From the Field: An easily constructed Tuttle trap for bats

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Abstract A new design for an easy-to-build bat trap is presented here with details for its construction. This trap was assembled from widely available polyvinyl chloride (PVC) tubing and fittings. It was used in a variety of different landscape types under various environmental conditions. The trap functioned effectively and efficiently without harm to the animals. Captures included many individuals from several bat species.

Key words bats, collapsible, frames, monofilament, PVC, trap

Bats have been collected by various means, including shooting, hand-catching, insect nets, gillnets, mist nets, bat traps, "H" traps, and trip wires (Kunz and Karta 1988, Waldien and Hayes 1999). Recent work has been conducted using trap designs similar to that used by Tuttle (1974), with good success (M. D. Tuttle, Bat Conservation International, personal communication). Although this design has worked effectively and efficiently with a number of bat species and in various landscape types (Francis 1989), the materials for Tuttle's design are expensive and difficult to procure. Additionally, Tuttle's design requires welding aluminum (heliarc welding), which is not a skill that the average person can perform. These materials make field repairs difficult or impossible.

The design offered here follows that of Tuttle (1974), using a double frame, but can be modified to use several frames as described by Francis (1989). My design diverges from Tuttle's in the materials used, in its potential for making repairs in the field more practicable, and in making the system collapsible for easy transport.

Methods and materials

The design consisted of 2 rectangular frames assembled with polyvinyl chloride (PVC) fittings and held together with PVC glue. The double frame was assembled as depicted in Figure 1, Table 1. All parts were assembled dry (without glue) on a clean, flat surface before the final (glued) assembly. The top part of the frame was constructed of 1.90-cm copper tubing. This copper top section was glued with 2-part epoxy but also can be soldered (Figure 1). Copper tubing along the top of the frame was used to limit flexing that occurred during the adjustment of string tension. The entire frame and supports were spray-painted with flat black paint to reduce visibility to visually oriented bats in the field.

Support legs were glued in a triangular shape and dry-fitted into the lower T-fittings of the frame. Differing lengths of tubing were placed into the 2 downward openings of the T-fittings to adjust the frame height under various field conditions (Figure 1). Several lengths were kept on hand to facilitate setting the frame level and at the desired height.

Four pieces of 1.27-cm angled aluminum, 152.5 cm long and drilled at 2.54-cm intervals along one side, allowed attachment of strings. Two of these pieces were screwed to the top of the 2 bottom tubes (Figure 1). The remaining 2 pieces were loosely bolted to the bottom of the copper tubes

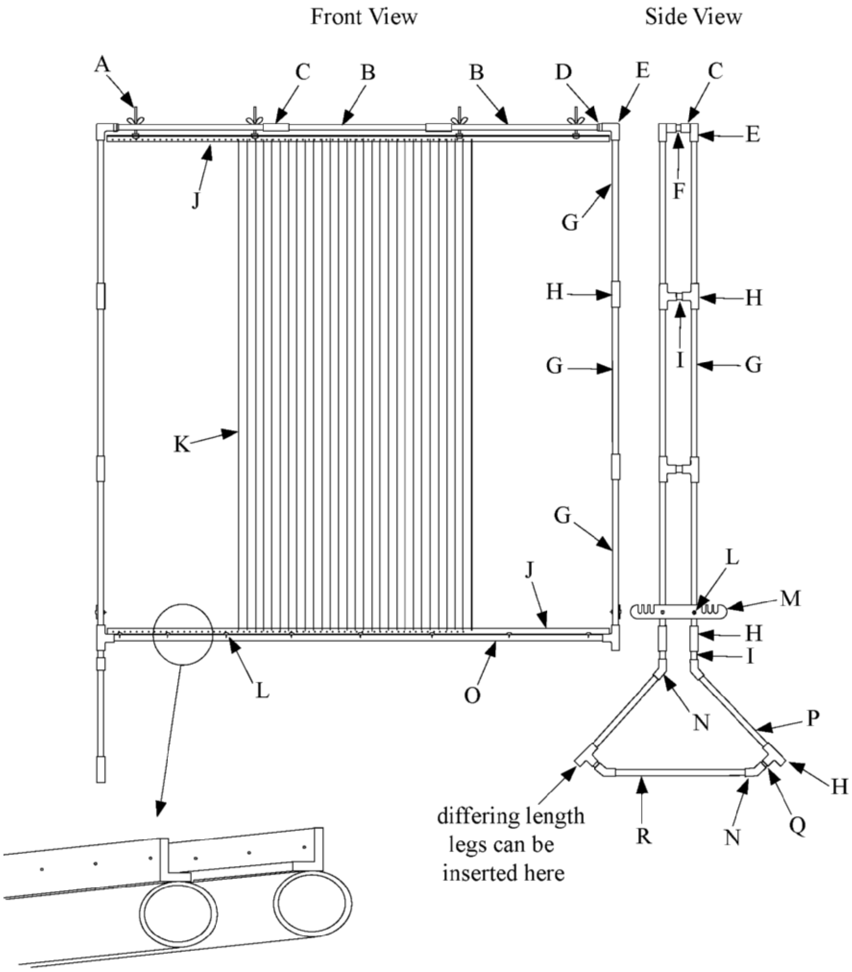

Figure 1. Design of a constructed PVC bat trap showing each part and its placement on the structure; letters correspond to first column in Table 1.

