The Herpetology Project

Students construct traps to collect and analyze turtle data

by Peter Vacchina and Mary Aguirre

Every spring, my environmental science class constructs pitfall traps to catch turtles, frogs, toads, and snakes. As part of the Herpetology Project, students collect baseline data and take pictures and videos of these creatures to determine their reproductive success in an area with heavy human competition. Human beings live within the world's ecosystems, and our presence increasingly modifies ecosystems through population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors threaten global stability, and if these matters go unaddressed, our ecosystems will be irreversibly affected (Semlitsch et al. 2007; Massal, Snodgrass, and Casey 2007; Brown and Laband 2006; NRC 1996).

In this article, we describe our ongoing experience with the Herpetology Project. Through this field study, students catch and track amphibians and reptiles in the Assabet River area, record and analyze data, share their findings with the community, and ultimately, work toward protecting turtles' habitats. We chose to focus on turtles in this article because they helped to inspire the project and because we have a method of tracking their recapture.

Background

The Herpetology Project was inspired by and modeled after students' participation in several Earthwatch Institute (see "On the web" at the end of this article) field expeditions in the Pantanal of Brazil. For four years, groups of 10 students and 2 teachers traveled to Brazil to assist scientists with field studies of bats, jaguars, peccaries, giant river otters, frugivores, birds, small mammals, frogs, snakes, turtles, and water quality. Students found both the bat and herpetology projects (e.g., frogs, snakes, toads, and turtles) the most exciting, but only the herpetology study showed promise for practical applications back at school.

Another event that sparked student interest in this project was an "invitation" of sorts from the snapping turtles themselves. Five years ago, our high school moved into a newly constructed building and adjacent athletic fields, which are about 300 m closer to the Assabet River than our old building. During our first year in the new building, one turtle walked out of the river and laid eggs at the shortstop on our new softball field, clearly visible from our classrooms. Exactly one year later, the event occurred again in almost the same location. Every June, snapping turtles *(Chelydra serpentina),* painted turtles *(Chrysemys picta picta),* and common musk turtles *(Sternotherus odoratus)* wander the fields seeking appropriate nesting sites—in spite of the newly developed athletic area and increased human impact on the surrounding wetlands (Conant and Collins 1998). As a result, students wondered how the increased use of playing fields might affect the nesting patterns of the turtles.

Going on four years now, the Herpetology Project—part of environmental chemistry, environmental science, and biology classes—has received six grants to engage and facilitate student experiences in field research along the Assabet River.

Protocols for vertebrate research

Because of the sensitive nature of vertebrate research, students do not deviate from the protocols established by Earthwatch scientists. For example, in setting up traps, students take care to make sure that the buckets drain properly so that animals do not drown and provide water and shelter for animals caught in the traps to prevent dehydration. Students are also required to adhere to the guidelines set by the Federal Animal Welfare Act (see "On the web"). Before beginning research, permits for capture and release of reptiles had to be obtained from the Department of Fisheries and Wildlife (DFW) through contact with the local office via phone and followed up with a written letter. Students are taught to capture and handle organisms safely and humanely, making sure that organisms are collected daily to prevent harm from dryness or cold. When traps are not in use, students close the traps tightly to prevent unnecessary capture.

According to the American Society of Ichthyologists and Herpetologists (ASIH), researchers are required to adhere to certain guidelines for animal study (Beaupre et al. 2004). These include the following:

- Care must be taken to ensure that conservation is the key goal.
- All handling and sampling in the field must be recorded and thoroughly described in a field notebook or sampling form.
- Every effort must be made to prevent deaths of animals due to trapping methods—this includes drowning, desiccation, or shock.

(**Safety note:** For students, prudent safety protocol in field work such as this includes safety

Creation of a snapping turtle nesting site.

As snapping turtles' established nesting areas have been compromised and totally lost to our new school's athletic fields, the turtles still return and roam our fields searching for the right spot in which to lay their eggs. Some turtles have made risky choices and laid eggs in these high-traffic areas—and many have been lost to a predator, possibly a raccoon or skunk, that finds most nests and makes a meal of the eggs (see photo).

