

PRE-SITE ACTIVITY

SALAMANDER INFORMATION



Grade Level: High School

Subject Area: Science

Activity time: 60 minutes

Setting: Classroom

Skills: Analyzing, Classifying, Collecting information, Connecting, Contrasting, Formulating questions, Interpreting, Researching

Vocabulary:

•**All Taxa Biodiversity Inventory:** also called the ATBI. A research project in the Great Smoky Mountains National Park to inventory every life form in the park. It is estimated that we currently know only 14,000 of an estimated 100,000 species.

•**Baseline Information:** information about how things are now, at this point in time, so we will know if there is a change the next time we look at it.

•**Biodiversity:** the variety, distribution and abundance of life forms and ecological processes in an ecosystem; includes the ways in which different life forms interact.

•**Biological Inventory:** a technique used by scientists to study the various life form in a given area. In the Great Smoky Mountains National Park, inventories are done in study plots.

•**Biological Monitoring:** a technique used by scientists to check the condition of a particular species or ecosystem over time.

•**Canopy:** the top layer of the forest, the treetops.

•**Density:** the number of individuals of a given species within a certain area.

•**Dichotomous Key:** an identification method that narrows down a species in question using a series of pairs of choices.

•**Ecosystem:** a system formed by the interaction of groups of organisms with each other and their environment.

•**Hypothesis:** a proposition based on assumptions that can be evaluated scientifically.

•**Vertebrate:** an animal that has a backbone.

•**Taxonomy:** the classification of plants and animals according to their natural relationships.

Materials:

- Vocabulary (page 1)
- “Inventory and Monitoring” worksheet (page 3)
- Salamander Information worksheets (pages 4-5)

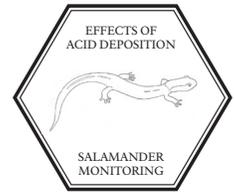
Objectives:

- 1) use the scientific method while studying biodiversity
- 2) describe the steps in scientific inquiry
- 3) learn the identifying characteristics between different species of salamanders
- 4) understand the biodiversity of the Great Smoky Mountains National Park
- 5) recognize the threats to aquatic and terrestrial salamanders

Background:

When students visit the Smokies on their field trip one group will be collecting data as part of a Salamander study. This lesson will introduce the scientific method and use the identifying anatomical characteristics to key different species of salamanders.

To be a scientist you don't necessarily have to have an advanced degree. All you need to have is the ability to observe the world around you and to ask good questions. Why do things happen? How do they happen? Scientists use a systematic method to find answers to their questions. The approach is known as the scientific method or scientific inquiry. The key components to this method are: making careful observations using your senses (sometimes that includes noticing what is not there as well as what is), asking a question that is clear and specific, gathering information from literature to develop a procedure for study and to discover what is already known about your question, forming a hypothesis (possible answers to the question), testing the hypothesis (surveys,



experiments and field observations are techniques), interpreting the results (make sense of your data by creating graphs or charts), drawing conclusions (was the hypothesis correct, what can you learn from your results, what factors were not in your control...), and sharing your results.

Procedure:

Have the students read the “Inventory and Monitoring” worksheet (page 3). Discuss why it is important for a park to develop an Inventory and Monitoring program.

Have the students read the “Salamander Information” worksheets (pages 4-5). Discuss the 1) Characteristics of a salamander, 2) What the term “lungless” salamanders mean in terms of how the salamanders breathe, 3) Differences between salamanders and lizards, 4) Different ways salamander monitoring is done in the park, 5) Correct method of measuring the length of a salamander, and 6) Differences between dusky and woodland salamanders.

Have the students read over the Vocabulary associated with the Salamander program (page 1). All of the definitions will be used within the salamander inventory session. Students will probably be familiar with most of the definitions but reviewing the list before the trip is essential.

INVENTORY AND MONITORING

THE SCIENCE OF DISCOVERING WHAT'S THERE & HOW IT IS DOING



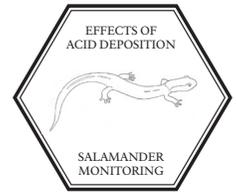
When someone knocks on your door and you ask, “Who is it?” you have just taken a simple inventory of the people at the other side of your door. When you let them in and they ask, “How are you?” they have conducted a simple monitoring program to determine your health. Of course, the accuracy of the data depends on how truthful the answer is. Conducting a biological inventory or ecological monitoring makes use of most of the tools of science, but it does not involve developing a hypothesis to test. Instead it involves making careful observations of how things are (inventory) and how things may or may not change over time (monitoring).

