Are There Really Treefrogs Living in the Schoolyard?

by Brooke L. Talley and Melissa A. Henkel

**E**very schoolyard presents a wealth of opportunities for science exploration. To capitalize on this resource, we developed an activity in which students assessed whether our schoolyard could provide a viable habitat for treefrogs. This inquiry-based module was composed of three lessons: A Hoppin’ Treefrog Adventure, Field Research Means Having Fun in the Field, and All This Data! The actual sampling for treefrogs occurred over a period of time with several sampling events. There is no specific minimum number of sampling events necessary, but there should be enough to determine if trends in the population exist.

Sampling for treefrogs is accomplished by temporarily installing vertical PVC pipes around the schoolyard, pounding one end into the ground. Treefrogs are commonly monitored by herpetologists (scientists that study amphibians and reptiles) using frog calls and PVC pipes. Treefrogs are attracted to these pipes for protection from the elements, as well as from predators. Being in a pipe does not endanger or trap the animal, so this is a safe and cost-effective way to perform large-scale studies for novice and expert herpetologists, alike (Boughton 1997; Moulton et al. 1996; Staiger and Boughton 1999).

After a series of sampling events, students assessed their results to make conclusions about the schoolyard habitat. In our case, the number of treefrogs was very limited, so students determined the schoolyard habitat was not conducive to supporting a large population. The students were able to make suggestions for habitat and sampling regimen improvements. Results will vary depending on the schoolyard habitat and sampling effort.

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**Brooke L. Talley** (bltalley@yahoo.com) is a graduate student in the Department of Environmental Engineering Sciences at the University of Florida in Gainesville, Florida. **Melissa A. Henkel** (henkelma@sbac.edu) is a sixth- and seventh-grade science teacher at Westwood Middle School in Gainesville, Florida.
Education standards
The introductory lesson and inquiry-based labs on surveying treefrogs meet the following specific middle grades standards outlined in the National Science Education Standards: Content Standard A, Science as Inquiry; Content Standard C, Life Science (structure and function in living systems, regulation and behavior; populations and ecosystems, diversity and adaptations of organisms); Content Strand E, Science and Technology; and Content Standard F, Science in Personal and Social Perspectives (populations, resources, and environments; natural hazards) (NRC 1996).

Science and ecology background
Treefrogs typically live in trees (but may be found on other vertical surfaces, including outdoor school walls), clinging to the surface with enlarged adhesive toe pads. As bioindicators (biological indicators), treefrogs may become fewer in number when the environment is degraded (i.e., if the environment surrounding their habitat has been disturbed too extensively, then the treefrogs will either become locally extinct or move to more suitable areas).

Treefrogs are considered bioindicators because (1) they have permeable skin that directly absorbs toxins from the water and air; (2) they have two life phases consisting of an aquatic larval phase (tadpole) susceptible to change in water systems and an adult terrestrial phase (the adult frog) susceptible to change in terrestrial systems; and (3) they have a relatively low physiologic threshold for extreme change in temperature and moisture. Typically, treefrogs are negatively affected by habitat destruction, chemical pollution (water, land, and air), and increased UVB radiation.

A Hoppin’ Treefrog Adventure (50 minutes)
Through a teacher-facilitated discussion (in congruence with a computer-generated PowerPoint presentation) the first part of the lesson introduces students to the importance of bioindicators. The presentation, including notes and lesson plan is available online free-of-charge at the SPICE website (see Resources). Before beginning the presentation, teachers should familiarize themselves with the presentation so that they can anticipate student questions and responses. Specific notes are included on each slide for reference. The species list used in the presentation may need to be altered for different parts of the United States, because the online version is for Central Florida distributions. To have a better idea of what species may be present in the schoolyard, teachers should search the internet for their region’s treefrog species list. The entire presentation should take approximately 35 minutes. During the presentation, student participation is encouraged by asking probing questions, such as, What are treefrogs? Why study them? If you could, how would you study treefrogs? The presentation is designed to get students interested in the subject matter, and for teachers to gain a better understanding of their students’ current understandings.

In this specific presentation, the treefrog species covered are common to the southeastern United States: Spring Peeper (Pseudacris crucifer), Gray treefrog (Hyla chrysoscelis), Green treefrog (H. cinerea), Pinewood treefrog (H. femoralis), and Squirrel treefrog (H. squirella). Photos and common names of all the species are included in the presentation. Scientific names can easily be substituted if the teacher desires. Many other treefrog species exist throughout the United States (and the world). For more information about what species may be found in your area, look in a fieldguide (such as The Petersons Field Guide to Amphibians and Reptiles) or visit the U.S. Department of the Interior, Checklist of Amphibian Species and Identification Guide website (see Resources).

The second part of the lesson is an activity labeling individual PVC pipes for subsequent installation during the following class day. Some advanced preparation is needed for this portion, including cutting PVC pipes to the appropriate length (2.5–3 ft. segments). Total number and size of the pipes can be altered to fit your classroom needs. However, pipe diameter should not exceed two inches to prohibit occupancy by large exotic treefrogs (e.g., the Cuban treefrog).
The same online lesson plan (see above) outlines instructions for six PVC pipes per class, for five classes (30 total pipes). Pipes can be purchased at any hardware store, where they can also be cut to length free-of-charge. Total purchase costs should not exceed $30. Teachers may also consider using various lengths and diameters so that students can interpret effectiveness of different variables for frog detection.

Student instructions for pipe preparation include details about how to label the PVC pipes so that each one is unique. Permanent markers should be made available for student use. PVC pipe preparation instructions can be laminated and reused for each lab group (Figure 1). Students should work in lab groups of three to four people. Once students finish labeling the pipes, they should set them aside for installation during the following class. The activity should take approximately 15 minutes. If students finish early, encourage them to begin thinking about the habitat where they want to install their pipes (e.g., near buildings, in grassy areas, near retention ponds, and so on).

