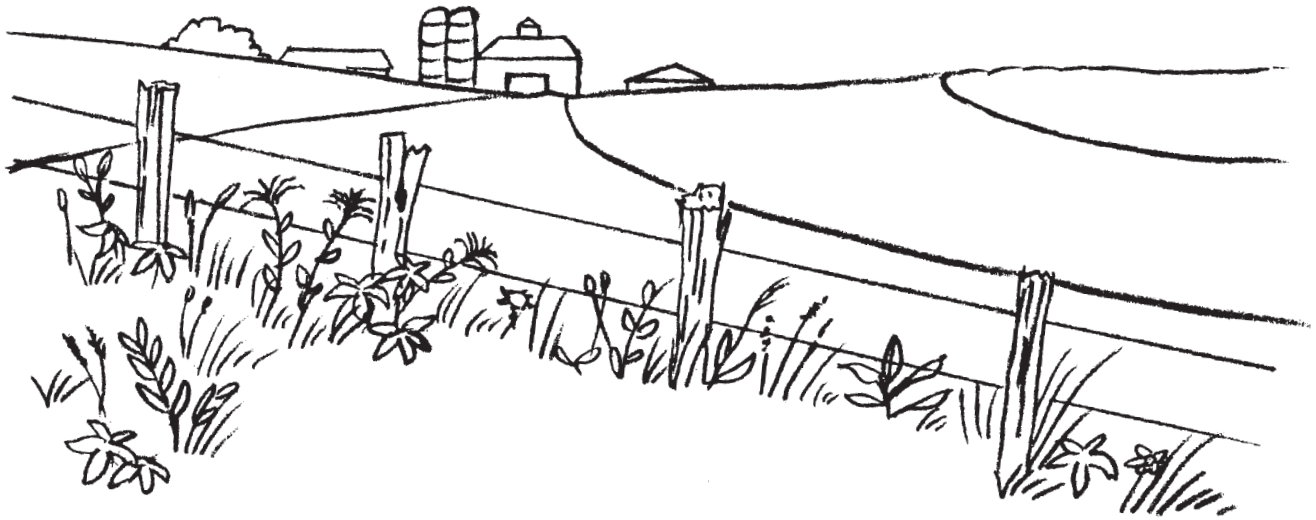
**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

As the sun begins to climb over the horizon, tall grasses and wildflowers hide a black rat snake as it swallows a mouse. A Fowler's toad, after a long night of foraging, buries itself in the dirt.

**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

# "Herp" Sweet Home Habitat Clue Cards

Basking in the sun, a northern fence lizard rests on an old fencepost. Weeds grow thick along the field's edge, where a rough green snake hunts for grasshoppers.



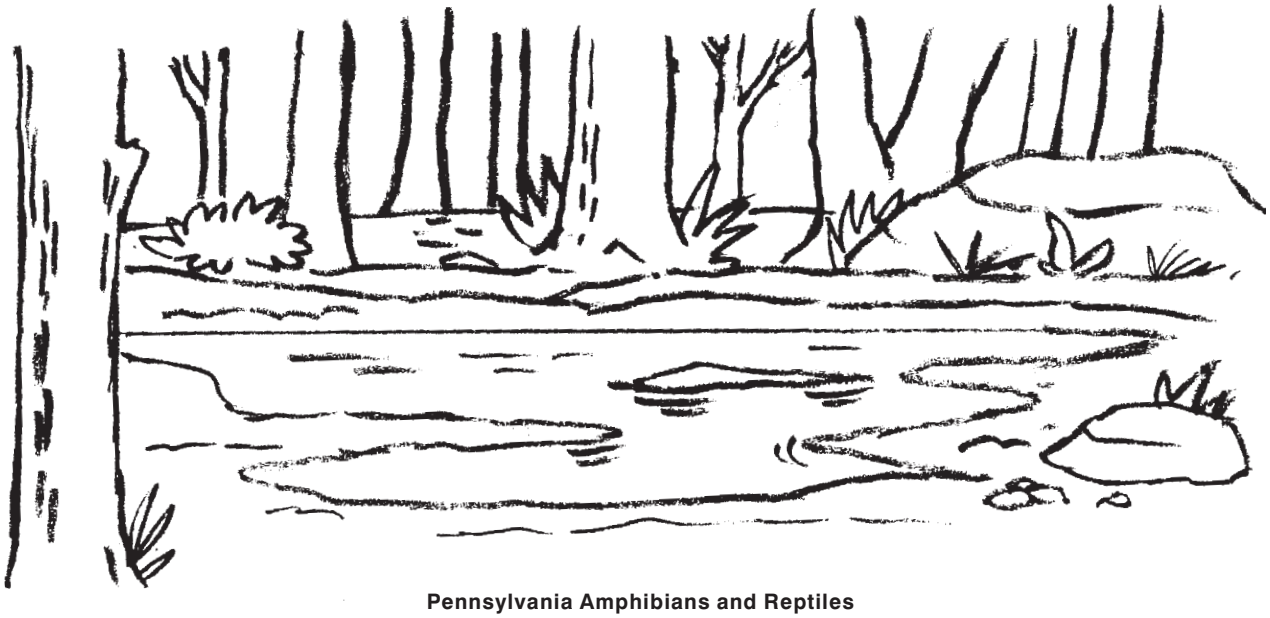
**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

A ringneck snake hides in the compost pile. Under the woodpile, a box turtle escapes the afternoon heat.

**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

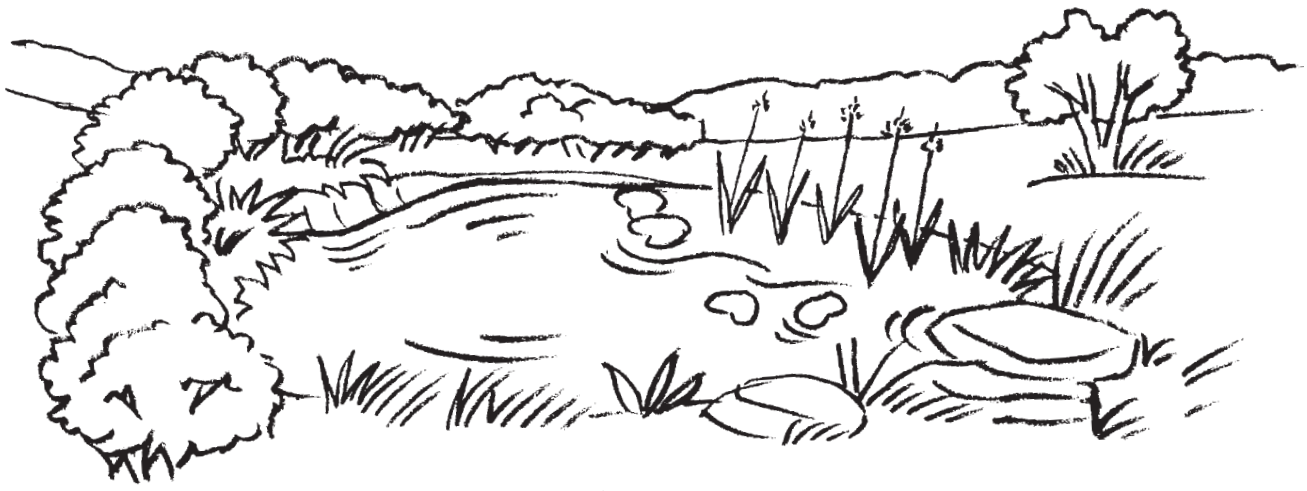
# "Herp" Sweet Home Habitat Clue Cards

The spring sun warms the water left behind from melting snow. Wood frog tadpoles fill the water. Soon they will be gone, becoming adults before the water disappears.



