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Tom R. Johnson

*Missouri Department of Conservation*

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## Mosquito Control and Minnesota Amphibians

TOM R. JOHNSON\*

**ABSTRACT** — Minnesota has 19 species of amphibians. Most of these animals have habitat requirements that include natural marshes, woodland ponds, and temporary pools. Amphibians need a stable and unpolluted environment. Changes in the pH of marshes or other aquatic habitats can be detrimental to Minnesota's amphibians. Habitat loss through the draining of marshes will be especially damaging. Several questions concerning mosquito control and its effects on amphibians need to be addressed.

Many people have observed that if there's a naturalist in your midst, it's likely he's *against* something. Especially since the first Earth Day in 1970, naturalists, biologists, and conservationists have felt a responsibility to share their understanding and their efforts to defend the natural system. Again and again they have stressed that man, as an organic being, is a part of this complex system. We humans are far from being observers or manipulators of the natural world; we are totally dependent on it—for our oxygen, food, and water. I admit to being one of those biologists. My college years coincided with the so-called "environmental movement." But that is not why I was invited to participate in this symposium. I have a responsibility to share specific facts about some specific animals.

It is likely that most Minnesotans would have difficulty naming the more common amphibians native to their state. This is true of most people in most states. Why? Because we're talking about animals of little or no economic value. They're seldom seen and are the type of creatures that few people get excited about. However, it is the responsibility not only of biologists but of every concerned citizen to realize that we have a charge to protect, conserve, appreciate and at least tolerate the wide variety of creatures that are part of the vertebrate fauna of Minnesota — part of the state's natural heritage.

Minnesota has 21 species and subspecies of amphibians. Most of these animals live in aquatic habitats, or require such areas for breeding (1, 2). Fifteen species and subspecies are toads and frogs and the rest are salamanders (6 species and subspecies) (Table 1). Their requirement for water is especially critical. Most species in Minnesota reproduce in marshes, wet prairies, bogs, or woodland pools. Many cannot

coexist with fish and so select fishless aquatic habitats.

The amphibians of Minnesota exist because of the variety of wetlands produced by the last glacial retreat. They slowly moved into suitable habitats and have been a part of the Minnesota landscape ever since.

It is commonly understood that the best way to rid an area of an animal or plant is to strike when it is most vulnerable. For most amphibians that is during their tadpole or aquatic larval stage. The tadpoles of toads and frogs and the larvae of salamanders require specific foods, are vulnerable to subtle changes in their aquatic habitat, are usually concentrated, and are susceptible to a variety of pesticides (3).

These amphibians have evolved under a complex system of population dynamics, predator pressures, and requirements for adequate rainfall, water temperature, and aquatic breeding sites. As a result of these influences, many of the species require a relatively stable environment, leaving them highly sensitive to the slightest changes in their habitat (4).

Due to the nature of Minnesota's bedrock, soils, and aquatic vegetation, most aquatic communities are slightly acidic. This condition has existed for many thousands of years and native aquatic fauna have evolved under these circumstances. Since amphibians and other creatures are not able to adapt to rapid changes in their environment, a sudden increase in the pH of a marsh (e.g., caused by the addition of calcium sulfate in the plaster of paris coating of the chemical methoprene, an insect growth regulator) would have a serious impact on these animals.

A serious decline in the number of frogs in Minnesota was observed during the late 1960s, eventually causing the closing of commercial leopard frog (*Rana pipiens*) harvesting for biological and medical uses. Populations have yet to make a

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\*Herpetologist at the Missouri Department of Conservation, Jefferson City, MO

Table 1. The amphibians of Minnesota.

**Salamanders**

1. Mudpuppy, *Necturus maculosus maculosus* (Rafinesque)
2. Central Newt, *Notophthalmus viridescens louisianensis* (Wolterstorff)
3. Gray Tiger Salamander, *Ambystoma tigrinum diaboli* Dunn\*
4. Eastern Tiger Salamander, *Ambystoma tigrinum tigrinum* (Green)
5. Blue-spotted Salamander, *Ambystoma laterale* Hallowell
6. Redback Salamander, *Plethodon cinereus* (Green)\*

