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A New Technique for Capturing Burrow-Dwelling Anurans

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Although a substantial proportion of North American frogs and toads will use burrows facultatively, as retreats from stressful environmental conditions (typically cold and/or dry weather; Lannoo et al. 2005; individual species accounts in Lannoo 2005), a handful of species use borrows obligately—relying on them to meet physiological or ecological needs. The Nenirana group of Hillis and Wilcox (2005) contains three species, *Lithobates areolatus* (Crawfish Frogs), *L. capito* (Gopher Frogs), and *L. sevosus* (Dusky Gopher Frogs) that inhabit burrows constructed by other species (predominantly crayfish in the case of *L. areolata*, and Gopher Tortoises [*Gopherus polyphemus*] in the case of *L. capito* and *L. sevosus,* though they are also known to inhabit small mammal burrows and holes in dead or rotting trees; Lannoo 2005). Adults of these three species are secretive and rapidly retreat into burrows when disturbed. Therefore, outside of the breeding season these frogs are rarely seen, and when seen near burrows (as they almost always are) they are next to impossible to capture. All three species are of conservation concern (Jensen and Richter 2005; Parris and Redmer 2005; Richter and Jensen 2005); *L. sevosus* is known from only two populations and is listed as federally endangered (USFWS 2001).

If we are to gather the basic ecological information needed to conserve these species, we must develop techniques for capturing animals year-round, through all life history stages. Once captured, animals can be weighed and measured, assessed for health, marked, and implanted with radiotransmitters. The best techniques for capturing animals retain the integrity of the burrow, because animals are known to use the same burrow throughout the warm season (Richter et al. 2001; JLH, unpubl. data) and perhaps longer. Further, it has been suggested that burrows are a limiting resource (Thompson 1915; Jensen and Richter 2005).

We developed a technique to capture Crawfish Frogs from their burrows, but the technique can be applied to Gopher Frogs and other animals occupying small-diameter burrows. We work on Crawfish Frogs in southwestern Indiana; *L. areolatus* is classified as state endangered in Indiana. Crawfish Frogs spend the majority of their adult lives associated with upland burrows, primarily those created by crayfish. Several different species of crayfish construct suitable burrows; at our study site in southwestern Indiana there are *Cambarus diogenes, Fallicambarus fodiens,* and *Cambarus* (*Tubericambarus*) *polychromatus* (Thoma and Armitage 2008). Crayfish burrows extend from the soil surface down to the water table, and while chambers and side passages may be common, crayfish burrows are not usually a part of a vast burrow network. Burrows tend to be in clay soils, which create well-defined burrow walls and retain water (Grow and Merchant 1980). Compared with Gopher Tortoise burrows, crayfish burrows are narrow; burrows used by Crawfish Frogs are typically not much wider at the surface than the frog itself.

It follows that methods used to extract crayfish from burrows would be effective at extracting Crawfish Frogs. Published methods of successful crayfish extraction include excavation of burrows (Simon 2001), Norrocky pipe traps (Norrocky 1984), plungers (Simon 2001), motorized pumps (Thoma and Armitage 2008), and burrowing crayfish mist nests (Welch and Eversole 2006). However, several of these methods (excavation, plungers, pumps, and pipe traps) permanently damage burrows and the surrounding area (Ridge et al. 2008), and they all could potentially stress or injure the frog.

In addition to considering the above techniques, we tried securing a collapsible mesh minnow trap over the crayfish burrow. We also tried inserting a piece of PVC pipe at the burrow entrance with the idea that once the frog entered we would remove and cover the burrow end of the pipe (with a spatula) to trap the frog. We tried putting mist netting outside the burrow (similar to the Welch and Eversole [2006] crayfish net) as well as putting variations of a trap door over the burrow opening. Though occasionally successful, all of these methods turned out to be less than ideal for the capture of Crawfish Frogs. The success of some traps (minnow traps and PVC pipe traps) was limited because they did not prevent animals from returning to their burrows and all traps required constant monitoring, potentially for several days, while waiting for the frog to emerge from the burrow.