**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

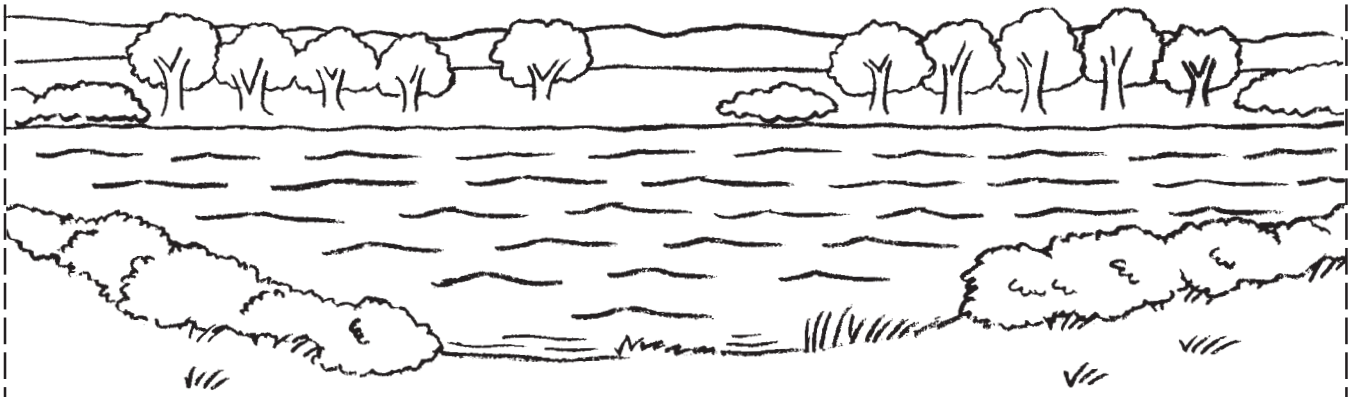
An adult red-spotted newt has returned to the water to breed. A common snapping turtle moves through the open water, feeding its voracious appetite on a variety of tadpoles and fish.



**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

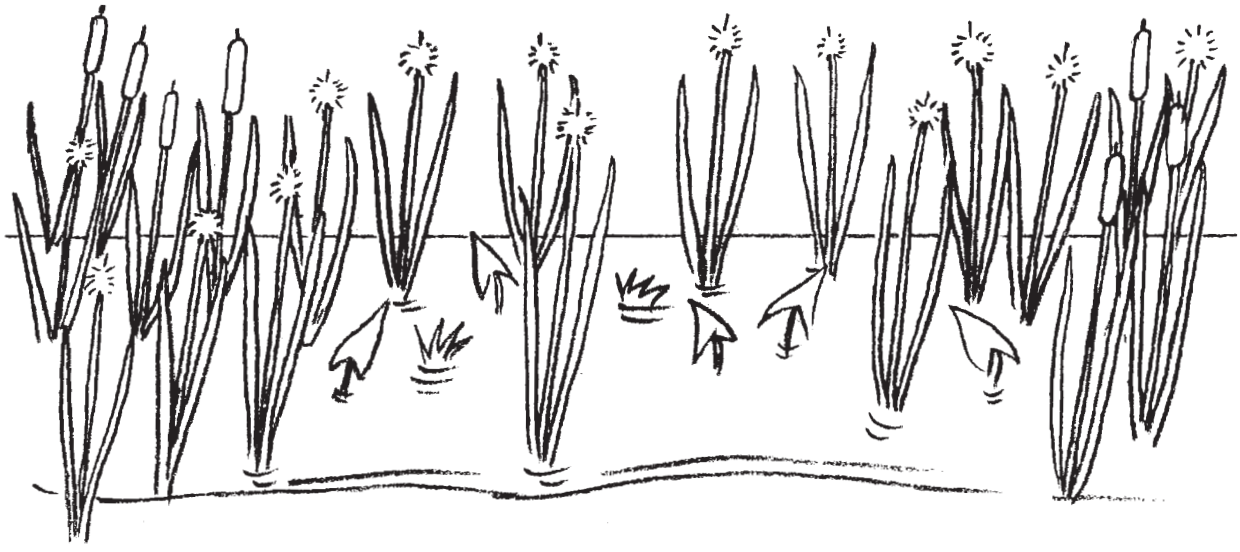
# "Herp" Sweet Home Habitat Clue Cards

Below the deep, open water, a mudpuppy blends in with the muddy bottom. Not even its blood-red gills are evident. Closer to shore, a spiny softshell turtle has buried itself in a sandbar.



**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

The croak of a pickerel frog can be heard coming from somewhere among the cattails and bulrushes. A brightly colored ribbon snake suns itself along the water's edge.



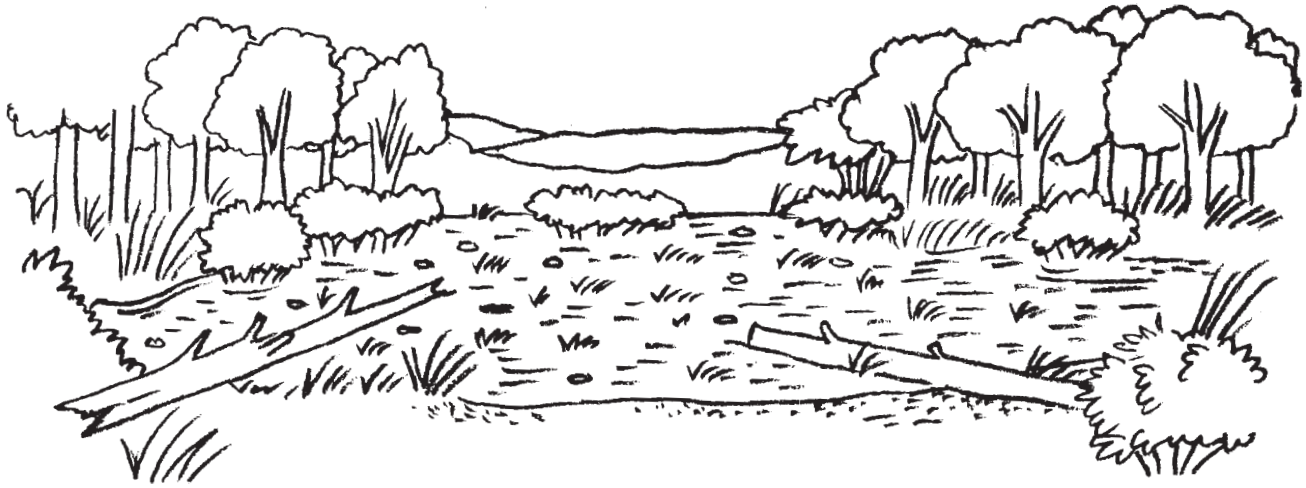
**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

# "Herp" Sweet Home Habitat Clue Cards

A northern leopard frog hops through the grass, its belly wet from the water that seeps up every time it lands. It is unaware of the eastern massasauga that lurks in a clump of grass, waiting for a meal.

