



# Seeing Spots:

## The Northern Leopard Frog

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The northern leopard frog is known to scientists as *Rana pipiens*. This spotted frog should be one of the most commonly found amphibians in Pennsylvania. Historically, it was. However, recent information gathered in Pennsylvania and in other northern states suggests that the northern leopard frog has been declining in our wetlands and along our waterways. People aren't seeing "spots" where they should be. Biologists in other states have also noticed that this species has declined. In 1996, the United States Fish and Wildlife Service began reviewing the status of this species in each of the states where it occurs. The agency is attempting to determine, from a regional perspective, how northern leopard frogs are faring. Early reports are not encouraging.

The Pennsylvania Fish and Boat Commission is featuring the northern leopard frog in 1999 as the latest species in a series of collectible nongame patches. We chose to focus on this amphibian because the environmental factors that may be influencing its survival in the Commonwealth are typical of those affecting other species. Consider this frog's life history to identify and better understand this species.

### Identification

Northern leopard frogs belong to the Ranidae family (true frogs). They get their name from the apparently random placement of spots on their bodies. Other similarly appearing species include the Pennsylvania endangered coastal plain leopard frog (*Rana sphenocephala*) and the pickerel frog (*Rana palustris*). Leopard frogs reach a maximum length of about

photo-Joe McDonald; graphic-Ted Walke

five inches. Pickerel frogs typically do not exceed four inches. Thus, overall size can be useful in identification.

The coastal plain leopard frog is found only in Bucks and Delaware counties along the coastal plain near the Delaware River. It displays a white spot in the center of its tympanum (ear membrane) and has a longer snout than the northern leopard frog. In Pennsylvania, there is no overlap in the range of the two leopard frog species. This makes it easier to distinguish between the leopard frog species. Incidentally, the coastal plain leopard frog is endangered primarily because of habitat loss and degradation in the relatively small area of Pennsylvania in which it historically occurs.

The pickerel frog is widely distributed across Pennsylvania and can be found sharing habitats with the northern leopard frog. Thus, these two species are often misidentified by the casual observer. The most obvious difference between the two is their spot patterns. Northern leopard frogs display round spots that are encircled by white or light halos and are not distributed in rows on the frog's back. Pickerel frogs have squarish spots usually

outlined in black, which are aligned in two parallel rows on the back. Also, the belly and inside of the legs are white on a northern leopard frog but yellow or orange on a pickerel frog.

### Reproduction

Like most frogs, northern leopard frogs attract mates by calling during the spring breeding period. Both males and females vocalize. Although they may begin calling in March, breeding can extend into June. Permanent and temporary ponds as well as areas along the edges of lakes and streams are used for courtship and egg-laying. Females deposit up to 6,000 eggs in a jellylike mass. The eggs hatch about 10 days later with most of the tadpoles transforming into juvenile frogs during July and August.

### Feeding

Northern leopard frogs consume a variety of foods. As tadpoles they are herbivores. Using specially developed teeth, they forage on aquatic plants and algae. After transformation into froglets, they become carnivores and eat almost any small insect or invertebrate they can catch. Although they can be

active hunters, their basic method of prey capture is ambush. Their perfectly adapted camouflage helps them avoid becoming the main course in the meal of a snake, snapping turtle, raccoon, or great blue heron.

While foraging, this species can be found a fair distance from water. They are often referred to as "meadow frogs" because they often forage in wet or damp meadows and grassy areas away from open water. Activity levels are greatest during the cooler periods of the day, such as dusk and dawn. For a frog, dew-laden grass provides an ideal situation for comfortable hunting.

### Reasons for decline

Researchers around the world are reporting marked declines in the abundance of many amphibian species, including frogs. People have also reported declines of local amphibian populations with which they have personal experience. We have heard quotes such as, "I don't hear frogs calling along the river as I did 20 years ago," or "When I was a kid, we went down to the pond and caught frogs all the time; now you rarely see one."

*The northern leopard frog may be what ecologists call an "indicator species." Its health and survival may reflect the environment's health. The frog's apparent decline may be a warning for us to examine closely our influence on the environment.*





There is no doubt that these observations are accurate. There have been many reasons offered and theories proposed to explain these noted declines. One of the most obvious is that habitat is lost or altered at an alarming rate. In Pennsylvania, we have lost a majority of the wetlands that were present at the turn of the 20th century. All of Pennsylvania's frogs require water and wetlands in which to lay their eggs so that they may hatch into tadpoles and develop into juvenile frogs. Loss of wetland habitat results in the loss of wetland-dependent species such as frogs.

Even though outright wetland destruction or degradation is obvious even to the casual observer, some other environmental alterations may be less visible. New highways have been built, and vehicular traffic has increased on most older highways. Frogs and salamanders that need to cross roads to

reach ancestral breeding grounds often become nighttime mortalities, left on the road as food for crows and raccoons. These losses are not obvious to most people because scavengers often consume the carnage by daylight.