If you are given a box full of stuff to use and protect, one of the first things you’ll probably want to do is open it to take an inventory of what is inside so you could do your best job of using and protecting it. A biological inventory may involve developing a simple list of species or may include estimates of populations size (how many), mapping their range (where they are), and even what other species they associate with - their ecological community. An inventory is most useful if it occurs over a brief period of time because over a long period of time things can change and your inventory stops being accurate. An inventory is best as a snap-shot in time. A good inventory produces baseline data which is the standard against which you can compare what happens over time (for example there may have been changes in the environment, such as air pollution, or a change in the way people use the resource). We usually don’t know what things were like 500 years ago, but we can find out what things are like now, which might let us determine if things are changing, becoming less or more diverse the next time we look. The All Taxa Biodiversity Inventory is a huge inventory project started in Great Smoky Mountains National Park in 1998 to determine what species live in the park, their distribution, and their ecological community. It is estimated that as many as 100,000 species of plants, animals, and fungi live in the park. Right now, biologists have found 14,000 of these species. That leaves a lot of stuff in the “box” that park managers don’t know about.

Though an inventory is conducted over a brief period of time, a monitoring program could be designed to go on forever. Usually a monitoring program is set up to help detect if an unexpected change is happening to a protected area or a population of rare species, or to determine if an expected change is happening as we thought it would. If a population of rare plants is being protected, it would be better to know that the population is declining while it is still large and you can do something about it, rather than go out one day and discover it is all gone. Great Smoky Mountains National Park monitors air quality, forest recovery after fires, rivers, populations of endangered species, and many other systems.

Inventory and monitoring are important parts of managing a National Park or any natural area. Findings from these projects allow managers to make informed decisions on when and how to act, and when to keep hands-off. Inventory and Monitoring programs also develop many questions that may be answered by hypothesis testing and other scientific methods.

SALAMANDER INFORMATION IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK



Two major groups of amphibians occur in Great Smoky Mountains National Park: the salamanders (30 species) and the frogs and toads (13 species).

Great Smoky Mountains National Park is known as the “Salamander Capital of the World!” Salamanders are an especially abundant and diverse group in the Smokies. The majority of park vertebrates (the animals with back bones) are salamanders. We estimate that there are more salamanders than all of the park’s mammals combined.

Five families of salamanders are represented in the park: Cryptobranchidae, Proteidae, Salamandridae, Ambystomatidae, and Plethodontidae.

The southern Appalachian Mountains, including the Great Smokies, are a major center of evolutionary diversification for the family Plethodontidae, commonly known as the lungless salamanders. There are 24 species of lungless salamanders in the park. The family has undergone an extraordinary level of evolutionary diversification in the southern Appalachian Mountains. As their family name implies, these salamanders lack lungs. They “breathe” (exchange oxygen and carbon dioxide) through the walls of tiny blood vessels in their skin and linings of their mouths and throats. Lungless salamanders occur everywhere in the Great Smokies, in and along streams and under rocks, logs, and leaf litter in the forests.

Salamanders are commonly called “spring lizards” in the southern Appalachians. Lizards and salamanders are, however, very different sorts of animals: salamanders are amphibians while lizards are reptiles. The skins of salamander lack scales and are moist or slimy to the touch. Their eggs are surrounded by clear jelly. Lizards, on the other hand, have scales on their skin, and are dry to the touch. They lay eggs with leathery shells.

Amphibian life cycles are tremendously varied, and some are highly adapted for life on land. Amphibians as a group; however, are semi-aquatic or at least moisture-loving creatures.

Adult amphibians are carnivorous. Frogs and many lungless salamanders use their tongues to capture small prey, while other salamanders capture their prey by grasping them in their jaws. Amphibians generally feed on any prey small enough to be subdued and eaten. Insects and other small invertebrate animals comprise the bulk of salamander and adult frog diets.

Larval salamanders are also carnivorous, feeding mainly on small aquatic animals such as the immature stages of aquatic insects. Frog and toad larvae (tadpoles) are aquatic herbivores and scavengers, feeding on algae, aquatic plants, and bits of decaying organic matter.

Salamanders can drastically range in size. The Hellbender, the largest in the park, can grow up to almost 3 feet in length, has teeth, and roams stream bottoms at night. The smallest species in the Smokies is the Pigmy, at under 2 inches.