**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

A spongy mat of sphagnum hides young four-toed salamanders, but if you look closely you may see their gilled heads peeking out from under the moss. The acidic water does not seem to bother the spotted turtle who seeks refuge here.



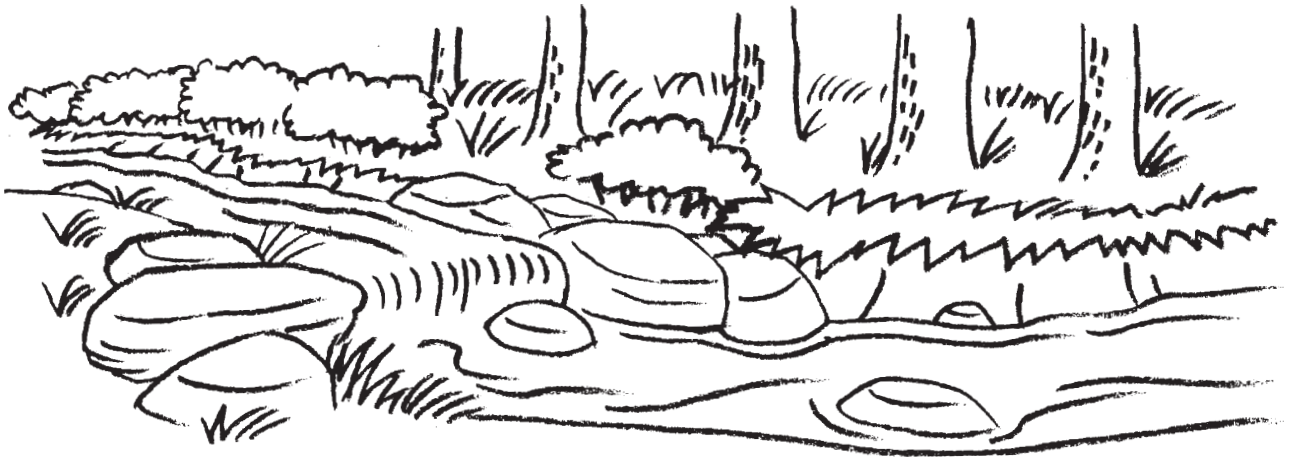
**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

# "Herp" Sweet Home Habitat Clue Cards

The trees rise right out of the water. One has fallen, and on this rotting log a wood turtle is warmed by the sun's rays. A green frog swims near the water's edge, searching for aquatic insects to eat.

**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

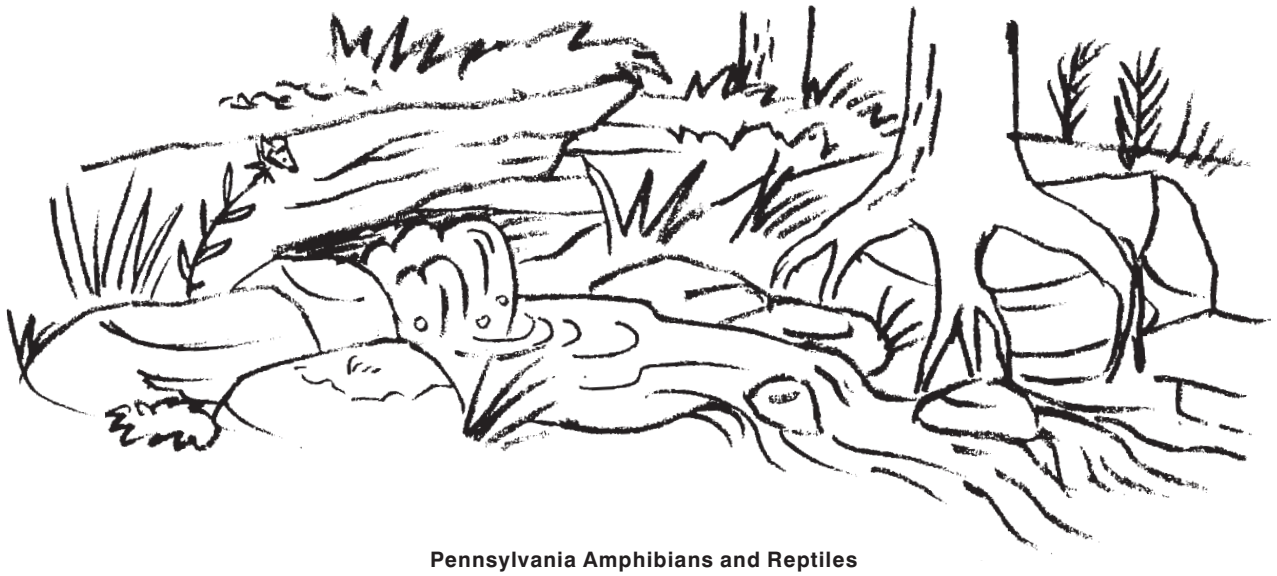
The water gurgles as it sweeps over rocks, rocks that hide many northern dusky salamanders. The crayfish also hide under these rocks, trying to escape the queen snake who searches for a crustacean meal.



**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

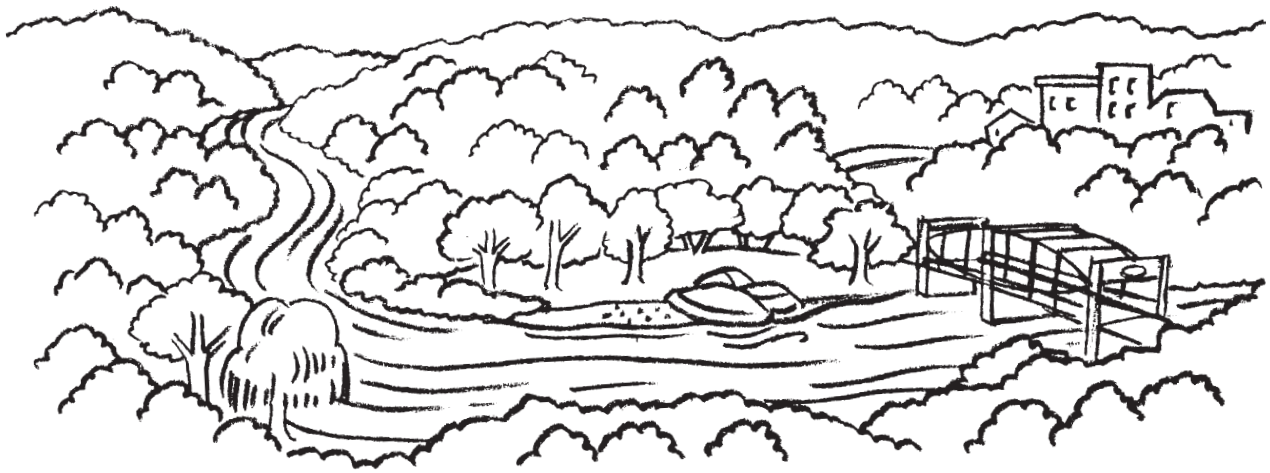
# "Herp" Sweet Home Habitat Clue Cards

The water is cold as it bubbles from the earth. Laden with dissolved limestone, it tumbles over newly hatched northern spring salamanders as it makes its way downhill.