Amphibian road mortality studies were conducted at the Hawk Mountain Sanctuary in Berks County in 1997. On seven rainy nights during spring and early summer, more than 100 amphibians (including frogs) per night, representing up to 13 species, were recorded as mortalities on some three miles of road. When one considers the vast amount of road mileage that bisects or borders wetlands and forested areas in Pennsylvania, the potential losses of amphibians to highway mortality are staggering.

Research conducted in central Pennsylvania has unequivocally linked acid precipitation to the decline of



photo Andrew L. Shields

*Pickerel frogs (above) can be identified by the double row of squarish dark blotches or spots on the back. The spots are encircled with dark or black lines. Northern leopard frogs (below left) have light halos encircling round spots.*

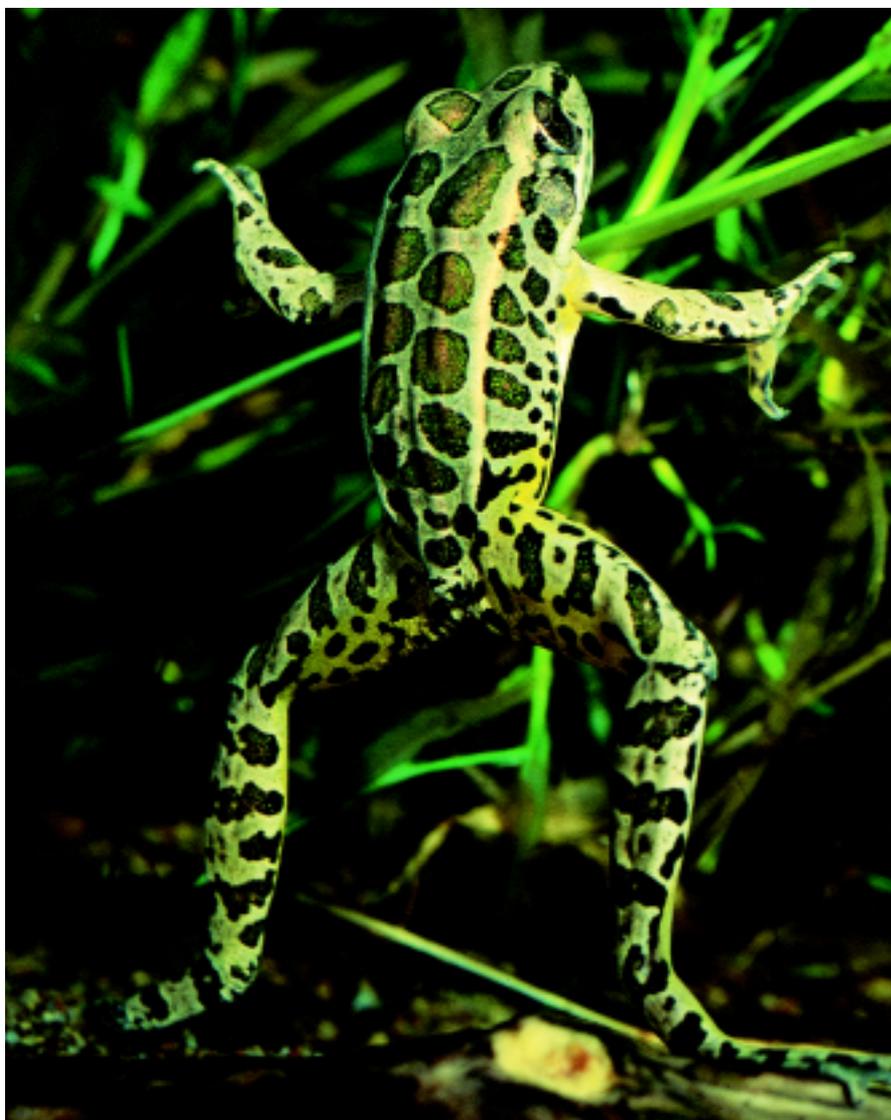


photo Rob Criswell

wood frogs and several species of woodland salamanders. These amphibians require seasonal temporary ponds for reproduction and rearing of young. Temporary ponds do not contain water year-round, so they do not support fishes that could be predators on the larval amphibians. Thus, the survival rates of larvae would be expected to exceed those from ponds that do contain fish. However, many of these ponds occur in mountainous areas where the soil has a low pH (highly acidic), and where the soil is naturally poorly buffered. Thus, a further drop in pH caused by acid deposition causes the pH to drop to lethal levels, causing the eggs or larvae to die. Additionally, sublethal effects can cause deformities in the animals that do survive.