Two years ago, as a community service and out of concern for the survival of the snapping turtles, students decided to build a turtle nesting site with gravel at the edge of the tree line alongside our softball field. Since the area is within wetlands, we were required to work closely with the town's Conservation Commission and the Department of Public Works (DPW) to establish the gravel nesting site for snapping turtles. After some discussion and meetings with DPW officials, students completed the required documentation, and applied to the Conservation Commission for authorization to place the gravel in the wetlands.

Once the project was approved, students raked 10 yd^3 of gravel into a smooth 5 m^2 area at the sunny edge of the field. However, even with the gravel in place, predators still managed to get to the eggs of snapping turtles that nested there. Students recognized the need to design a better method of protection from predation.

This year's student researchers have decided to assemble a wire-mesh cage to cover the nests. The cage will be 3600 cm^2 and 20 cm high above the ground with a 20 cm section buried underground. The buried section will be angled away to prevent a predator from digging under it to get to the eggs. The section above ground will have a small window large enough to allow newly hatched turtles to find their way out, but too small to allow predators' paws in. Students are hopeful that their efforts will help counteract both predators and the disruption by humans upon the wetlands ecosystem.

glasses [goggles if using chemicals], gloves, long pants, long-sleeved shirts, hats, socks, and closed-toe shoes to cover the feet.)

Building pitfall traps

Pitfall traps are buckets placed in the ground to catch animals that fall into them. The concept behind them is that animals walking in the area bump into a drift fence and, in attempting to get around the obstacle, accidentally fall into a bucket (Corn 1994; Dold and Scott 1994).

To construct these traps, students dig four holes—large enough to easily hold a 30 L bucket and spaced 10 m apart—using shovels, grub hoes, and post-hole diggers. When necessary, pruning shears are used to cut through tree roots. (**Safety note:** Safety precautions and instructions are given during a demonstration of proper tool use to avoid any potential injuries. Safety gloves and safety glasses or goggles are needed while digging and using shears.) After the four holes are created, 30 L buckets are placed in each, keeping the mouth of the buckets level with the ground. The holes are then backfilled to provide stability for the buckets.

The drift fence is made using a 1 × 40 m black plastic sheet. It passes directly over the middle of each bucket in the line and extends 5 m beyond the first and last bucket. The fence is supported with 1 in. diameter PVC tubing; stakes and a trench are carved underneath it to bury the bottom of the plastic in the ground so that animals cannot crawl under it, and must instead go around. (**Safety note**: Blunt stakes and tubes should have end caps, such as rebar caps, as sharp ends are a safety hazard.)

The fence defines where the transect—a fixed path along which observations are made—is placed, which should run along the length of the drift fence. While building these transects, students maintain a safe distance from the water, do not enter the river or the holding ponds, and always work with a partner. Students carry walkie-talkies and cell phones in case of emergencies (the chosen site should be pretested by the teacher to make sure cell phones are operational in the area). Using a global positioning system (GPS) device, the location of the transect and each bucket is marked. See Figure 1 for an example.

Collecting data

Last year, students built four 40 m transects, each containing four pitfall traps. Two ran parallel to the river (about 20 m away from it), while the third ran perpendicular. The fourth transect was located between three storm water retaining ponds that separate the two athletic fields (50 m from the river).

Following the guidelines established by Earthwatch scientists (Corn 1994; Dold and Scott 1994) and Davidson College (Dorcas 2005), students caught turtles both in the traps and by hand in the playing fields, checked the traps on a daily basis, and placed perching rocks and shallow dishes

FIGURE 1

Pitfall trap photos.

FIGURE 2

Students engraving a snapper.

filled with fresh water for hydration within the traps. Additionally, upon removing protective gloves, students were careful to wash their hands with water and soap or antibacterial solution both before and after handling the animals to prevent spread of bacterial or other diseases.

Data collected included photographs of dorsal, ventral, and lateral surfaces along with tibial and body length measurements (nose to tail) for amphibians and reptiles, including frogs, toads, turtles, and snakes. Special care was taken with snakes as some species of snakes are aggressive when cornered. Calipers were used for acquiring precise measures. Finally, the organisms were weighed, photographed, and then released in the same location (Dorcas 2005).

For turtles captured, in addition to photographs and weight, students measured the carapace (shell) midsagitally and transversely. The marginal scutes (bony external plates) were marked along the perimeter to keep track of recaptures, according to Davidson College reptile research protocols (Dorcas 2005) (Figure 2).