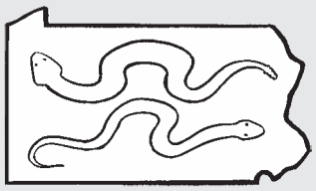
**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

The brown water seems to move slowly here, and it is a long way to the other bank where a northern water snake has draped itself on an overhanging branch. A midland painted turtle crawls along the soft, sandy bottom, hiding in the vegetation on the water's edge.



**Pennsylvania Amphibians and Reptiles**
"HERP" SWEET HOME HABITAT CLUE CARDS

# *Who Am I?*



- **GRADE LEVELS:**
  3 – 8
- **SUBJECT AREAS:**
  Communication, Environmental Studies, Science
- **DURATION:**
  1 session
- **SETTING:**
  Classroom
- **SKILLS:**
  Analyzing, classifying, cooperating, formulating questions, listening
- **VOCABULARY:**
  Amphibian, ectotherm, metamorphosis, reptile, scutes, tadpole, tympanum
- **CHARTING THE COURSE:**
  Looking for Differences; Getting in Touch with "Herps"; Puzzles; What'sss My Name?; "Herp" Habitat Haggle; Replica Round Up; What Do You Know About "Herps?"; "Herp" Prints; Key in to "Herps"
- **"HERP" HAPPENINGS:**
  What's So Important About Museums and Specimens?


## Summary

In this game, students determine the identity of an amphibian or reptile whose picture is taped to their backs. By asking each other questions to discover their "herp" identities, students learn the characteristics of Pennsylvania amphibians and reptiles.


## Objectives

Students will

- identify six characteristics of Pennsylvania amphibians and reptiles.
- distinguish the Pennsylvania amphibians and reptiles from one another.

## Materials

Identity tags each with a name and picture of a Pennsylvania amphibian or reptile species, one per student; tape or safety pins; field guides; Pennsylvania Fish and Boat Commission amphibian and reptile posters; several copies of Simple Key to Pennsylvania Amphibians and Reptiles (page 271).

## Background

**Amphibians** and **reptiles** are among the oldest living vertebrates found on Earth today. They have many unique characteristics that distinguish them from other vertebrates and from each other. Both amphibians and reptiles are **ectothermic** or "cold-blooded." This means that an amphibian's or reptile's body temperature, rather than being maintained internally, can fluctuate with the temperature of its surroundings. To help them regulate their body temperatures, amphibians and reptiles must utilize their environment: they commonly seek shelter from extreme heat and cold by burrowing deep underground or sunbathing on rocks.

Most amphibians have smooth, moist skin. Amphibian eggs, which have a gelatinous protective coating but lack a hard shell, must be deposited in a moist or wet environment to prevent desiccation. Many amphibians undergo a transformation after hatching from the egg. Referred to as **metamorphosis**, the transformation occurs as the amphibian progresses from the larval stage to the juvenile stage. All Pennsylvania frogs and toads go through metamorphosis. However, not all salamanders go through a metamorphic change — some emerge from the egg without gills and are able to live on land immediately. In Pennsylvania, the genus Plethodon has this type of life cycle. Frogs and toads of Pennsylvania begin their lives as eggs and then hatch into tadpoles. **Tadpoles**, the larval form of frogs, have gills and a tail and live in water. Tadpoles slowly transform into adults by growing legs, losing their tails, and undergoing rearrangement of some internal organs. Some amphibians are unique in that they have external ear openings or **tympanums**. On some frogs and toads, such as bullfrogs and northern green frogs, these are easily visible as the circular disks located on the head somewhere behind the eyes.

Pennsylvania's amphibians can easily be grouped into orders, simply by dividing them into two groups — those with tails and those without. The salamanders, order Caudata, have tails. The frogs, order Salientia, do not possess tails as adults. The salamanders can be further grouped into those that spend their entire lives in water (mudpuppies and hellbenders,) the large mole salamanders (marbled, spotted, and Jefferson,) Pennsylvania's only newt (red-spotted,) and the lungless salamanders. The frogs can be grouped arbitrarily into frogs and toads, with the toads represented by the true toads and spadefoots. The remaining frogs can be grouped into tree frogs and true frogs.

The skin of reptiles is dry and scaled. When reptiles hatch out of their shells

they look like miniature adults. Their eggs are covered by a tough, leathery shell that allows them to be deposited in a dry environment. In fact, all reptiles, including aquatic turtles, lay their eggs on dry land. Reptiles do not go through metamorphosis; from birth they breathe through lungs, making them mainly land dwellers. Reptiles have skin with scales; this is easily seen in snakes and lizards. The skin of turtles is also scaly. In addition, *turtles* have a shell covered with **scutes** — horny plates that in some turtles are shed as the shell grows; they overlie the bony layer of the shell. (Only aquatic turtles shed scutes, *tortoises* and *terrapins* do not.)

Pennsylvania's reptile species can be grouped into turtles, lizards, and snakes. The turtles, order Testudines, have a hard or semi-hard shell. The lizards, order Squamata, suborder Lacertilia, have four limbs with clawed toes, external ear openings, and movable eyelids. Though there are exceptions to this, all Pennsylvania lizards fit this description. The snakes, order Squamata, suborder Serpentes, are legless and lack eyelids and external ear openings.

The turtles can be further grouped into snapping turtles, musk and mud turtles, softshell turtles, and the largest group, the pond, marsh, and box turtles. Pennsylvania's lizards include one iguanid lizard (northern fence lizard) and three species of skinks. Most Pennsylvania snakes are in the family Colubridae, with the exception of the three venomous species of the family Viperidae.

At first glance, amphibians and reptiles seem to be very similar in their characteristics. After studying individual species within each group, however, one can see that distinguishing between the different animals is not so difficult.

## Preparation

**1.** Help your students become familiar with Pennsylvania's amphibians and reptiles. Hang posters and pictures of "herps" around the room and provide students with books and magazine articles about them. Appendix V lists references and posters available through the Pennsylvania Fish and Boat Commission. You can also show slides of amphibians and reptiles and lead a classroom discussion about them. Appendix V lists audiovisual materials.

**2.** To ensure your students have enough background information to do this activity, you may want to do one or two activities from the awareness section first. Puzzles and Getting in Touch with Herps provide a good background for the differences between amphibians and reptiles. What'sss My Name? is another good activity to do before this one.

