

Hurricane Toads¹

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Hurricanes and tropical storms are a fact of life if you live in Florida or other coastal states in the southeastern United States. When one of these powerful weather systems is predicted to impact your area, strong winds and torrential rainfall probably come to mind. However, one concept that is not generally associated with hurricanes and tropical storms is a *horde*, which means a large unorganized group of individuals or a teeming crowd or throng. Every few years a tropical storm or hurricane creates ideal conditions for the sudden appearance of a teeming throng of tiny frogs in numerous places across the Southeast. The tiny frogs that form these hordes could well be called “hurricane toads,” but they are in fact a common species of toad (a toad is just a specific type of frog) that is most often encountered during short periods every few years—the eastern spadefoot.

This publication describes the biology of the eastern spadefoot and offers tips on how to identify this unique frog. The primary target audience is homeowners who find their property seemingly invaded with hundreds or thousands of tiny spadefoot toads about two to three weeks after heavy rainfall. But don't worry, soon the little toads of the horde will disperse into nearby woods and natural areas where they will eventually mature and wait for their opportunity to contribute to the next generation of “hurricane toads.”

“Hurricane Toad” Lifecycle

Scaphiopus holbrookii, better known as the eastern spadefoot, are triggered to come out of hiding and engage in a raucous, short-lived, explosive breeding event when

torrential hurricane or tropical storm rains fall during the warm summer months. Adult spadefoots hop into action as rain fills small ponds and depressions in forested areas, pastures, and even neighborhood yards, that are usually dry. During very heavy rain, adult toads migrate from surrounding upland, underground retreats to these newly formed breeding sites to produce the next generation of “hurricane toads.” This breeding frenzy usually lasts only 1 or 2 days. While floating at the surface of the shallow breeding pond, males call loudly to attract females. When one approaches and bumps into him, the male quickly grasps her around the waist to stimulate the release of her eggs. Adult females can lay several thousand eggs, which are fertilized by the male after the female releases them (external fertilization). Immediately after breeding, adult males and females leave the shallow wetlands, and their eggs, and hop back to their upland hiding places. See this YouTube video for a first-hand look, and listen, of an eastern spadefoot breeding event in Gainesville, FL: <https://www.youtube.com/watch?v=KwT0YHwc81M>

The embryos develop and hatch into small, black larvae in as little as 24 hours, depending on the water temperature. These larvae quickly develop into recognizable tadpoles. Water temperature not only largely dictates the time it takes eggs to hatch, but also the rate at which tadpoles develop. The warmer the water, the faster they grow.

If the ponds retain water and the tadpoles have enough to eat, the young will make a sudden appearance a few weeks later when they complete development simultaneously,

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undergo metamorphosis, and emerge from the pond as tiny toads. Though the adults may have gone unnoticed, even if they bred in a shallow depression in a neighborhood back yard, the sheer number of tiny eastern spadefoots that emerge together from a single pond is not likely to go unnoticed; a thousands-strong mob of juvenile toads is certainly worthy of the term horde! These tiny toads are only about the size of a raisin (Figure 1), but there can be so many of them that they may cover the ground in a literal carpet of toads (Figure 2). If their breeding pond was near a road or parking lot, carnage may ensue as the horde of baby toads migrates from their natal pond to the surrounding uplands. As they try to hop across a road, they may be killed in the thousands by unsuspecting motorists. Even when drivers can see the baby toads, there often is no way to avoid crushing them (Figure 3). During this period of dispersal, they may also find their way into people's garages and homes, but after a week or so the horde of tiny toads will seemingly disappear. The lucky ones will find a suitable hiding place, eat enough insects, and avoid predators and anything else that could lead to their demise. Once they mature, which takes about 2–4 years, they, too, will be triggered into a breeding frenzy when inches of tropical rains fall and nearby shallow depressions fill with water, re-starting the cycle of life for the hurricane toad.



Figure 1. Very young eastern spadefoot toads are the size of a raisin, as seen here by a days-old froglet resting on a dime.

