This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-96SR18500 with the U. S. Department of Energy.

PVC pipe samplers for hylid frogs: a cautionary note

By

F. Douglas Martin, Lynn D. Wike and Michael H. Paller

Environmental Sciences and Technology Department

Savannah River Technology Center, Westinghouse Savannah River Company

Aiken, SC 20809

When such is available, many hylid frogs use artificial refugia (McComb and Noble 1981), and this trait is frequently used as a basis for sampling populations of these frogs (Moulton et al. 1996; Boughton et al. 2000 and others). Artificial refugia are any manmade objects that the animals may use for shelter (e.g. bird houses, bamboo stakes, lengths of pipe, etc.). By choosing refugia that the animals will readily enter and from which they may be easily removed, sampling can be directed toward particular species or size classes. Several variables have been considered when examining bias in sampling using these refugia. Among these variables are inside diameter of the pipes (Domingue O'Neill and Boughton, 1996; Moulton et al. 1996), pipe length (Domingue O'Neill and Boughton, 1996; Boughton et al. 2000), associated vegetation (Moulton et al. 1996; Boughton et al. 2000) and height above ground (Boughton et al. 2000).

Our observations were not intended as an evaluation of polyvinyl chloride (PVC) pipe traps as a sampling technique but rather were part of a study examining invertebrate and amphibian faunas associated with slope wetlands. Slope wetlands are wetlands formed where soil contours favor outcropping of water to the surface to form pools or channels often connected to streams (Smith et al. 1995). Despite the apparently small amount of appropriate data in this study, there are few enough quantified or semi-quantified data on this topic to be worth a cautionary note.

Our pipe trap arrays consisted of opaque white PVC pipes having two inside diameters and three lengths. Pipe inside diameters were either 1.9 or 3.8 cm while pipe lengths were 0.5, 1.0 or 1.5 m. Each array of six pipes was arranged into a bundle held together with strapping tape and the bundles were placed upright by embedding the bottom of each bundle 4 to 8 cm into the soil. Each of twelve slope wetland sites had three such arrays arranged around the margin of the largest pool within that portion of the slope wetland. These arrays were checked daily from 4 to 11 March and again from 6 to 13 May, 2002.

The slope wetlands examined in this study were all located in bottomland mixed hardwood forest. Canopy was closed or nearly so for six sites and more or less open for the other six. While not statistically significant, the single site with the most open canopy accounted for seven of the fifteen captures. Moulton et al. (1996) reported no significant differences in capture rate related to density of surrounding vegetation.

Bowers et al. (2000), working in similar nearby bottomland hardwood forest, reported five species of *Hyla* (*H. avivoca, H.chrysoscelis, H. cinerea, H. femoralis and H. squirella*) with *H. cinerea* being the most common. Except for *H. avivoca*, all of these species have been reported to use artificial refugia. However, all frogs found during this study were green treefrogs, *H. cinerea*. There were a total of 15 captures of frogs, all in the May observation period. These frogs were not retained nor were they marked, but because of spatial and temporal distribution of captures, at least nine individuals were involved. With one exception, no individual pipe was occupied two days in a row thus indicating that there was movement of frogs between observations and that these pipes were not permanent shelters. On three instances two frogs were found in the same pipe array on the same date; in each of these cases one frog was in the 3.8 cm X 1.0 m pipe and the other was in the 3.8 cm X 1.5 m pipe.

Of the 15 frog captures, ten frogs were found in 1.5 m length pipes, five in 1.0 m length pipes and none in the 0.5 m pipes. Using the null hypothesis of even distribution among pipe lengths we get a probability less than 0.01 that this distribution of captures is by chance ($X^2 = 10.0$, df = 2). Boughton et al. (2000) reported that, for pipe traps suspended in trees, significantly more captures of *H. cinerea* occurred at 4 m height than at 1 or 2 m while 5 cm diameter, 0.9 m long pipes inserted upright in the ground caught more individuals than open ended traps suspended in nearby trees. Height above ground appears to play an ambiguous role in rate of capture. This ambiguity is probably amplified by the lack of standardization of refugial designs in the reported studies.

Fourteen of the fifteen frogs captured were discovered in 3.8 cm diameter pipes while only one was found in a 1.9 cm diameter pipe. Using the null hypothesis of even distribution between diameters, the probability is less than 0.001 that this is by chance ($X^2 = 11.3$, df = 1). Domingue O'Neill and Boughton (1996) reported *H. femoralis* to be 1.5 times more likely to be found in 3.8 cm diameter pipes than in 1.9 cm diameter. Zacharow, et al. (2002) reported *H. cinerea* to occupy 7.7 cm diameter pipes more frequently than 5.1 cm or 1.9 cm. Moulton et al. (1996), using 1 m lengths of pipe inserted vertically into the ground, reported adult hylid frogs, including *H. cinerea*, to occupy 2 cm diameter tube in 98.5% of observations compared to 1.5% for 5 cm diameter pipes. This latter observation is contrary to the observations we have seen so that the role in frog refugial preferences of pipe diameter appears to also be ambiguous.

While it appears that *H. cinerea* prefers particular diameters of pipe and specific heights above ground, it also appears that local conditions may influence what these choices are and none of these preferences apply to all habitats and time periods. Implications to sampling design are that no single pipe diameter, pipe length or elevation above ground should be considered as the "best" procedure. Accumulated wisdom further suggests performing preliminary studies to determine optimal refugial design (e.g. inside diameter, pipe length, open or closed ends, elevation of placement, etc.) prior to conducting any detailed studies because information in the literature will be of limited utility.

Literature Cited:

Boughton, R. G., J. Staiger, and R. Franz. 2000. Use of PVC pipe refugia as a sampling technique for hylid treefrogs. American Midland Naturalist 144:168-177.

Bowers, C. F., H. G. Hanlin, D. C. Guynn, Jr., J. P. McLendon, and J. R. Davis. 2000. Herpetofaunal and vegetational characterization of a thermally-impacted stream at the beginning of restoration. Ecological Engineering 15:S101-S114.

Domingue O'Neill, E. and R. G. Boughton. 1996. PVC pipe refugia: a sampling method for studying treefrogs. North American Amphibian Monitoring Program (NAAMP), NAAMP III meeting online, http://www.mp2-pwrc.usgs.gov/naamp3/papers/10n.html

McComb, W. C. and R. E. Noble. 1981. Herpetofaunal use of natural tree cavities and nest boxes. Wildlife Society Bulletin 9:261-267.

Moulton, C. A., W. J. Fleming, and B. R. Nerney. 1996. The use of PVC pipes to capture hylid frogs. Herpetological Review 27:186-187.

Smith, R. D., A. Ammann, C. Bartoldus, and M. M. Brinson. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices. Wetlands research program technical report WRP-DE-9. US Army Corps of Engineers Waterways Experiment Station.

Zacharow, M, W. J. Barichivich and C. K. Dodd, Jr. 2002. Effectiveness of PVC pipes in monitoring hylid treefrogs at a mesic hammock-open pond ecotone in North-Central Florida. U. S. Geological Survey, Florida Integrated Science Center - Gainesville, poster (http://cars.er.usgs.gov/posters/Herpetology/Effectiveness_of_PVC/effectiveness_of_pvc.html).