**3.** Make an identity tag for each student, with the name and picture of an amphibian or reptile species found in Pennsylvania. A convenient source for pictures is the Pennsylvania Fish and Boat Commission amphibian and reptile poster set. Cut out the individual pictures and write the species name on the picture. Laminate them before handing them out to students. Be sure to have a second set of posters on hand to hang around the room, and also display copies of the Simple Key to Pennsylvania Amphibians and Reptiles. Your students will need both of these to complete the activity.

## Procedure

**1.** Explain to the students they will each be given the identity of an amphibian or reptile that is found in Pennsylvania. They will not know their assigned identities, but instead must discover their identities by asking a series of yes or no questions. Point out the resources around the room (field guides, posters, Simple Key to Pennsylvania Amphibians and Reptiles, etc.) Explain that the resources are there to help them discover their identities.

**2.** Explain the rules to the class before handing out the identity tags. You may want to write the rules on the board so they are not forgotten during the activity.

a. Ask only questions that can be answered with a yes or no.
b. Ask only one question of each person. When a person has answered your question, you may answer one for them, then move on to another person to ask your next question.
c. Each student must ask at least five questions.

**3.** Attach an identity tag to the back of each student. Do not let them see the identity of the amphibian or reptile. Stress to the class that they should not reveal other classmates' identities. Have everyone stand and move to an area where they will have space to move around. Allow them to begin asking questions. *Note*: You may find that this activity is difficult to do with a big class. If you have a large class size, divide your class into two groups. Let each group do the activity simultaneously but in different areas. Be sure to have enough references and resources for both groups (i.e., two sets of posters.)

**4.** When the students have either learned their identity or appear to be nonplussed, stop the game and have them return to their seats. Ask those that successfully discovered their identity what types of questions they asked. Was there a logical order to their questions? Lead the students to recognize that beginning with "Am I an amphibian?" followed by questions such as "Do I have a tail?" leads one to the right answer. On the other hand, beginning with "Am I a bullfrog?" tends to lead to an endless line of questions that may not arrive at the final answer or identity. This discussion should aid the students in devising a more strategic line of questioning.

**5.** Collect the identity tags and redistribute them. Each student should now have a different identity than before. Remind them to use a strategy for questioning, then have the class play the game again. You can play several rounds so that they practice the questioning and reasoning process, and also so that they become familiar with more amphibian and reptile species.

## Conclusions

This pattern of providing and repeating clues will help students learn physical characteristics, habitats, behaviors, and other interesting facts about Pennsylvania amphibians and reptiles.

## Assessments

**1.** After practicing, evaluate the kinds of questions the students ask each other and the number of questions it takes to arrive at an answer.

**2.** Make the statement, "I am a [name a species of amphibian or reptile]." Have students write down the series of questions and answers it would take to identify that species. Collect the papers and grade them for correctness and efficiency (arriving at the species with the fewest questions).

**3.** Have students list five characteristics of the last amphibian or reptile they were assigned. In writing, have them explain how those five characteristics helped them in the identification process.

## Extensions

**1.** A variation of this activity would be to use Pennsylvania amphibians and reptiles and their characteristics to play Hangman. Put a list of several characteristics of both amphibians and reptiles on a chalkboard or poster. Choose a specific Pennsylvania species and have the students guess characteristics of the animal from the list. For each incorrect guess, draw a portion of the animal hanging from the gallows. Continue this until the correct answer emerges.

**2.** This activity could also be used as a review. Give the class clues about the identity of a Pennsylvania amphibian or reptile. With each clue, the students write down what they know about the animal. When someone knows the answer, he or she calls it out.

*Example*

Teacher says, "I am an animal who has moist, water permeable skin" or, "who has eggs that must be laid in water or a damp environment." Use any general amphibian or reptile characteristic.

Student writes, "amphibian."

Teacher repeats first clue and adds, "I have a vocal sac for calling to other members of my species."

Student writes, "frog or toad."

Teacher repeats first and second clues and adds, "I am one of the smaller members of my group and I climb trees."

Student narrows the focus to the frogs and writes, "small frog."

Teacher repeats all clues and adds, "In early March, I can be heard making loud peeping sounds at night."

Student may write, "spring peeper."

Teacher repeats all clues and adds, "I have a dark X pattern on my back."

Student writes, "spring peeper."

**3.** Allow students to play the role of teacher. Let them make up their own clues of the characteristics of Pennsylvania amphibians and reptiles and ask their classmates which animal they are describing.

**4.** Have the students choose a particular species of Pennsylvania amphibian or reptile and write a report about it, including important facts about what the animal eats, what its specific habitat requirements are, etc.

## Tadpole Option

For younger students, make sure they understand the differences between amphibians and reptiles before beginning. Have a class discussion on the different groups, or orders, of amphibians and reptiles. Hold up pictures and ask "Is this an amphibian or reptile?" and such questions as "Is it a salamander or a frog?" Then have the students play the game, but only identify the order of the assigned amphibian or reptile. They need only identify themselves as salamanders, frogs, turtles, lizards, or snakes.

## Resources

Halliday, Tim R., and Kraig Adler. *The Encyclopedia of Reptiles and Amphibians.* New York: Facts on File, 1986.

Shaffer, Larry L. *Pennsylvania Amphibians and Reptiles.* Harrisburg, Pa: Pennsylvania Fish Commission, 1991.