Credits: Steve A. Johnson, UF/IFAS

How to Identify Adult Eastern Spadefoot Toads

Fully grown adults range from 4–8 cm long (1.5–3 inches, Figure 4). Their backs are mostly brown with varying amounts of dull-yellow color and covered with numerous small bumps. Usually there are two light lines running down the back, which often form an hourglass shape (Figure 5). The sides of eastern spadefoots are often mottled brown and light yellow, but individual variation in color and pattern is common (Figure 6). Two distinguishing features shared by all eastern spadefoots are their bright

yellow eyes with vertical pupils, and a hard, black spade located on each hind foot (Figures 7 and 8). This spade allows the toads to dig into the soil, rear first. (For tips on identifying other toads in Florida, see *The Cane or “Bufo” Toad* (*Rhinella marina*) in Florida: <https://edis.ifas.ufl.edu/uw432>.)



Figure 2. Eastern spadefoot spawning event in the Ocala National Forest. The tiny dark objects are baby toads that carpet the sandy shoreline as they make their way away from the breeding pond and disperse into the surrounding upland.

Credits: Steve A. Johnson, UF/IFAS



Figure 3. As they disperse away from breeding ponds, young eastern spadefoot toads may be unavoidably crushed on roads by the thousands.

Credits: Steve A. Johnson, UF/IFAS



Figure 4. A pair of adult eastern spadefoot toads encountered in Gainesville, Florida, breeding in a ditch following several inches of rain.

Credits: Steve A. Johnson, UF/IFAS



Figure 5. Many eastern spadefoot toads have an hourglass shape on their back.

Credits: Steve A. Johnson, UF/IFAS



Figure 6. Adult eastern spadefoot from the Apalachicola National Forest near Tallahassee, Florida. Note that this individual has very few yellow markings.

Credits: Ryan C. Means, Coastal Plains Institute



Figure 7. Eastern spadefoot toads have vertical pupils, as seen in this toad from St. Marks National Wildlife Refuge, south of Tallahassee, Florida.

Credits: Steve A. Johnson, UF/IFAS



Figure 8. All eastern spadefoots have a hard, black "spade" on each rear foot that the toads use to dig into the soil.

Credits: Steve A. Johnson, UF/IFAS

What do the juveniles look like?

Juveniles look like tiny versions of the adults, but they are much smaller, often with tiny red bumps on their back (Figure 1). The hourglass pattern on the back, vertical pupils, and tiny spade are all present on juvenile toads, but they may be hard to see given their size.

Tadpole Identification and Ecology

The tadpoles are small and a deep bronze to brown color (Figure 9). The body of the tadpoles is wide and flattened, and they have a blunt snout with a short, rounded tail. Their tiny eyes are located on the top of their head. The tadpoles can grow very quickly, and in as little as two weeks they can

complete development from egg into tiny toad. As the tadpoles grow and develop, they form large schools that may number in the thousands or more. These schools look like a large, dark amoeba moving through the shallow breeding pond (Figure 10). Spadefoot tadpoles are very active and feed constantly in their race to develop and metamorphose before their breeding ponds dry. The length of the larval (tadpole) period depends mostly on water temperature and can be as short as 10 days or as long as 2 months. Because of the “explosive” breeding of adults (frequently just 1–2 days), the short tadpole period, and the schooling behavior of the tadpoles, there is often a sudden “boom” of young spadefoot toads venturing out of the spawning ponds. This results in the hordes of baby toads that may be encountered 2–4 weeks after torrential rains.



Figure 9. Eastern spadefoot tadpoles. Note that their small eyes are located high upon the snout.

Credits: Pierson Hill, Florida Fish and Wildlife Conservation Commission



Figure 10. Eastern spadefoot tadpoles form schools; some of these schools may contain tens of thousands of the small tadpoles.

Credits: William J. Barichivich, US Geological Survey

Eastern Spadefoot Ecology, Habitat, and Range

Eastern spadefoots are native to the eastern United States and occur in most of Florida, with the exception of the very southwest (Figure 11). They are found in many types of habitats, including yards in suburban neighborhoods. They tend to prefer drier areas with sandy soils in which they can easily dig, quickly burying themselves by using the hard spades on each of the rear feet to dig, posterior first, into the soil. Spadefoots spend most of their lives buried underground and can remain buried for extended periods of time. They can burrow up to a foot below the surface. However, they venture out near their burrow on moist nights to hunt for insects.

