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# A Device for Excluding Predators from Pitfall Traps

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Pitfall trapping is a common technique for sampling small vertebrates (Jenkins et al. 2003; Sutton et al. 1999). As with most live trapping methods, trapped animals might incur mortality through desiccation (Jenkins et al. 2003), drowning (Aubry and Stringer 2000), starvation (Yunger et al. 1992), exposure (Padget-Flohr and Jennings 2001), and increased predation risks (Dodd and Scott 1994). However, most studies rarely mention predation and typically only attempt to mitigate the other problems. Only anecdotal evidence of predation is mentioned and mainly deals with predation within the pitfalls (Jenkins et al. 2003) or disturbances to pitfall covers (Sutton et al. 1999). We present a device to reduce predation of animals captured in pitfall traps. Our design provides an alternative to cover boards that are often employed in drift fence studies as anti-predatory mechanisms (Phillips et al. 2002) and is unique in its ability to capture a wide array of small vertebrates, including frogs and toads, while providing secure protection from larger vertebrate predators. We devised predatory exclusion devices (PEDs) in response to increased predator activity (scat, tracks, and disturbance) observed along specific drift fence arrays. Our ultimate goal was to design an inexpensive and time-efficient exclusion device that would reduce predation risks to captured animals in pitfall traps without jeopardizing capture rates of target species.

We operated eighteen terrestrial drift fences year-round and checked them daily at the Griffith League Ranch in north-central Texas, Bastrop County. Our study was part of a long-term study of the endangered Houston Toad (*Bufo houstonensis*). Arrays were either linear or Y-shaped (Bury and Corn 1987) and erected using aluminum flashing (Gibbons and Semlitsch 1981) with 39 19-L buckets distributed among the fences. Only pitfall traps known to have captured adult Houston Toads during previous survey periods were outfitted with PEDs. Eleven of 18 arrays captured *B. houstonensis* among 34 pitfalls. We outfitted 32 PEDs to the terminal pitfalls of the 11 arrays.

PEDs had a cover-board, two strips, four posts, cable ties and binder clips. We built 40.64 × 40.64 × 1.27 cm cover-boards from treated plywood. Each board had four 5.0 cm holes drilled 1.27 cm from each corner and a 30.48 × 1.27 cm gap center cut so the cover-board seated at the fence's end. Strips measured 7.62 × 40.64 × 1.27 cm and had two 1.27 cm holes drilled at each end at 1.27 cm from the end. We cut re-bar (1.27 cm) into 60.96 cm lengths for the posts (Fig. 1). For assembly, we first drove the posts 40.64 cm into the ground and oriented the strips parallel to the fence at 10.16 cm high. Second, we cinched cable ties on the posts above and below the strips then placed the cover-board snugly on top of the strips. Lastly, we secured the cover-board to the strips with two large binder clips. Our design enabled animals to crawl or