Microchips were embedded in the posterior left leg of several larger (7 kg or greater) snapping turtles for identification and tracking purposes. These microchips are about the size of a grain of rice and use passive radio frequency identification (RFID), a method used by many pet owners, rescue groups, and animal shelters to aid in the identification of lost pets and their return to their rightful owners. Snapping turtles have short tempers out of water, so extreme care is needed when handling them; students were pretrained in safety practices and closely monitored by teachers during this part of the research (Figure 3). Students placed each turtle on its back and its head and front legs were wrapped with a cloth. The area for the injection was scrubbed and sterilized with alcohol before the microchip was inserted under the tough scaly skin (Deyer et al. 1994) by the teacher (wearing chemical splash goggles). The microchips were prepackaged in sterile syringes for insertion into the study animal. Care was taken to keep the animal secured safely while causing as little trauma to the animal as possible by following protocols for capture and release from the state DFW. A local grant provided funds for purchasing the microchip equipment, and permission was granted by the DFW to embed chips into the turtles (Deyer et al. 1994). Students released the turtles immediately after data were gathered.

CAUTION

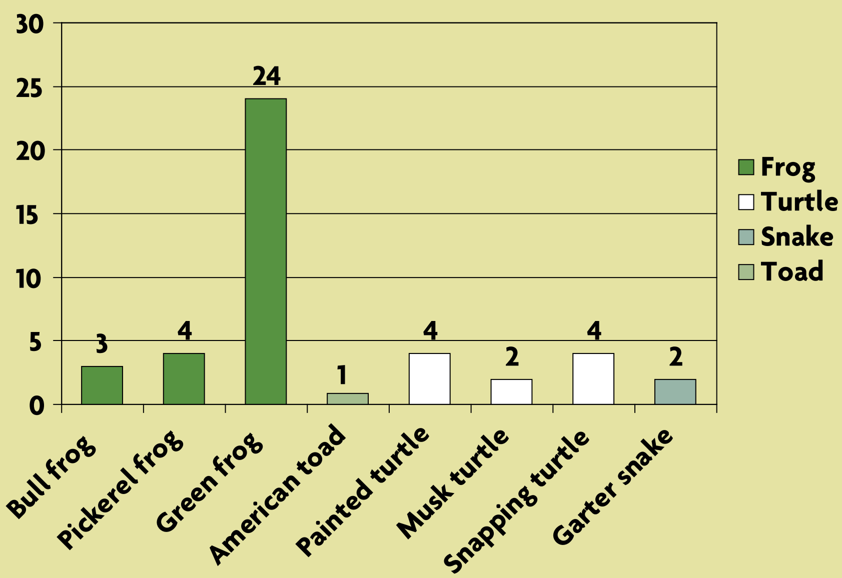
When turtles were observed walking or laying eggs in the fields, students used the RFID scanner to check if the turtles had already been tagged with a microchip. Students identified two previously tagged turtles that returned to the same location (within 100 m) to lay eggs.

FIGURE 3

Student handling a snapper.

FIGURE 4

Histogram of data collected in June 2007.



GPS locations of the turtle nests are recorded each year by hand on a photocopied map of the school building site, and students upload that information to mapping software from the GPS.

If data could not be gathered immediately by a student researcher, the organisms were safely bagged (Dorcas 2005) and brought back to the lab for processing. The organisms were stored in containers with water and released within 24 hours.

Students then analyzed data to look for trends in numbers and hypothesize the reason for changes (Figure 4, p. 53). For example, students observed an increase in snapping turtle numbers over the past five years and hypothesized that this demonstrates the adaptability and resilience of the snapping turtle populations in the disrupted habitats. Additionally, student reflections, based on this year's data, may indicate the school's location has not permanently disrupted the immediate ecosystem. (**Editor's note:** See Schneideer, Krasny, and Morreale 2001 for more information on herpetology projects.)

Student written and video reflections

Written forms of assessment include students maintaining a field-research journal of reflections on their research and its impact on local environmental issues, as well as scientific thinking in more global terms. In addition, students write articles for the summer edition of the district newsletter, *Visions*. Writing for an authentic audience helps inspire and motivate students' successful completion of a written article.