## ▼ Notes

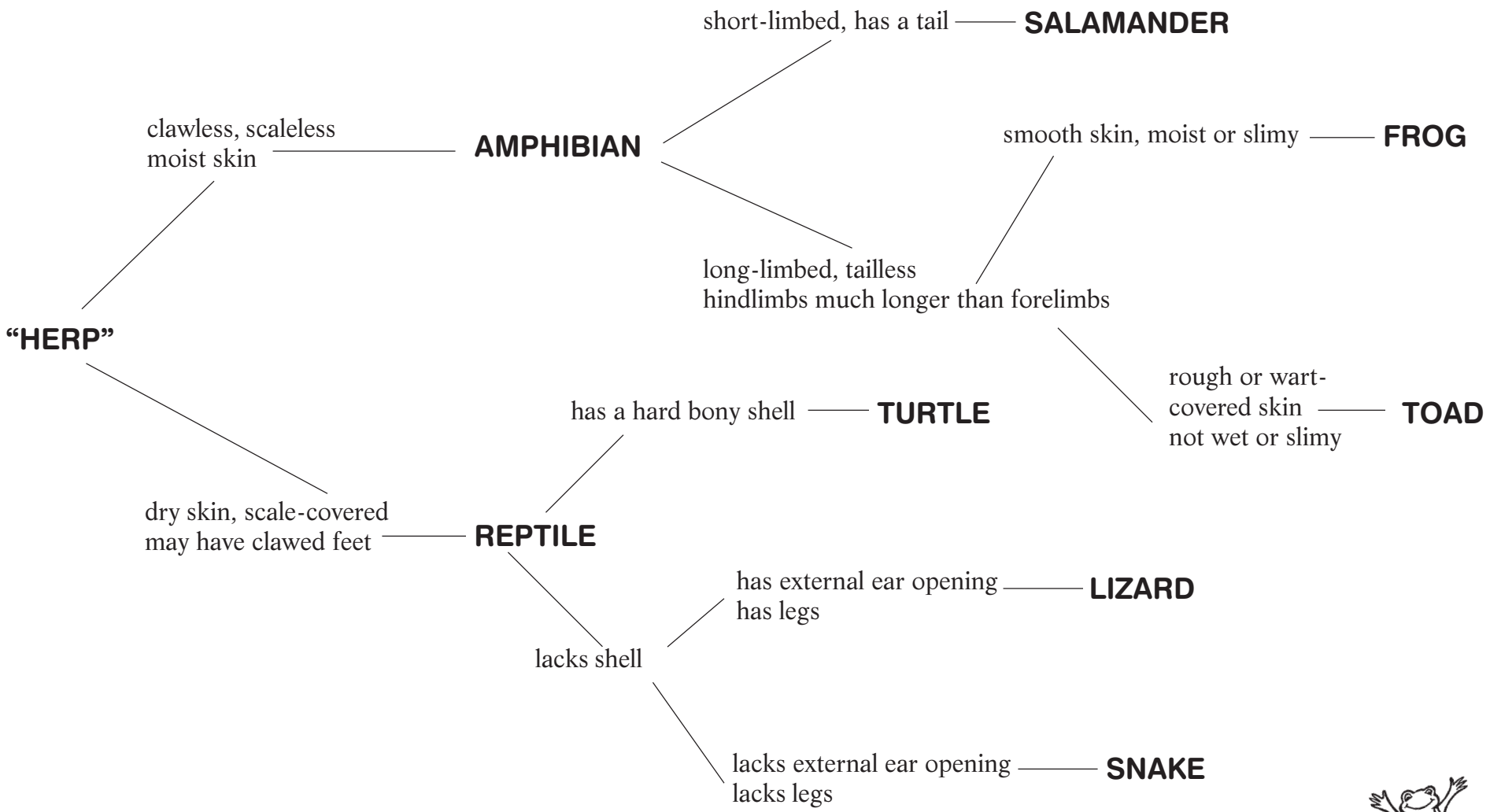
### HERP JOKE

**Ernie:** My dad was bitten by a milk snake once.

**Chris:** *Oh yeah? What happened?*

**Ernie:** He's been lactose intolerant ever since!

# Simple Key to Pennsylvania Amphibians and Reptiles




# Bog Turtle Hurdles

Adapted from "Turtle Hurdles" in *Project WILD's Aquatic Education Activity Guide* (Bethesda, Md.: Council for Environmental Education ©1987, 1992.) Adapted with permission from Project WILD.

- **GRADE LEVELS:**
  4 – 12
- **SUBJECT AREAS:**
  Environmental Studies, Mathematics, Physical Education, Social Studies, Science
- **DURATION:**
  1 – 2 sessions
- **SETTING:**
  Outdoors or gymnasium
- **SKILLS:**
  Analyzing, applying, computing, discussing, inferring, observing
- **VOCABULARY:**
  Endangered species, limiting factors, predator, wetland
- **CHARTING THE COURSE:**
  Class Field Guide; Decisions, Decisions; Froggy Swamp; Puzzles; Picture This; Park It Here!; Turtles: What's Their Cover?; What Every "Herp" Needs
- **"HERP" HAPPENINGS:**
  A Tiny Turtle in Danger of Disappearing; What's So Important About Museums and Specimens?


## Summary

Students become bog turtles and limiting factors in a highly active simulation game.


## Objectives

Students will

- describe the life cycle of bog turtles.
- define limiting factors and identify specific threats to bog turtles.
- make inferences about the effects of threats to bog turtle populations.
- make recommendations for ways to minimize the threats to bog turtles.

## Materials

Thin rope or clothesline to mark playing area (about 500 feet); uncooked macaroni/rigatoni or beans; identity tag for each "limiting factor"; bottle caps, poker chips, or checkers for year tokens; wastebasket or other container for "dead turtle zone." *Optional*: four traffic cones for corners; flag-football flags or belts for two-thirds of the class.

## Background

Bog turtles are very small turtles that live in the *bogs*, or **wetlands**, of Pennsylvania and other northeastern states. They range in size from 3 to 4½ inches and could easily fit in the palm of your hand. These dark-shelled turtles can most easily be identified by the large red-orange or yellow blotch behind each eye.

Although bog turtles like to sun themselves on grassy patches in marshy meadows and bogs, they are very secretive. The bog turtle may be encountered basking on sedge tussocks or moving slowly about under concealing vegetation. When danger threatens, they burrow rapidly into the mucky bottom of spring runs. Their favorite spots in their wetland homes tend to be narrow, shallow, slow-moving little streams.

Bog turtles reach sexual maturity in five to seven years. Mating occurs in May and early June. During June or July they lay a single clutch of one to six flexible-shelled one-inch eggs in a nest that the female has dug. The hatchlings emerge in August and September, or they may over-winter and emerge in the spring.

Bog turtles are active from April to mid-October, a bit longer than some other turtles. They eat tadpoles, slugs, snails, worms, and insects. In turn, **predators** of the eggs and young bog turtles include herons, foxes, minks, and even snapping turtles. Recent research has confirmed the impact of vole and field mice predation on bog turtle eggs in the nest.

The first turtle to be placed on the Pennsylvania List of **Endangered Species**, the bog turtle is considered the rarest of North American turtles. Besides the natural predators that serve to keep the *population* at a stable level, bog turtles are threatened by human collectors (bog turtles are highly valued by turtle collectors in this country and overseas, and bring a good price in illegal sales) and primarily from human development of wetland areas. In fact, the main cause for loss, or endangerment, of species is *habitat* destruction and degradation. A large percentage of the species on Pennsylvania's endangered and *threatened* lists rely on wetlands for part or all of their life cycle. These areas are rapidly being turned into housing developments and shopping malls, and in the Poconos region wetlands are mined for peat (decaying sphagnum moss). Wetland habitats are being degraded by illegal dumping sites for garbage, unwanted cars and large appliances, and toxic chemicals.

Bog turtles must face a myriad of

hazards that serve as **limiting factors** in the completion of their life cycle. Limiting factors are factors that reduce the population of living organisms. Sometimes the limiting factors are natural and sometimes they are the result of human intervention with natural systems.

## Procedure

**1.** Set up the playing field as shown in the diagram (page 387). The "dead turtle" container (wastebasket) is to be placed in the mortality zone.

**2.** Divide the class into two groups. About two-thirds of the students will represent a population of turtles that hatch from one wetland. The other one-third will be predators or other "threats" to the turtle population. (This activity is designed for a class of 25 to 30 students.)

**3.** Group 1—Turtles. Give each student a packet of six macaronis or beans which represent baby turtles. Group 2—Limiting Factors. Divide this group into two smaller groups, predators and threats. The predators are raccoons, herons, field mice, skunks, mink, snakes, snapping turtles. The other threats are human egg collectors, highway construction, ATVs, mining for peat moss, pollution, dumping, draining for agriculture, development of building lots for residences.

Give each student a sign to wear that indicates what kind of limiting factor he or she represents.