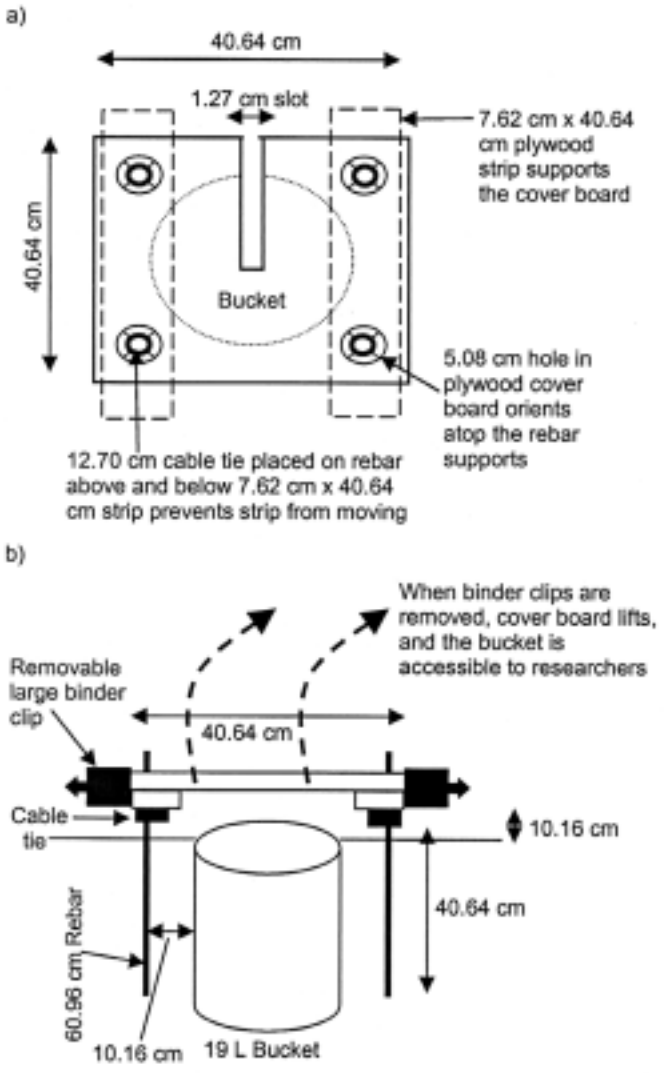


FIG. 1. Detailed drawing of a Predator Exclusion Device illustrating its general operation and an aerial view (a) plus a lateral view (b) of the PED with pitfall trap.

hop underneath the PED thus preventing larger vertebrate predators from reaching the pitfalls' bottom.

Creating a PED secure enough to deter predators yet still readily removed by the researchers was an important goal. With such a large trapping regime, checking each trap, especially on wet spring days with dozens of captures, might take anywhere from a few minutes to several hours. We estimated removal of PEDs added approximately 1-minute to check each pitfall. Beyond the labor, drift fences can be expensive creating problems in short-term studies with smaller budgets (Malone and Laurencio 2004). We estimated the costs for wood, cable ties, re-bar, and binder clips at approximately US $5.00 per PED. An added benefit is preventing injury to unaware livestock and personnel, a concern when conducting studies on sites with high activity.

During an eight-month test, all PEDs remained intact with no damage or disturbance. Most importantly, the presence of PEDs did not affect the capture of the target species, the endangered Houston Toad. The proportion of *B. houstonensis* caught in unprotected pitfalls out of total captures from 2003 did not significantly differ from the proportion of *B. houstonensis* caught in PED protected pitfalls during the 2004 season (95% CI $P_1$-$P_2$ = -0.0947 < $P_1$-$P_2$ < 0.1227) indicating that capture success was not affected by the presence of the PEDs. The same pattern was observed in captures of the southern leopard frog *Rana sphenocephala*, whose proportional captures in protected and unprotected pitfall traps did not significantly differ among the 2003 and 2004 seasons (95% CI $P_1$-$P_2$ = -0.0145 < $P_1$-$P_2$ < 0.1325). However, a majority of these frogs were juveniles, large adult Ranids may be excluded from PED protected pitfalls due to the height limitation of the device.

Three months into the study we documented failed predation attempts at ten pitfalls having PEDs using ten Deercam® motion sensor cameras. Cameras recorded predators entering pitfalls without PEDs and attempting, but failing to enter pitfalls with PEDs (specifically *Procyon lotor*). Despite the PEDs' effectiveness, agile predators (e.g., snakes) can still enter pitfalls and consume animals. Our PEDs provide an inexpensive solution to predation from larger vertebrates. Although alternatives to pitfall trapping that also help limit predation in herpetofaunal studies exist, these techniques are often limited in taxon sampling and even increase other mortality factors such as desiccation (Jenkins et al. 2003; Lohoefener and Wolfe 1984). We think our technique provides an inexpensive and unbiased tool that will aid in reducing predation associated with pitfall trapping for other studies.

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