**Toads and Frogs**

1. Canadian Toad, *Bufo hemiophrys hemiophrys* (Cope\*)
2. Eastern American Toad, *Bufo americanus americanus* (Holbrook)
3. Great Plains Toad, *Bufo cognatus* (Say)
4. Northern Spring Peeper, *Hyla crucifer crucifer* (Wied)
5. Eastern Gray Treefrog, *Hyla versicolor* (Le Conte)
6. Cope's Gray Treefrog, *Hyla chrysoscelis* (Cope)
7. Western Chorus Frog, *Pseudacris triseriata triseriata* (Wied)
8. Boreal Chorus Frog, *Pseudacris triseriata maculata* (Agassiz)
9. Blanchard's Cricket Frog, *Acris crepitans blanchardi* (Harper\*)
10. Green Frog, *Rana clamitans melanota* (Rafinesque)
11. Bullfrog, *Rana catesbeiana* (Shaw\*)
12. Northern Leopard Frog, *Rana pipiens* (Schreber)
13. Pickerel Frog, *Rana palustris* (Le Conte\*)
14. Mink Frog, *Rana septentrionalis* (Baird)
15. Wood Frog, *Rana sylvatica* (Le Conte)

\*Amphibians of limited distribution in Minnesota

comeback. The cause of the drastic decline has not been determined; some possible causes are agricultural pesticides, habitat loss, bacterial or viral diseases, or a combination of these.

In the meantime the northern leopard frog (Figure 1D), various other amphibians, and many other creatures face additional threats to their existence in the form of the addition of the chemical methoprene, along with a thick coating of plaster of paris, into their aquatic habitat, and the permanent draining of marshes, sloughs, and ephemeral pools—all in the name of mosquito control.

Here is a sampling of some of the 19 species of Minnesota amphibians which require unspoiled, natural marshes, bogs, or woodland ponds:

**Blue-spotted Salamander, *Ambystoma laterale* (Hallowell).** Length: 10 to 13 cm. A black salamander with numerous small light blue flecks over its head, body, limbs, and tail. Adults live in mixed hardwood and hardwood/pine forests under logs and leaf litter. Breeds during spring in woodland ponds and fishless swamps or sloughs. The larvae eat a variety of aquatic invertebrates. Transform to sub-adults in late summer. Minnesota distribution: eastern and northeastern parts of the state.

**Eastern Tiger Salamander, *Ambystoma tigrinum tigrinum* (Green)** (Figure 1B). Length: 18 to 27.9 cm. The largest terrestrial salamander of the eastern half of North America. Dark brown or black with large, irregular dull, yellow blotches. Occurs in wooded areas or prairie habitats. Adults move to fishless marshes or woodland ponds to breed during early spring. The gilled larvae eat a variety of aquatic inverte-

brates and grow quickly. Transform into sub-adults during late summer or early autumn. Minnesota distribution: occurs over most of the state but absent from northeast corner. A population occurs along the north shore of Lake Superior.

**Central Newt, *Notophthalmus viridescens louisianensis* (Wolterstorff)** (Figure 1A). Length 6 to 10.2 cm. Adults are olive-brown above and yellow below. Entire animal covered with small black spots. An irregular row of orange-red spots may occur along each side of the back. This aquatic salamander lives in permanent ponds, sloughs, or small lakes. The tiny, gilled larvae transform into a small terrestrial life state known as an eft. These brown creatures live on the forest floor under leaves or rotten logs for several years, then return to ponds or sloughs as aquatic adults. The larvae and aquatic adults eat a variety of aquatic invertebrates, including mosquito larvae. Minnesota distribution: occurs in the forested regions of northern and eastern sections of the state.

**Great Plains Toad, *Bufo cognatus* (Say).** Length: 4.8 to 8.9 cm. This is a cream-colored toad with large, green blotches. Prairie species that requires marshes and pools along river floodplains. Adult toads consume large numbers of insects. The small, black tadpoles eat algae. Minnesota distribution: western edge of the state.

**Eastern Gray Treefrog, *Hyla versicolor* (LeConte)** (Figure 1C). Length: 3.2 to 5.1 cm. The common treefrog of the eastern half of North America. May be greenish-gray, gray, or brownish. Irregular dark markings may occur on the back and limbs. There is a large, white marking below each eye. Adhesive toe pads allow treefrogs to climb on bark, branches, and leaves. Adults live in trees during the summer. During early summer they move to fishless ponds, woodland pools, or sloughs to breed. The colorful larvae (tadpoles) eat algae. Minnesota distribution: statewide.

**Wood Frog, *Rana sylvatica* (LeConte).** Length: 3.5 to 5.1 cm. A small, colorful frog of the North Woods. Color may be pinkish tan or gray brown. A dark brown "mask" extends through each eye and external eardrum. In Minnesota some populations of this woodland frog contain individuals with a white stripe down the back. Lives in moist woods or along the edges of trout streams. Breeds in early spring in fishless, woodland ponds, pools in stream valleys and in bogs. The tadpoles of *Rana sylvatica* eat algae and some aquatic invertebrates. Minnesota distribution: occurs over most of Minnesota, but not in the prairie counties of the southwestern corner of the state.