through 0.64-cm holes drilled through the pipe every 30.5 cm. Four nuts and bolts and a second set of wing nuts were used to secure the upper parts of the angled aluminum to each copper tube. This setup allowed simple and fast adjustment of the string tension.

Bag supports were made from 30.5-cm notched metal plates, which were bolted to the lower section of the outside of the frame (Figure 1). This allowed a plastic-lined, canvas bag, which held captured bats, to hang in the proper position. The design of the canvas bag was not altered from that used by Tuttle (1974) and Tidemann and Woodside (1978). These designs worked well with the PVC-style frame and should be referred to for construction of the capture bag. Black canvas material was used to create the bag, which was hung from the bag supports by round curtain rods.

In contrast to the stainless spring-steel wire reported by Tuttle (1974), monofilament fishing line (8.8- to 13.2-kg test) was used as the string material (see Francis 1989). The upper lengths of angled aluminum were adjusted via the wing nuts until there was about 7.50 cm of space between the angled aluminum and copper tubes. Strings were then tied between the holes in the bottom angled aluminum piece and the corresponding hole at the top of the frame. Each string was tied individually such that it was just taut when the adjusting bolts were near the lowest position. Tension was adjusted with wing nuts along the top of the frame and was then limited to relieving slack in the strings. Adjustments to tension were made only after all strings were tied. Temperature changes, excessive numbers of captured bats, and the species being targeted may necessitate some adjustment in the string tension during capture events.

Results and discussion

This trap design was tested in a variety of landscape types from dry desert to high-elevation meadows and has proven effective in catching different bats. Species captured while testing the traps included western pipistrelle (*Pipistrellus hesperus*), California myotis (*Myotis californicus*), western small-footed myotis (*M. leibii*), Yuma myotis (*M. yumanensis*), Mexican free-tailed bat (*Tadarida brasiliensis*), and hoary bat (*Lasiurus cinereus*).

The most significant design change from previous traps was the use of 1.90-cm schedule-40 PVC tube in place of aluminum tubing. PVC is readily

Table 1. List of materials needed to construct a PVC bat trap.

Item[a]	Material	Qty.	Purpose
A	0.64 cm × 10 cm bolt	8	adjustment screws
	0.64 cm nut	8	secure bolt to angle bar
	0.64 cm wing nut	8	angle bar adjustment
B	1.90 cm × 210 cm copper tube	6	top portion of frame
C	1.90 cm copper "t" coupling	4	separate top tubes
D	1.90 cm copper coupler/male adapter[b]	4	connect copper to PVC
E	1.90 cm 90º PVC coupling[b]	4	top corners of frame
F	1.90 cm × 7.6 cm copper tube	2	separates the 2 frames
G	1.90 cm × 68.6 cm PVC tube	12	sides of frame
H	1.90 cm PVC "t" coupling	16	joins sides and legs
I	1.90 cm × 7.6 cm PVC tube	8	separates the 2 frames
J	1.27 cm × 1.27 cm × 183 cm aluminum angler bar	4	strings tied between bars
K	monofilament fishing line[c]	150 m	vertical strings
L	1.90 cm × 0.48 cm wood screws	20	secure angle bar to bottom tubes and bag brackets to side tubes
M	2.54 cm × 25.5 cm × 0.4 cm steel plate	2	supports for capture bag
N	1.90 cm 45º PVC coupling	8	base/leg assembly
O	1.90 cm × 183.0 cm PVC tube	2	bottom portion of the frame
P	1.90 cm × 45.7 cm PVC tube	4	base assembly
Q	1.90 cm × 5.0 cm PVC tube	4	base assembly
R	1.90 cm × 63.5 cm PVC tube	2	base assembly
	PVC glue	1	
	capture bag (not shown)[d]	1	

[a] Item designation corresponds to parts labeled in Figure 1.
[b] One end is threaded; the other slips on.
[c] 8.8- to 13.2-kg test line.
[d] See Tidemann and Woodside (1978) for design and materials for capture bag.

available at most hardware and home- center stores, where a variety of PVC fittings also can be found. Through selective use of glued joints, the trap can be made collapsible, allowing it to be transported without damage in a canvas duffel bag. Estimated cost of materials at the time of testing was $60–$70. Estimated time of initial assembly was about 4 hours; field setup took <30 min.

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