**4.** Walk the class through the activity as you explain the playing field and rules.

**5.** Review the rules two times to make sure the students understand their roles and the procedures. You may want to have the class play the game once at a slow pace (just walking) to be certain they understand the rules. With this type of game, it is easy for students to get overly excited and not focus on the game's purpose. If your class is too energetic, you may have to limit them to just walking to avoid chaos.

**6.** Conduct the activity.

## Playing Field

**Nest Zone (start/finish line):** the place where the eggs are laid and hatch. This is the zone to which the surviving turtles will return in six years. This is also where the baby turtles hatch and begin their journey in the bog.

**Bog Zone:** the zone where the hatchlings must spend six years moving between the two side zones. This is the zone where the limiting factors can tag the turtles.

**Stream Zone and Mud Hole Zone:** the two zones that the turtles must visit to get the year cards necessary to "mature" to six years of age (three visits to each zone). During the trips between the zones the turtles are vulnerable to limiting factors. Turtles are safe from limiting factors when they are inside either year zone.

**Vegetation Zones:** places where the turtles are safe from limiting factors.

## Rules

A. Turtles must hatch and spend six years in the bog. The time in the bog is simulated by the turtles running between the mud hole zone and the stream zone, picking up a token at each zone. Each token represents one year of successful bog survival. After collecting six tokens, turtles return to the nesting area to reproduce.

B. While turtles are maturing in the bog zone, they try to avoid various limiting factors. If tagged by a limiting factor, a turtle stops and gives one macaroni or bean (representing a baby turtle) to the limiting factor.

C. Patches of concealing vegetation in the bog provide safety zones for turtles where limiting factors cannot tag them. The teacher may set a time limit for how long a turtle may rest in the vegetation zone.

D. Limiting factors must obey the following rules:

- They must use both hands to tag a turtle. (Option: Turtles may wear flagging that the limiting factors must pull, like flag football.)
- They cannot tag the same turtle twice in a row.
- They cannot tag turtles that are stopped and paying out a baby turtle (macaroni/bean) to another limiting factor.
- Once they have tagged three turtles, they must leave the field and put their "baby turtles" in the "dead turtle" container.

E. Any turtle that loses all six macaronis/beans is dead and must go to the Nest Zone and become a shopping mall. If the malls (sitting side by side) eventually block the access to the nesting site, the remaining turtles die without reproducing and starting the next cycle.

F. The activity ends when all turtles are either dead or have returned to the nesting site.

## Conclusions

Both human and natural factors limit the survival and breeding success of bog turtles. In particular, destruction of wetland habitats has decreased the number of bog turtles to the point of endangering the species.

## Assessments

**1.** After completing the activity, encourage the students to discuss the results. It is likely that some students will be disturbed by the high number of turtles that died. Tell them that there are groups actively trying to stop humans from collecting bog turtles (it is illegal) and from destroying wetlands.

However, it is also important to emphasize that the natural threats are built into the scheme of things. If all bog turtle eggs survived, there might well be an overabundance of these creatures. Many animals produce more young than will survive, serving as food for other species as a part of nature's dynamic balance.

**2.** Ask the students to briefly describe the life cycle of bog turtles.

**3.** Summarize the importance of the high numbers of turtles that result from the reproduction of two turtles—six baby turtles. Identify and discuss the factors that limit the turtles' survival. Since bog turtles are threatened with extinction, the threats to their survival seem to be out of balance. What specific recommendations would the students suggest to increase the successful reproduction and survival of bog turtles? (By saving wetlands, we save bog turtles and many other plants and animals that live there.)

## Extensions

**1.** Change the ratio of predators and hazards to turtles (one-third turtles and two-thirds limiting factors) and replay the simulation. Describe and discuss the differences.

**2.** Replay the simulation with a small bog. How does a shrinking habitat change the number of surviving turtles?

**3.** Add another zone such as a Road Zone between the nesting site and the bog with "car" limiting factors in it. Replay the simulation and see how many turtles can cross the road without getting flattened. Compare this version of the game with the results from the original simulation.

**4.** Allow a few children to be on the sidelines and "collect" a few turtles to take to their "homes," "nature center," or "pet store." Compare the results of this version with the original results. The turtles that are removed from their habitat are lost from the wetland forever. Turtles that are collected from the wild and kept in captivity can die from stress, poor nutrition, or improper handling.

**5.** Discuss other species that seem to have the odds against them (other endangered species). List the reasons they are endangered and discuss plans that have been developed (by state or federal agencies) to increase the numbers of these species. Watch the video *Bog Turtles: Living on the Edge.* (Available from the Pennsylvania Fish and Boat Commission; see Appendix V: Education Resource Catalog.)

**6.** Declare an "Endangered Species Day" (or week) at your school. Have your students work up a play about local endangered species (like bog turtles) and perform it for the school. Help other classes learn about local endangered species through posters, daily announcements, bumper stickers, and t-shirts made with a common theme.

## Resources

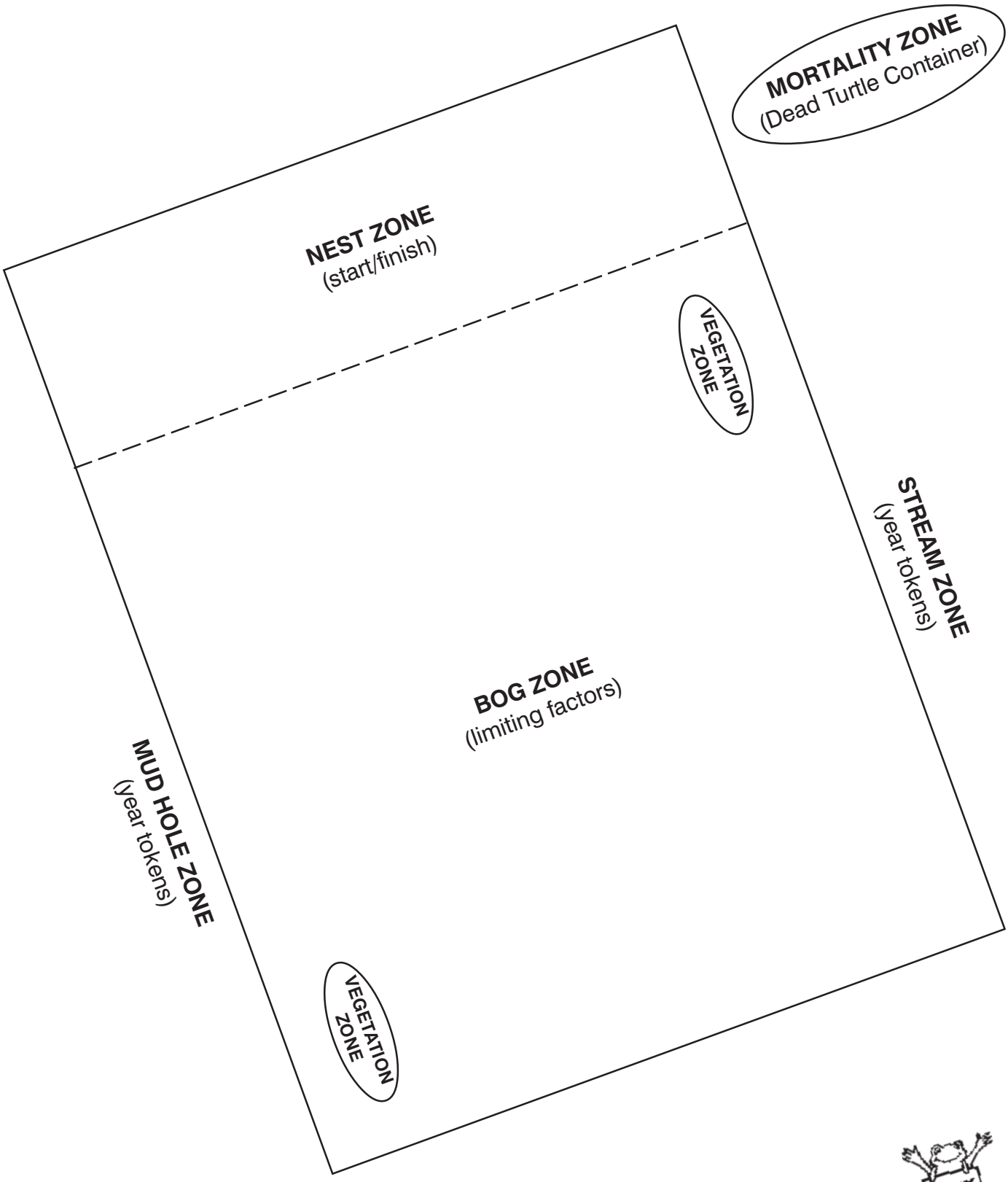
*Endangered and Threatened Species of Pennsylvania*. Harrisburg, Pa.: Wild Resource Conservation Fund, 1995.

