Sing Out LOUD, Sing Out STRONG!

It's early fall, tail end of a bone-dry summer. A here-and-gone afternoon shower has freshened the air, sharpening the senses of night hikers on a Nature Center moon walk through the bosque. They stop and listen: from a nearby field comes a rattle-clack clamor, a metallic chorus of yearning sound.

Floating on the surface of an ephemeral pond just a few yards wide and inches deep is a macho muster of New Mexico spadefoots, *Spea multiplicata*. Their loud, insistent cry, a summons worthy of New Mexico's official state amphibian, reverberates in waves across the plains, reaching females in burrows over two miles away. Tympanic membranes vibrating, the spadettes hotfoot it over to breed.

Art: Pat Cohen

Frog and Toad Together*

Homing in at low to mid-level altitudes, New Mexico spadefoots cut a wide swath across two nations: from southern Kansas to central Texas, across southern Colorado and Utah, through all of New Mexico and Arizona, and deep into several states of northern Mexico. Along with plains and Couch's spadefoots, fellow species found in their name state, New Mexico spadefoots are plump, 1.5-to-2.5-inch toadlike frogs that share features with species of both anuran groups while displaying some special traits and talents of its own.

Like their many water-living, water-loving relatives in frog country, *S. multiplicata* have thin, moist, smooth skin and webbed feet ─ not the bumpy hide and free-toed pads of land-dwelling toads. (If unable to escape from heat and desiccation, a spadefoot will wither and die inside its semi-permeable skin.) Also froglike, spadefoots have teeth in their upper jaws which toads lack, and catlike, vertical pupils instead of a gaze marked by the horizontal line in toads' eyes.

In company with typical toads, spadefoots are plump, relatively short-legged land dwellers that hop, not slim-waisted pond natives that jump. For spadefoots, seeking water is a sometime thing: if forced to remain in a wet

**While both are amphibians in the Order Anura (= tailless), frogs and toads exhibit some general differences: frogs have wet, smooth skin, tiny teeth, longer legs, and lay eggs in clumps while toads have dry, warty skin, no teeth, shorter legs, and lay eggs in strings. The words "frog" and "toad" are largely constructs of common speech: "toad" may refer to true toads in the genus* Bufo *or to any bumpy-skinned squatty amphibian. All frogs and toads may be called frog, but not the reverse.*

environment, a spadefoot will die.

Perhaps the most remarkable feature shared by *S. multiplicata* with all but one of the eight spadefoot species in North America is where many survive and thrive: in the loose soils of dry plains, grassland prairies, and deserts of the Southwest. The drier the land, it seems, the more a spadefoot digs in.

How Do They Do It?

Nocturnal, secretive, and seldom-seen, New Mexico spadefoots occupy underground burrows either borrowed from squirrels, gophers, and kangaroo rats or dug with specialized hind feet armed with thick, sharp-edged, horny spades. During the rainy season, a New Mexico spadefoot may be only two inches below the surface; should the weather turn scorching dry, he'll burrow three feet under. Down he digs backward, churning and drilling into the ground, one spade-slicing foot after another. Life for a burrower of up to ten months at a time is a fluid balancing act: spadefoots avoid the stress of osmotic pressure by accumulating urea in their plasma and decreasing the water potential in their bodily fluids, allowing them to absorb water from the surrounding soil. In addition, a spadefoot's skin, highly permeable for quick water uptake, is wrapped around a globe-shaped body that equals a surface-to-volume ratio limiting evaporation.

Emerging from their burrows as seasonal nighttime temperatures climb, New Mexican spadefoots show their stuff as fierce arthropod hunters in an uncertain environment, taking all the beetles, fat-packed termites, ants, and millipedes they can find before climbing back into their burrows at sunrise. Raptor, snake, and mammal predators, along with herp fanciers with grasping fingers, await topside: camouflage of brown, green, and grey coloration marked by red speckling helps a spadefoot disappear into rocky, russet-flecked sand and mesquite prairie. Standing stock still or inflating lungs to look imposing are useful tactics, too. If threatened further, a spadefoot will fight back with a musty, irritating skin secretion that smells like raw peanuts. (The female's mucal secretions are more copious than those of the male, perhaps because she must remain topside in predator territory longer than the male, stoking up on food to create nutrient-rich eggs.)