We were compelled to find a technique that would induce animals to leave their burrows while we were present, and would prevent them from returning to burrows once they were aware of our presence. The key observation (JLH) was that following heavy rains and burrow flooding, Crawfish Frogs surface every 20–40 min to breathe. The technique we introduce here has two basic components: flooding burrows to induce animals to surface, and blocking their retreat with an inflated balloon.

We outfitted a bicycle tire pump with a long (> 2 m) plastic tube (8 mm diameter) and attached a circular-shaped balloon to the end with a rubber band, so that when the bike pump handle was depressed, the balloon inflated (Fig. 1A, B). When inflated, the balloon conforms to the interior contours of the burrow but does not alter the burrow itself. To capture frogs we inserted the deflated balloon into the burrow (~20–30 cm). We then filled the burrow from a 23-liter jug containing water from a nearby lake. It usually took about 12 liters of water to fill burrows, and more water to maintain the water level at the surface of the burrow. Crawfish Frogs take an average of 30 min to surface. When they surface, we inflate the balloon, trapping the frog at the burrow entrance. In response, the frogs typically inflate their bodies and lower their head, tucking their jaws towards their chest. To extract them we gently pull up on the tubing and the balloon, forcing the frog out. For stubborn frogs, we insert a spatula and gently pry them out. This technique does not damage the burrow when done carefully, and we do not use enough force to harm the frog. The vegetation around the burrows gets trampled but recovers. Some frogs come

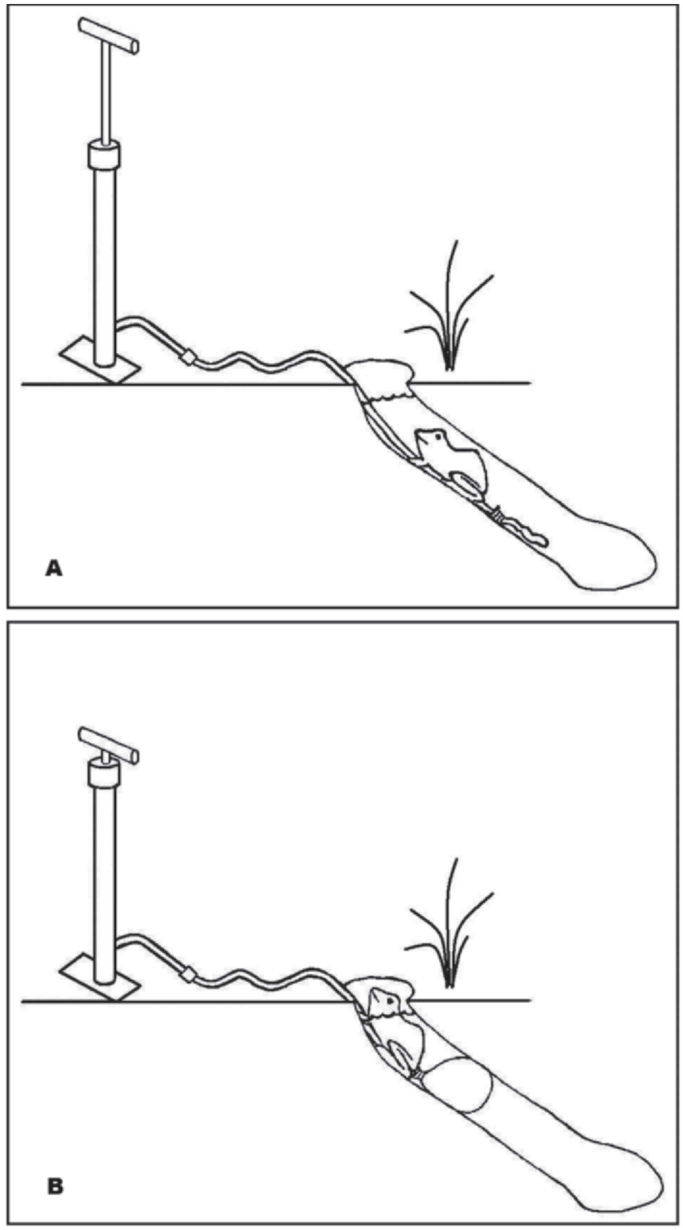

Fig. 1. A) Crawfish Frog in burrow below water surface, balloon deflated, tire pump plunger up. B) Crawfish Frog rises to water surface, balloon inflated, tire pump plunger down.

up for air and quickly escape back into the burrow before the balloon can be inflated. In these cases, we repeat the procedure. On a few occasions the balloon ruptured.

