What's threatening our rare amphibians? Researchers learn about this unfortunate disappearing act.

The gray tree frog (*Hyla versicolor*) is a mid- to late-spring breeder in nearly all counties in Illinois.

Restoring a Native Amphibian Community

Story and Photos By
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Many people consider amphibians—in spite of their "slimy skin"—to be attractive animals. The red-eyed tree frog is often considered a "poster-child" for tropical ecosystems, and the variety of colors found on several species of poison dart frogs rivals those seen in just about any other animal group. Even if they lack brilliant colors, the large eyes of frogs and salamanders can make their faces quite endearing. The many modes of locomotion exhibited by amphibians (e.g., crawling, swimming, burrowing and, especially, jumping) can be entertaining to watch. What's more, identifying frogs and toads solely from their vocalizations is a source of satisfaction to many.

Amphibians also are interesting animals to work with from a conservation perspective. Nearly all species lay shell-less eggs and the developing embryos are protected only by a gelatinous coat. Most amphibian species have an indirect life cycle; that is to say that an aquatic larvae has a different appearance and occupies a different habitat than the land-living adult. The transition from one stage to the next is termed metamorphosis and is usually the time when the amphibian becomes less dependent on aquatic habitats. The slimy texture of adult amphibian skin is due to the presence of numerous glands just below the skin that secrete mucous to keep the skin moist when they are out of water.

Graduate student Lee Gross, holding a bullfrog (*Rana catesbeiana*), assisted with the long-term study of pond-breeding amphibians.

Four ponds were surveyed for amphibians throughout the study period. The pond in the upper photo previously contained sunfish whereas the pond in the lower photo never contained fish.

Although many adult amphibians are terrestrial, they typically return to a body of water to reproduce. The ponds used by some amphibian species might be smaller than a kitchen table, but they must hold water for the duration of the larval stage—approximately from February to August depending on species and location. With the loss of more than 90 percent of the natural wetlands in Illinois since 1820, enhancement of existing wetlands and the creation of new breeding ponds is critical to the management of these animals.

In cooperation with the Illinois Nature Preserves Commission, the Department of Natural Resources and a private conservation landowner, a long-term research project in east-central Illinois provides an opportunity to study pond-breeding amphibians with the hope of guiding future amphibian conservation efforts.

The study site is a privately owned Illinois nature preserve near the Embarrass River. Four ponds, three of which hold water year-round, are present on the property (the fourth usually dries up by early August). Since 2000, more than 10 species of amphibians have been observed breeding in and around these ponds—including gray tree frogs, wood frogs and smallmouth salamanders.

Prior to being designated as a nature preserve, populations of bullhead catfish and sunfish had been introduced in two of the four ponds. These fish eat amphibian eggs and larvae and frequently are detrimental to frog and salamander populations breeding in these ponds.

The first task was to monitor pond use by individuals of each species. Traps were placed around the ponds to collect individuals as they migrated to the ponds to breed or away from the ponds after reproducing. This trapping system also caught young adults after they completed their metamorphosis and moved into the terrestrial habitat around the ponds. All individuals were marked to avoid counting the same individual twice when estimating yearly population sizes, and then they were released. From this data, reproductive success for each species could be estimated as the average number of juveniles produced in each breeding season divided by the number of females using the pond.

As expected, the number of species successfully breeding in the "fish" ponds was lower than in the fishless ponds. Further, the individuals that survived to the adult stage in "fish" ponds consisted primarily of American toads. While all amphibians produce some form of toxin from skin glands, toad larvae are particularly distasteful to fish and were surviving in the presence of these predators. Other species, having less potent skin toxins, were more readily eaten by fish and experienced low reproductive success. Fewer animals survived to become adults and populations were low and/or declining.

With cooperation of DNR biologists, a project to improve the quality of amphibian breeding habitat was initiated. Fish were removed from the two ponds during periods when amphibians were dormant (over-wintering below

Wood frogs (*Rana sylvatica*) are early spring breeders that were common only in ponds lacking fish.

(Photo by Michael Redmer ©.)

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The tiger salamander (*Ambystoma tigrinum*; above left) and spotted salamander (*A. maculatum*; below left) are both candidates for reintroduction at this nature preserve. Small-mouthed salamanders (*A. texanum*), the most common salamander species at this nature preserve, in a pitfall trap (above).

ground). In the years that followed, an increase in the reproductive success of amphibian species other than American toads has been observed. The duration of the larval period for several species decreased after fish were removed, indicating that larvae were able to mature faster in the absence of these predators (a definite advantage for those populations using ephemeral ponds). The removal of predatory fish improved the breeding success for several amphibian species and appears to have restored the amphibian community to one that more closely resembles natural conditions as well as increased populations of formerly rare species.

A third study of techniques to restore amphibian populations—the re-establishment of species that previously occurred in the area—is under way at this site. This technique is restricted to rare situations such as implementing recovery plans for endangered species. Using closely related species as a test organism, however, can provide insight into appropriate techniques without danger to already-rare endangered species.

Historical records indicate that tiger and spotted salamanders once were present in the area of the study site. Local populations of these species have not been observed for more than 30 years. This phase of the project involves relocation of individuals from stable populations outside of the county. Like migratory salmon, many pond-breeding amphibians typically return to breed in the pond in which they hatched. As embryos and larvae, they imprint on features of the pond (like a chemical "signature") that enable them to relocate it when mature enough to reproduce. This translocation effort should have the greatest success if salamander egg masses are placed in the pond instead of adult individuals.

So that the effects of this relocation effort can be accurately monitored, only one species at a time is targeted, starting with tiger salamanders. The donor population was geographically close to the site and was destined for extirpation as its breeding site was to be destroyed by development. More than 2,000 eggs were introduced in 2005 and 2006 and, because tiger salamander adults may take two years to transform, results will not be known until after the 2008 breeding season. The uncertain outcome of this project can seem frustrating at times but also keeps the anticipation levels high and the successes more rewarding.

With funding from the DNR State Wildlife Grant program, in cooperation with the U.S. Fish & Wildlife Service, and management priorities of the Illinois Nature Preserves Commission, some regional declines in the populations of these interesting animals may be reversed.

The publication "Illinois Landowners' Guide to Amphibian Conservation" (Special Publication 22) is available for $8 from the Illinois Natural History Survey. To order a copy, visit www.inhs.uiuc.edu/chf/pub/index.html or call (217) 244- 2161.

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Among the individuals who contributed time and effort to this project are graduate students Drew Foster, Lee Gross, Brian Towey and Lee Walston. Barrie Hunt and DNR biologists Mike Mounce and Bob Szafoni also provided valuable assistance.