In addition to the journal, students use several methods to document an extensive amount of information during the project. They take designated digital photographs, videotape activities, collect positional data using a GPS device, and use mapping software to plot the data on a map of the area. This data can then be posted on the web in an unalterable form and used by other educators. A DVD of the photos and video footage are woven into a live television production, discussed in the following section.

Culminating activity

Using technology to engage students in the excitement of science has been a rewarding and motivating outcome of the project. Learning the ins and outs of technology connects students to their work and provides them opportunities to express their understanding through a technological medium.

At the end of the school term, students peer edit PowerPoint presentations and make DVDs of graphs, spreadsheets, photograph collections, digitized animal sounds, and video clips taken during their research to communicate their findings to the school and community. They also produce a live television production in the studio in front of a green screen that is broadcast over the local cable television station and posted online to educate the community about the local wetlands. Students' work has also been highlighted in local newspapers. This year, we hope to add podcasting from the field and follow-up by blogging on a daily basis.

Impact on student knowledge

Much of teacher planning is motivated by the desire to reach diverse learners—particularly "at-risk" learners—through innovative ways. With authentic research, students who might normally show little interest in science are motivated to participate in this project. For the Herpetology Project, student assessment is based on research goals, research journals, participation, and successful completion of a video, PowerPoint, or television production. Alternative methods of assessment not only motivate teaching, but also motivate some students when traditional methods fail.

The Herpetology Project meets several curricular objectives, including

- identifying and analyzing the factors in an ecosystem that influence fluctuations in population size;
- using technology to create classroom presentations and communicate data;
- working collaboratively to achieve research goals; and
- using challenging and effective methods of differentiating instruction.

The Herpetology Project also addresses Content Standard C (NRC 1996, p. 186) (Figure 5), as well as the Massachusetts Curriculum frameworks.

FIGURE 5

Addressing the Standards.

The Herpetology Project addresses the following National Science Education Standards found in Content Standard C (Life Science) under "The Interdependence of Organisms" (NRC 1996, p. 186):

- Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.
- Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.
- Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

Service component

In addition to meeting curricular objectives, the project's publications and video productions take on a service component by increasing community awareness of environmental issues concerning the changes in populations of amphibians and reptiles in our local wetlands. Students act as spokespeople for conservation, donating time to play a key role in the progress of field research as a way to learn and teach science. Our research focuses attention on an overall understanding of the Assabet ecosystem. Recognition by school committee and local community partners helps to magnify the impact of students' research throughout the community.

Project challenges and solutions

While this project has been largely successful, it does come with a few challenges. Even a 90-minute class does not provide enough time to gather equipment, get out to the field, collect specimens, record data, return, change clothing, and get ready for the next class. Establishing a secure location to store equipment can be a challenge when classroom space is at a premium and storage closets are already filled. Taking on a research project such as this requires students and teachers to commit time and energy above and beyond what is typically required of a regular school day. One teacher arrived an hour early to school to prepare; she sometimes taught the next block without changing clothing. The other teacher, whose class met during the last block of the day, stayed after school to catch up. Students were often scrambling to get to the next class or catch the bus. Keen time-management skills are important to the success of such an undertaking.

A project such as this can also be fairly expensive, but we have been fortunate to receive grants to help offset our costs—five from our community education foundation (two of which were results of student-written proposals) and one generated by students through the sale of candy at lunch. As part of our Honors Environmental Chemistry, Advance Placement Environmental Science, and Honors Biology II classes, the project expenses have been funded mostly through these grants and not from our normal yearly school budget. Grants awarded include monies for digital and video cameras, GPS devices, voice recorders, walkie-talkies, camera traps, and microchip and radio telemetry equipment.

Conclusion

The Herpetology Project unites authentic science research and learning with curriculum objectives. Students learn how to create research goals, catalog data, analyze the information for trends, and present their data to a larger community. Carrying out research allows students to be successful in a venue outside of the normal school curriculum. Students also spend time outdoors connecting with nature, realizing nature's interdependence and their guardianship responsibilities. As a result, students are more likely to care and take ownership for the natural world. Through this project, students are able to engage in authentic research that has real implications for the local community and connects them to global concerns. ■

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On the web

Earthwatch Institute: *www.earthwatch.org*

Federal Animal Welfare Act: *www.fws.gov/laws/lawsdigest/resource laws.htm*

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