Shaffer, Larry L. *Pennsylvania Amphibians and Reptiles*. Harrisburg, Pa.: Pennsylvania Fish and Boat Commission, 1991.

"Turtle Hurdles" in *Aquatic Project WILD,* Bethesda, Md.: Council for Environmental Education, 1992. The complete Activity Guide can be obtained by attending a KARE workshop. For more information, contact the Pennsylvania Fish and Boat Commission at (717) 657-4540.

## ▼ Notes

# Bog Turtle Hurdles Playing Field




# A Tiny Turtle in Danger of Disappearing

It's early April, and you are walking through the marshy bottom of a cow pasture in Lancaster County, Pennsylvania. You move each foot from one clump of tall, dry grass to the next, trying to avoid stepping in the muck. As you go to place your foot on another grassy tussock, you see that it is already occupied by a small turtle. You have just enough time to note that this turtle has a dark brown shell with a few yellow markings and, behind each eye, a large orange yellow blotch of color. Then the turtle scurries off the grass and quickly burrows in the mud.

You have just met a bog turtle, the rarest turtle in North America. Growing to just 3 to 4 inches, it is also one of our smallest turtles. If you really did see a bog turtle in early April, you could be fairly certain that it had just awakened from winter hibernation, crawled out of the deep wet mud that allowed it to escape winter's freezing temperatures, and climbed onto a tuft of grass to bask in the warmth of the sun. After gathering some solar energy, the turtle will probably find some food. No finicky eater, it will eat anything from tender plants and ripe berries to snails, millipedes, insects, tadpoles, and even carrion.

If it is mature (at least 5 to 7 years old) the bog turtle may mate during April, May, or June. Some evening in late June or July, it (if it is a female) will then find a grassy tussock or patch of sphagnum moss in which it will make a depression. In this nest it will deposit 1–6 white, oval, flexible eggs, leaving the nest exposed to the sun. After incubating for 6 to 8 weeks, the young will emerge in August or early September. In the meantime, the adult turtles may estivate in July and August: just as in hibernation, they will burrow in the mud, but in this case it is to avoid the hot temperatures of summer. In mid-October when the air cools, the adults and young will begin hibernation.

What you may not know about the bog turtle, or Muhlenberg's turtle, is that it is an endangered species in Pennsylvania. In fact, it was the first turtle to be placed on the Pennsylvania List of Endangered Species. There are two distinct populations of bog turtles: the northern population with a range from southern New England to Delaware and Maryland, including Pennsylvania and New York, and the southern population whose range is a small patch of the Appalachian Mountains from southern Virginia to northern Georgia. The southern population is not threatened, but the northern bog turtle population is declining, especially in Pennsylvania where the turtle was first found. These turtles are found in the southeastern corner of the state, north to the Pocono Mountains and west to Franklin County. They once lived in three counties in the northwestern part of Pennsylvania, but they have not been located there in recent years.

There are many reasons for the decline of the bog turtle. Because they are very rare, very small, and so uniquely marked, they are prized by reptile collectors, especially in Europe and Asia. Although it is illegal to capture, keep, sell, or harm bog turtles in Pennsylvania, poachers continue to smuggle them to other states where their sale is permitted. (It is protected in many northeastern states.) Also, since it is impossible to distinguish a northern bog turtle from a southern bog turtle, they can be passed off as nonendangered southern bog turtles.

More important, the bog turtle is disappearing because humans continue to destroy the wetlands in which it lives. Muhlenberg's turtle may not be a finicky eater, but it sure is choosy about where it lives. Not just any old wetland will do; it must be spring-fed, with relatively shallow water, a soft, muddy bottom, and emergent soil covered with grasses or sphagnum moss. In addition, the area cannot be overshadowed by tall plants because the turtle's eggs must incubate in a sunny spot. Unfortunately, this type of wetland is disappearing faster than others because it is generally small and does not have a large expanse of standing water. A lot of people do not even realize that these are wetlands! It is common for such small bogs to be drained for development or farmland, or to be flooded to make a pond. Sometimes, just developing land adjacent to the wetland can destroy it; use of water in a new development may lower the groundwater level, causing the wetland to dry up.

Contributing to the problem is the fact that bog turtles have small clutch sizes, and it's not uncommon for some of the eggs to be infertile. These turtles, moreover, do not reach sexual maturity until at least five

years of age. Also, because the nest site must be exposed to sunlight, they are vulnerable to predation. New housing developments nearby can worsen the problem: they tend to attract opossums, skunks, and raccoons, all of which find turtle eggs to be a quick and easy meal.

The northern population of bog turtles has declined 50 percent, and there may be only 2 or 3 sites in Pennsylvania with a good habitat and a viable turtle population. (Viable means there are enough turtles of the right age to keep reproducing.) Of 165 bog turtles sites remaining in the Northeast, only 35 are considered "good" by the U.S. Fish and Wildlife Service. But there is good news for the bog turtles: the U.S. Fish and Wildlife Service has listed this turtle as "threatened" so it will be protected by federal regulation under the Endangered Species Act. This means it will be illegal in any state to buy, sell, or trade any bog turtle, northern or southern. Violators of these regulations could spend up to one year in prison or pay up to $50,000 in fines! There will also be more money generated for bog turtle research and habitat protection. Existing habitats may be improved, and there will be money for conservation easements (agreements with landowners to protect the turtles and their habitat). Eventually, bog turtles may be reintroduced to suitable habitats, and their numbers may increase.