This method was also successful for retrieval of a Southern Leopard Frog (*Lithobates sphenocephalus*), but it took the frog about 165 minutes to surface. In addition to applying this technique to burrows known to be occupied (most of our known burrow sites were discovered following the implantation of their inhabitants with transmitters (3.8g PD-2 temperature sensing transmitters Holohil Systems Ltd. [Carp, Ontario, Canada]), we have also used this technique with success to determine the occupancy of suspected Crawfish Frog burrows (JLH, unpubl. data). The one time this technique did not work on a burrow known to be inhabited by a Crawfish Frog, the burrow branched uphill and therefore could not be sufficiently filled with water to force the frog to surface. We suspect a modification of this technique could be used to extract Gopher Frogs and Dusky Gopher Frogs from Gopher Tortoise burrows, small mammal burrows, and other small refugia situated in clay substrates. This technique may be also applied to other amphibian species and perhaps to reptiles and other burrow-dwelling taxa.

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Literature Cited

Grow, L., and H. Merchant. 1980. The burrow habitat of the crayfish, *Cambarus diogenes diogenes* (Girard). Amer. Midl. Nat. 103:231–237.

Hillis, D. M., and T. P. Wilcox. 2005. Phylogeny of the New World true frogs (*Rana*). Mol. Phylogenet. Evol. 34:299–314.

Jensen, J. B., and S. C. Richter. 2005. *Rana capito*. Gopher frog. *In* M. J. Lannoo (ed.), Amphibian Declines: The Conservation Status of United States Species, pp. 536–538. University of California Press, Berkeley, California.

Lannoo, M. J. (ed.) 2005. Amphibian Declines: The Conservation Status of United States Species. University of California Press, Berkeley, California.

———, A. L. Gallant, P. Nanjappa, L. Blackburn, and R. Hendricks. 2005. Introduction. *In* M. J. Lannoo (ed.), Amphibian Declines: The Conservation Status of United States Species, pp. 351–380. University of California Press, Berkeley, California.

Norrocky, M. J. 1984. Burrowing crayfish trap. Ohio J. Sci. 84:65–66.

Parris, M. J., and M. Redmer. 2005. *Rana areolata*. Crawfish frog. *In* M. J. Lannoo (ed.), Amphibian Declines: The Conservation Status of United States Species, pp. 526–528. University of California Press, Berkeley, California.

Richter, S. C., and J. B. Jensen. 2005. *Rana sevosa*. Dusky gopher frog. *In* M. J. Lannoo (ed.), Amphibian Declines: The Conservation Status of United States Species, pp. 584–586. University of California Press, Berkeley, California.

———, J. E. Young, R. A. Seigel, and G. N. Johnson. 2001. Post-breeding movements of the dark gopher frog, *Rana sevosa* Goin and Netting: implications for conservation and management. J. Herpetol. 35:316–321.

Ridge, J., T. P. Simon, D. Karns, and J. Robb. 2008. Comparison of three burrowing crayfish capture methods based on relationships with species morphology, seasonality, and habitat quality. J. Crustacean Biol. 28:466–472.

Simon, T. P. 2001. Checklist of the crayfish and freshwater shrimp (Decapoda) of Indiana. Proc. Indiana Acad. Sci. 110:104–110.

Thoma, R. F., and B. J. Armitage. 2008. Burrowing Crayfish of Indiana. Final report to Indiana Department of Natural Resources. Indianapolis, Indiana.

Thompson, C. 1915. Notes on the habits of *Rana areolata* Baird and Girard. Univ. Michigan Occas. Pap. Mus. Zool., No. 9.

United States Fish and Wildlife Service (USFWS). 2001. Endangered and threatened wildlife and plants; final rule to list the Mississippi gopher frog distinct population segment of dusky gopher frog as endangered. Federal Register 66:62993–63001.

Welch, S. M., and A. G. Eversole. 2006. Comparison of two burrowing crayfish trapping methods. Southeast. Nat. 5:27–30.