Although Minnesota amphibians are little known compared to the larger or more visible wildlife of the state, they are, nonetheless, valuable to the food web and natural diversity of the state. The tadpoles and salamander larvae provide food for a variety of animals (e.g., wading birds, turtles, and semi-aquatic snakes). Adult salamanders, toads and frogs are preyed upon by fish, wading birds, semi-aquatic snakes, turtles, badgers, and mink. It is difficult to imagine how silent and empty spring would be without the sounds of the various toads and frogs.

Several important questions should be asked concerning the proposed statewide mosquito control program and its effects on amphibians:

1. Is methoprene toxic to the tadpoles and salamander larvae of the various Minnesota species?
2. What will be the effects of adding calcium sulfate (plaster of paris) to aquatic habitats? Can tadpoles and salamander larvae tolerate such material?
3. Is the permanent loss of marshes and bogs and the eventual reduction in populations of amphibians too high a price to pay for mosquito control?

My recommendation is to look at all of the ramifications which may result from the proposed statewide mosquito control program. Someone must take the responsibility and understand the environmental risks involved in such a large, costly project.

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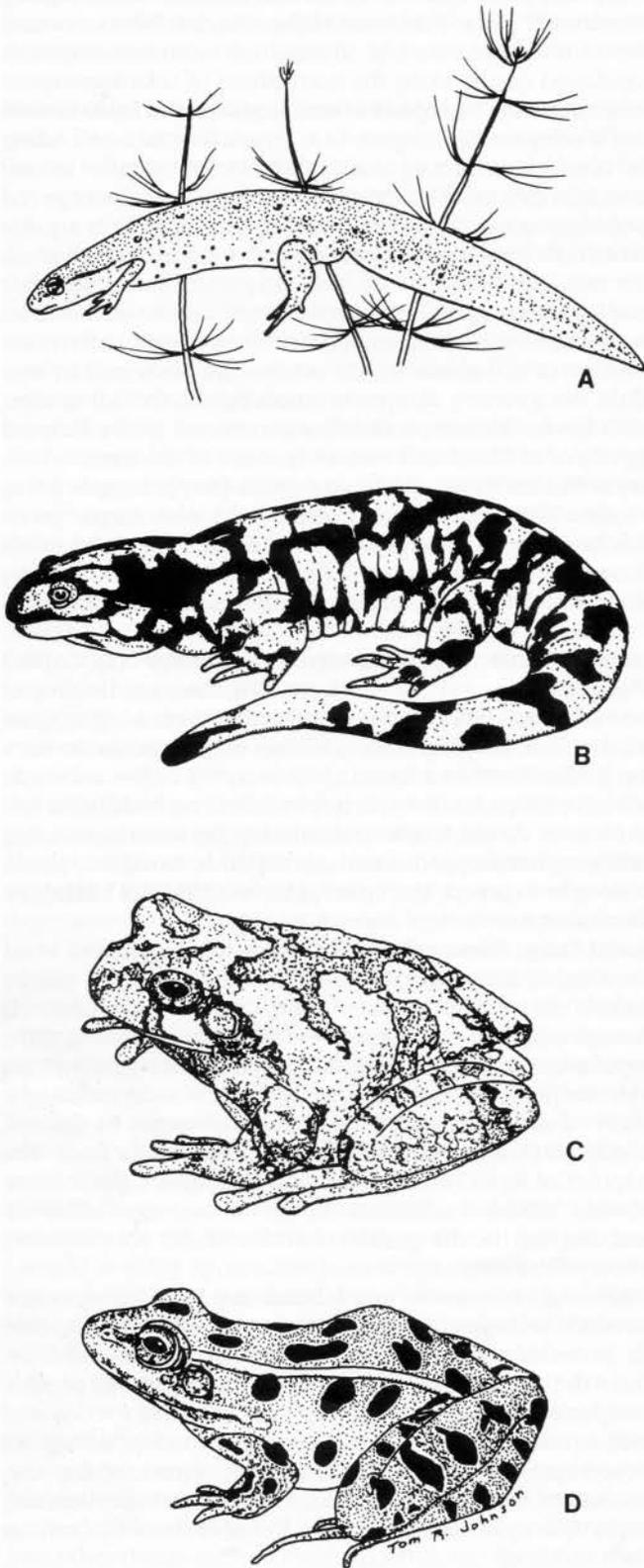


Figure 1. Some representative Minnesota amphibians: A Central Newt; B. Eastern Tiger Salamander; C. Eastern Gray Treefrog; D. Northern Leopard Frog.