Cloudburst Coming? Hop To It!

Super opportunists, New Mexico spadefoots know no breeding season. In the warm weather months of early spring to autumn, a spadefoot, two to three years old, keeps the opening of his shallow burrow clear for a quick exit. Picking up the low frequency tap-tap-taps of a sudden shower, off he goes to find the new pool. There, floating on his belly, he'll join a growing baritone chorus of males urging females to come over and procreate. Once together in the dark waters of their turbid pool, male and female sex recognition must be by voice: males grabbed by other males will croak their objections, while females remain quiet.

After an average breeding period of only 1.6 days in New Mexico, a female will lay some 1,000 eggs, fertilized as laid in cylindrical, jelly-like stalk masses on submerged vegetation. Time is flying and the pool is vanishing: spadefoot eggs are tiny to hatch quickly, in less than 48 hours. In the same hasty manner, tadpoles can double ther weight in 24 hours and then again the ext day. Larvae have been known to metamorphose into tiny toadlets in just eight days (three weeks is more common), a transformation that scientists belive is the fastest of all amphibians.

During their life as tadpoles, spadefoots display remarkable features of both form and behavior that enhance survival by stopwatch.

Filter-feeding, the long-tailed tads create huge, tail-thrashing schools which stir up plant material from the pond bottom while offering protection from predation by voracious insect larvae. In crowded, fast-shrinking ponds that contain more fairy shrimp than organic matter, tadpole carnivores will develop – big-headed, jaw-muscled hunters that cannibalize their plant-eating brothers. But there's a tradeoff: while carnivores grow fast and metamorphose into adults sooner than plant-eating tadpoles, a survival advantage in a swiftly shrinking pool, they also enter adulthood with less body fat than their brothers transforming at a slower rate in a less transitory pool. Whatever a junior spadefoot's diet, desiccation and predation by bullfrogs, larval salamanders, mud turtles, scavenging beetles, grackles, and skunks will produce a survival rate of just one percent.

While urbanization and agriculture have altered New Mexico spadefoot habitats, the anurans have taken advantage of other water sources developed by human activity: stock tanks and ephemeral pools that form at the base of highways and railroad grades. (The chytrid fungus, one cause of amphibian declines worldwide, does not seem to be a problem for spadefoots.) In addition to the Rio Grande Nature Center State Park and other state parks, New Mexico spadefoots are known to burrow down under at Bosque del Apache, White Sands Missile Range, the Gila National Forest, and on Los Alamos lands.

Opportunist and night hopper, vocalist and digger, the spadefoot lives by Shakespeare's counsel: the readiness is all.

Sources: Arthur Bragg. *Gnomes of the Night*: *The Spadefoot Toads.* Philadelphia: U. of Pennsylvania Press, 1965; Arthur Bragg. "In Quest of Spadefoots." *New Mexico Quarterly* 25(4) 1955; Jean-Luc Cartron et al. *A Field Guide to the Plants and Animals of the Middle Rio Grande Bosque.* Albuquerque: UNM Press, 2008; William Degenhardt et al. *Amphibians and Reptiles of New Mexico.* Albuquerque: UNM Press, l996; Anne Maglia. *The Remarkable Spadefoot Toads (*Scaphiopus *and* Spea*).* webspinners.com/coloherp/cb-news/archive; Steven Morey. *Spea multiplicata: Mexican Spadefoot, New Mexico Spadefoot.* Amphibiaweb; Robert Stebbins. *A Field Guide to Western Reptiles and Amphibians.* Boston: Houghton Mifflin and Co., l965; Robert Stebbins and Nathan Cohen. *A Natural History of Amphibians*. Princeton: Princeton University Press, l997.