Depletion of the ozone layer has been shown to allow certain wavelengths of harmful ultraviolet (UV) radiation to reach ground levels. This radiation was probably filtered by the ozone layer to a greater extent in the past than it is today. Researchers in the northwestern United States have documented that damage to the DNA of certain amphibians can result from exposure to these radiation levels. Some species can withstand higher exposure levels than other species. Similarly, some species are able to repair radiation damage to their cells, while others cannot. The early theories are that those species in greatest decline may also be those that are less able to repair radiation-damaged

DNA. Researchers are testing various amphibian species to determine if certain patterns are evident.

Another reason for the decline of many amphibian species is that herbicides, pesticides, and other chemicals in the environment have been linked to deformities and death in certain amphibians. Most amphibians and nearly all frogs breathe through their skin in addition to their lungs. They travel along the ground and are always in contact with the substrate. Because this is where many toxins accumulate, frogs are prime candidates for toxin-loading when harmful agents are found in their environment. Even though it may be difficult to determine which chemicals are harmful, just think of all the herbicides, pesticides, deicing agents, cleaners, and solvents that are in use today. Today's "harmless" chemicals could be tomorrow's DDT!

Other less obvious chemicals may be affecting our frogs. Recently, deformities in fish and amphibians have been linked to human female hormones that have found their way into the environment via birth control usage ("the pill") and the local sewer system.

Most recently, scientists working independently in the United States and Australia have discovered a new fungus genus known as a chytrid fungus. It is believed to be killing frogs and toads around the world. There are still several unanswered questions about this latest discovery. It is known that this fungus has been found on dead frogs. However, it is unclear whether this fungus caused death or appeared after the frogs were weakened by some other agent, such as ultraviolet radiation damage. Additional research is needed to be certain.

The research conducted so far suggests that the decline of frogs and other amphibians may not be caused by any single factor, but instead by a combination of environmental alterations. That may explain why some



leopard frog populations still exist and others have disappeared completely.

The natural environment has been compared to the workings of an automobile. Certain parts of a car, like the wipers, radio, or some wiring, can be removed and the car will still run—maybe not as well as before, but it will still run. However, at some point a critical part, such as the fuel pump, battery or distributor coil, might be removed, thus causing the car to stop working. Perhaps we are damaging or removing critical parts in the northern leopard frog's environment. In some areas they are gone already. In other areas it may be only a matter of time. Hopefully, the right answers will be found before it's too late.

### Commission efforts

What is the Fish and Boat Commission doing about leopard frog declines? Presently, the Commission has directed funding from the Wild Resource Conservation Fund to Dr. Arthur Hulse, of Indiana University of Pennsylvania, to conduct the Herpetological Atlas Project of Pennsylvania. Since 1996, amateur herpetologists have been searching the woods and wetlands of Pennsylvania to identify and document reptiles and amphibians for this project. Early reports have revealed that northern leopard frogs have been encountered only in 17 of the 34 counties where they had historically occurred.

Special attention will be given to locating northern leopard frogs as this survey effort continues. The baseline data collected by the atlas project will be crucial to identifying long-term monitoring sites that are necessary to document and understand frog population changes. We will also continue to monitor research initiatives that seek to solve the mystery of disappearing frogs. Then, where possible, we will apply the scientific data toward management techniques to halt the apparent declines of this interesting amphibian.

### Concerns for the future

The northern leopard frog may be what ecologists refer to as an "indicator species." That is, its health and survival may reflect the environment's health. Perhaps their apparent declines are a warning for us to examine closely our influence on the environment. Frogs are both herbivores and carnivores, predator and prey, and they are associated with wetlands where the quality of our drinking water is often determined. They are an important component of healthy ecosystems. If northern leopard frogs are missing from an ecosystem where they historically occurred, how does that affect the other components of that system? Similarly, when do human populations begin to reveal the effects foretold by indicator species in the environment in which we all live?

Based on the amount of media coverage some of the more recent issues involving frogs have received, there are reasons to be optimistic that the public is beginning to recognize that we as humans are linked to the health of frogs. Let's hope so. Pennsylvanians would surely benefit from seeing more spots! ☐

## Resources

### Northern Leopard Frog Patch

In 1999, the Commission continues its series of nongame species limited-edition patches with a northern leopard frog patch. Each sells for \$4.71 plus 29 cents PA state sales tax for a total of \$5.00. Include \$2.00 shipping and handling for each order.

Contact: Publications Section, PA Fish & Boat Commission, P.O. Box 67000, Harrisburg, PA 17106-7000.

### Pennsylvania Amphibians & Reptiles

Another excellent resource on frogs and Pennsylvania's other reptiles and amphibians is the Commission's book, *Pennsylvania Amphibians & Reptiles*, by Larry L. Shaffer.

The book sells for \$9.43 plus 57 cents PA state sales tax and \$2.00 for shipping and handling (total of \$12 for books sent to PA addresses). Contact the Commission Publications Section at the address above.

### Frogs wall chart

\$.94 plus 6 cents tax and \$2.00 postage. Send order to the PFBC address above.