“Field Research” Means Having Fun in the Field (50 minutes)
The first part of the lesson begins with installation of the PVC pipes, followed by a data integrity discussion and practice using students’ field notebooks. Before taking students outside to install PVC pipes, teachers should speak with relevant faculty and staff to locate potential survey areas where they have seen treefrogs. Once PVC pipes are installed, they should not be removed until the study is over. Therefore, pipes should not be placed in grassy areas where mowing occurs frequently, where high foot traffic could damage pipes, or in areas that should remain free from clutter for fire safety procedures. Students should decide where to install PVC pipes according to where they think frogs would occur naturally. Through discussion with one another, students will probably decide to put pipes near buildings because treefrogs are known to “stick” to walls. They also may decide to put pipes near light sources because frogs could be drawn to eat bugs that surround the light at night.

PVC pipe installation is simple and easy. Once a site is selected, the pipe should be held vertically by one student at midheight. Another student should hammer on the top of the pipe with a rubber mallet until placement feels firm in the ground. The teacher should mediate the installation process, and may need to assist in hammering. For one class period, pipe installation should take no longer than 25 minutes.

Sampling for treefrogs is as simple as looking down the vertical pipe to see if a frog is present. The first treefrog sampling day should not occur before the two weeks following the installation. From that point, pipes can be checked as frequently as the class and teacher decides is warranted. Checking pipes one time per week is an adequate frequency that can easily be rotated through class periods to accommodate regular lessons. Checking the pipes for treefrogs only takes a few minutes, unless several frogs are detected that need identification.

Upon returning to the classroom after installing the PVC pipes, the teacher should pass out student field notebooks (one per student) and brief them on aspects of the notebook. Field notebooks can be printed from the SPICE website free-of-charge (see Resources). Inside the front cover, field notebooks have photocopies of treefrog pictures and written characteristics (Conant and Collins 1998) to aid in species identification. When a frog is found, students must determine what species it is and write down additional data (period/group, date, time, area condition, weather, treefrog species, and notes) in their field notebooks. While explaining how the field notebook is used, discussion about scientific integrity should also be pursued. Emphasis must be placed on keeping accurate records that correctly identify what was observed.

Students must also understand that when a treefrog is encountered, it should be left in place for the safety of the students themselves and of the treefrog. Even lotion on human skin can be toxic to the animal. Furthermore, treefrogs have fragile leg bones that could be broken if handled improperly. Treefrogs can be identified by size, shape, and color while inside the PVC pipe.

The last portion of the lesson is dedicated to practicing identification. As a lab group, students use their field notebooks to identify treefrogs seen in photos. These photos and an accompanying worksheet are also available on the SPICE website (see Resources). Teachers may choose to print and laminate photos for re-use, or students may look at them online if enough computers are available. The introduction to field notebooks and identification practice should also take 25 minutes.

All These Data! (50 minutes)
After completing several sampling events to look for treefrogs, the data must be compiled and analyzed. The exact number of sampling events is not as important as making sure that a clear trend is present before the study is terminated. The teacher should create a spreadsheet with all of the results to be manipulated by students. The lesson plan, available on the SPICE website (see Resources), gives specific instructions for using Microsoft Excel. Nonetheless, the teacher should become familiar with the program so that he or she can help students when they encounter problems. If computers are unavailable for student use, hand-written graphs can be created in place of those that are computer-generated.
The first graph to be created by each student plots sampling date against number of treefrogs detected. Once the graphs are completed, students independently respond to questions assessing the suitability of the schoolyard as a treefrog habitat. Worksheets are available on the SPICE website (see Resources) free of charge. Next, students independently choose two variables to graph, either sampling event versus average temperature or relative humidity. These data are available online (historic weather data) or can be documented by students while looking for treefrogs. Students gain abiotic factors to see if there is a relationship with the presence or absence of treefrogs. Average temperature and relative humidity were chosen to be graphed because students understand what temperature and humidity changes feel like, relating personal experiences to what’s being studied.

Following data manipulation, students assess their results and draw conclusions regarding how their schoolyard habitat performed, as well as how they would improve the study in the future. For example, we asked students, “If your school principal asked you about the results of our treefrog study, what would you tell him about the habitat our schoolyard provides?” Their replies included:

- “I would tell him when the cold months come the frogs just want to be in something warm.”
- “That are [sic] schoolyard is not really a habitat in warm weather, but in cold.”
- “That the habitat does have frogs, but not many.”

Assessment and extensions
Student participation was heavily weighted by grading field notebooks and assessing general participation while outside. Were the students interested and engaged? Did they ask questions about what they did or did not see? Additionally, laboratory and computer activities were graded based on student responses and participation.

Extensions
- The USGS has a treefrog monitoring program (Schoolyard Treefrog Monitoring Project) in place where students can submit data online and see what other classes are finding (see Resources).
- A lesson designed to help students practice classification is available on the SPICE website focusing on treefrog species. Students create a binary classification system and dichotomous key that can be used when identifying individuals.
- The final lesson can be followed with discussion about amphibian declines. Additional information on amphibian decline can be found online or through the following student readings:


Conclusions
The treefrog monitoring module is an easy way to get students out of the classroom and into the outdoors, while examining real organisms living in their immediate environment. Our students looked forward to sampling days, questioning whether they got to go outside as soon as they walked through the classroom door. While excited to get “out of class” by going outside, students were enthusiastic to write down data in their field notebooks and to correctly identify any treefrog seen. Even those students that typically kept to themselves during class became much more communicative and excited about science when out looking for treefrogs in small groups.

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Resources
SPICE website—http://spice.ees.ufl.edu/news/cginews.pl

References