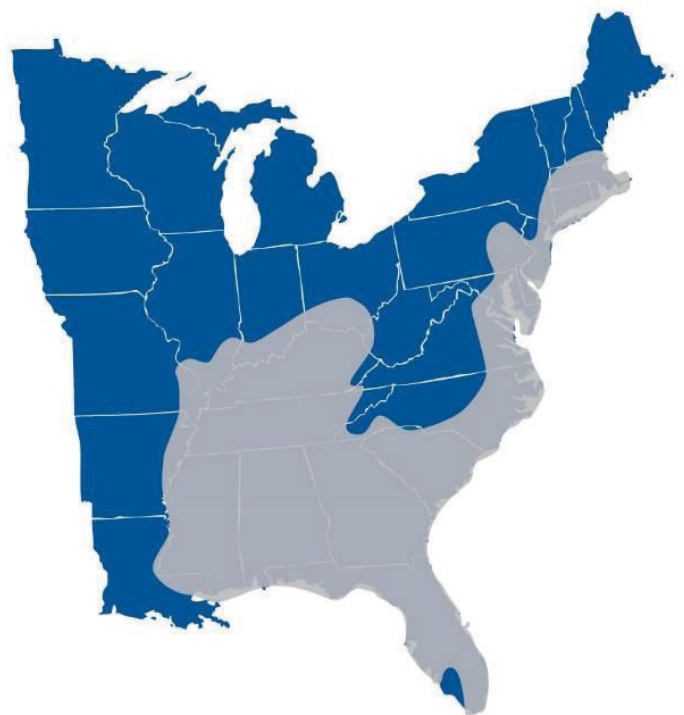


Figure 11. Approximate geographic range of eastern spadefoot toads shown in grey. They occur throughout much of the eastern United States, including almost all of Florida.

Credits: UF/IFAS Communications.

Similar Species and Evolutionary Adaptations

The eastern spadefoot’s closest relatives are found in the western United States (6 other spadefoot species are recognized), and they display behaviors similar to those of their eastern cousins, such as breeding in temporary ponds, short tadpole development periods, burrowing, and a preference for habitats with loose soils. Breeding in shallow depressions that only fill with heavy rains and dry up rapidly allows spadefoot toad tadpoles to take advantage of the lack of predators in the ponds. These ponds do not last

long enough to support fish or large populations of predatory invertebrates, such as dragonfly nymphs and other aquatic insects. Other species of frogs cannot breed in the same temporary locations as the eastern spadefoot because they require a longer tadpole growth period, preventing them from growing large enough to disperse from breeding ponds before they dry out. The eastern spadefoot's burrowing habits allow them to endure extended dry conditions and avoid predators. Their ability to tolerate drier conditions than many other species of frogs also allows them to exist in places where other frogs can't, potentially avoiding competition with other frog species for food and space.

What You Can Do To Help Eastern Spadefoot Toads

Due to habitat loss and fragmentation (e.g., roads), disease, climate change, and impacts of invasive species, amphibians have experienced severe population declines and extinctions across the world. Although eastern spadefoot populations appear healthy, we should all be aware of potential threats they face and take steps to ensure they persist well into the future. If you are lucky enough to have a breeding site on or near your property, take steps to ensure spadefoot survival: reduce or eliminate the use of herbicides and pesticides, and avoid introducing fish into breeding ponds because they may exclude frogs from using the site or reduce the survival of their tadpoles. And if you notice a spadefoot breeding event in a pond near a road on your property, consider installing a barrier of silt fence (available in hardware and home improvement stores) to keep the baby toads from venturing onto the road.

If you are interested in getting involved in environmental conservation, check out Frog Watch USA or the Project Finder link at SciStarter for opportunities to join the citizen science community. You should also consider joining iNaturalist and submitting images of frogs and other wildlife that you observe around your house or in natural areas you visit.

Helpful Resources

iNaturalist: <https://www.inaturalist.org/>

Frog Watch USA: <https://www.aza.org/frogwatch>

SciStarter: <https://scistarter.org/>

UF/IFAS Extension identification page for Florida's frogs and toads: <https://ufwildlife.ifas.ufl.edu/frogs/florida.shtml>