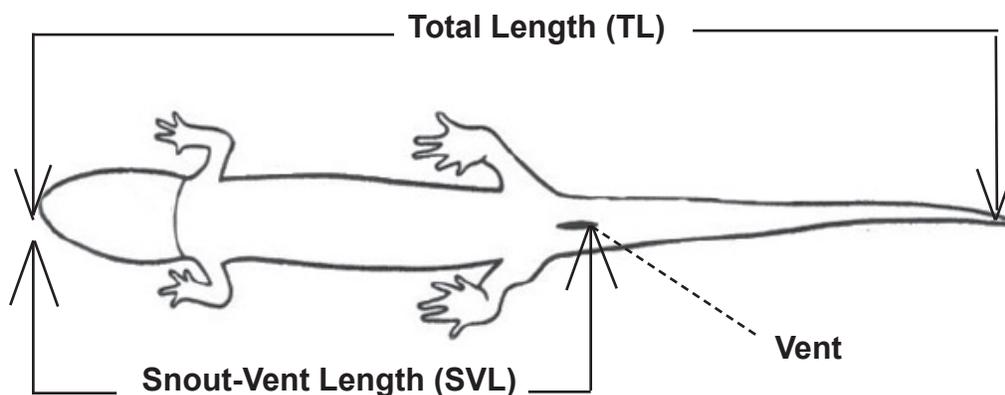
Most people go to the doctor for a yearly checkup to make sure they are healthy. Park biologists do a similar thing for the plants and animals in a park, only the periodic checkup is called monitoring. Salamander monitoring in the Smokies is done in several different ways. One way is using a nearby stream and forest. A length of stream is marked off into one meter sections, and students on field trips enter the stream to look for and hopefully catch salamanders. Another way is to use a forested area to the side of the stream that is also marked off into one meter sections, and students enter the forest to look for salamanders on the forest floor. A third method is to look under tree cross sections (“Tree cookies”). These tree cookies are designated by letter and number and are placed on the forest floor. All three groups need to note the flag number or tree cookie where they caught their salamander and bring it to the data collection station by the stream’s edge. There, each salamander is identified to species, weighed, and measured.



One of the reasons it is important to monitor salamanders is because they are considered bioindicators due to their sensitivity to environmental change. Salamanders lay eggs in water. The eggs have no outer covering or protective shell like chicken eggs. This makes their eggs very vulnerable to chemical pollutants, ultraviolet radiation, and other things that disturb growth. Also, salamanders skin is permeable, meaning it allows water and gases to enter and leave; they're 'environmental sponges.' When the water is healthy, they're healthy, and the eggs are healthy. Things like acid rain affect the water in which salamanders live and lay their eggs. When there's a low population of salamanders in a water source, that may be an indication of low water quality.

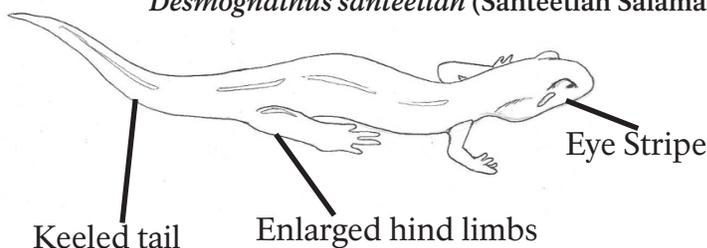
Anatomical Information for Identification

Total Length (TL) is the length from the tip of the snout to the tip of the tail. Snout-Vent Length (SVL) is the length from the tip of the snout to the back of the vent (the opening of the cloaca, or the all-purpose opening from which both wastes and sex cells leave the body). To measure the salamander in the field a Snout-Vent Length (see below) will be used since the salamander may have lost part or all of its tail in the past.



Most salamanders have four digits (fingers) on their front limbs and five digits on their hind limbs. The size and shape of the tail in cross-section are important in identification. The tail may be rounded, oval shaped, or keeled (knife-like) (see picture below of rounded versus keeled tail). Dusky salamanders can be distinguished from other lungless (Plethodontid) salamanders by their general body form. They all have strongly enlarged hind legs. A light line extending from the rear corner of the eye to the angle of the jaw is visible in nearly all specimens. As their name implies, most dusky salamanders are rather dully colored, in shades ranging from light brown to nearly black (see picture below of enlarged hind limbs versus equal sized front and hind legs).

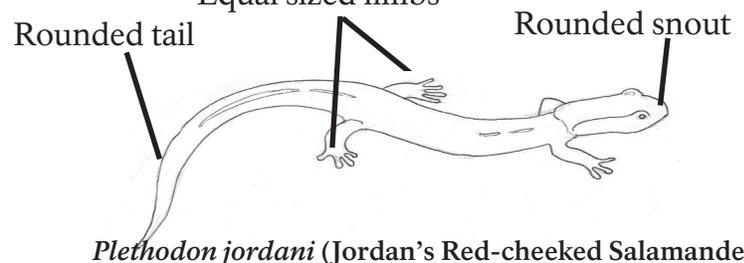
Desmognathus santeetlah (Santeetlah Salamander)



Genus *Desmognathus* (dusky salamanders)

- often difficult to identify to species
- have a pale diagonal line running from the eye to the angle of the jaw "eye stripe"
- hind legs often larger and thicker than fore limbs
- keeled tail

Equal sized limbs



Plethodon jordani (Jordan's Red-cheeked Salamander)

Genus *Plethodon* (woodland salamanders)

- all four limbs are about the same size
- rounded snout
- rounded tail