A METHOD FOR REDUCING MORTALITIES IN PITFALL TRAPS

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ABSTRACT: During rain storms when pitfall traps are used to capture amphibians, nontarget species may be incidentally captured and drown as the traps fill with water. To reduce mortalities of nontarget species, we designed floating shelters for use in pitfall traps. The shelters are constructed of polystyrene with a walled base and suspended cover. Cotton batting was placed in these shelters as bedding material. The structures were placed in 16 pitfall traps for 10 consecutive days. Incidental captures included western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), southern alligator lizard (*Elgaria multicarinata*), and western fence lizard (*Sceloporus occidentalis*). All rodents and 2 lizards were found alive in the shelters, and 1 lizard was found alive under the shelter. Rain did occur during the trapping period, although traps collected no more than 10 mm of water. Despite the rainfall, the shelters and the cotton batting remained dry, except for the shelter used by the California vole. Modifications of the materials may be necessary to insure structural integrity. The shelter design succeeded in providing a refuge for reptiles and small mammals and may help researchers reduce the number of unnecessary mortalities in pitfall traps.

Key Words: amphibians, pitfall traps, reptiles, small mammals, survival, trap mortality

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Pitfall traps are an effective method for capturing amphibians (McComb et al. 1991) as well as reptiles and small mammals. When using pitfall traps to capture amphibians during the rainy season, both target and nontarget species may die of exposure or drown if the traps fill with water. The best method of reducing mortalities is to increase the frequency of trap checks. However, as an added measure, researchers should modify the pitfall traps or utilize devices to shelter the animals until the next trap check.

Suspended covers, which are used to provide shade and thereby increase capture rates, have the added advantage of shielding the traps from precipitation (Bury and Corn 1987). If the pitfall traps are visited frequently, bailing may also be used to keep the pitfall traps from filling with water (Gibbons and Semlitsch 1981). If the traps are not visited frequently, drain holes may be drilled into the pitfall traps; however, depending on soil characteristics, drain holes may be only marginally successful (McComb et al. 1991). In areas characterized by impermeable soils, water may be collected below the perforated traps by digging holes deeper than the pitfall traps (Vogt and Hine 1982).

When pitfall traps cannot be kept free of water, researchers operating pitfall traps as live traps must look for options to protect the animals they trap from hypothermia and drowning. In an attempt to provide for the safety of animals falling into wet pitfall traps, we designed a floating shelter to keep animals dry until they are released. While conducting a presence or absence survey for amphibians, we evaluated the efficacy of these shelters in providing a refuge for captured animals.

STUDY AREA

Our study was conducted along the lower reach of Coyote Creek in the northern part of Santa Clara County, California, where the Santa Clara Valley Water District (SCVWD) has constructed an overflow channel and planted 2 riparian woodland mitigation sites within the outer levees. The riparian corridor along the original farmers' levees was left intact and is dominated by western sycamore (*Platanus racemosa*) and Fremont cottonwood (*Populus fremontii*). Adjacent to the intact riparian corridor, the SCVWD planted a 1.7 ha pilot riparian woodland mitigation site in 1987. A second 3.2 ha riparian woodland mitigation area was planted in 1993 adjacent to the newly constructed levee. These riparian woodland mitigation areas are predominated by Fremont cottonwood, box elder (*Acer negundo*), blue elderberry (*Sambucus mexicana*), and coyote bush (*Baccharis pilularis*). The under story is composed of California blackberry (*Rubus ursinus*), creeping wildrye (*Leymus triticoides*), mugwort (*Artemisia douglasiana*), California rose (*Rosa californica*), western goldenrod (*Euthamia occidentalis*), western aster (*Aster chilensis*), poison hemlock (*Conium maculatum*), bristly ox-tongue (*Picris echioides*), black mustard (*Brassica nigra*), and curly dock (*Rumex crispus*). Surrounding land uses are primarily agriculture and bio-solids drying beds.

METHODS

From 19 to 29 November 1996, we operated 4 permanent drift fence arrays within the Coyote Creek overflow channel. Arrays were arranged in a Y-shaped pattern with three 15.2-m drift fences of 50.8-cm aluminum flashing and four 18.9-liter plastic buckets. Pitfalls were installed in the middle of each array and at the end of each fence, for a total of 16 pitfall traps and 160 pitfall trap nights. Angles between drift fences were maximized as much as possible without severely impacting the surrounding vegetation. Drift fences were buried 20 cm deep and stood upright without additional reinforcement.

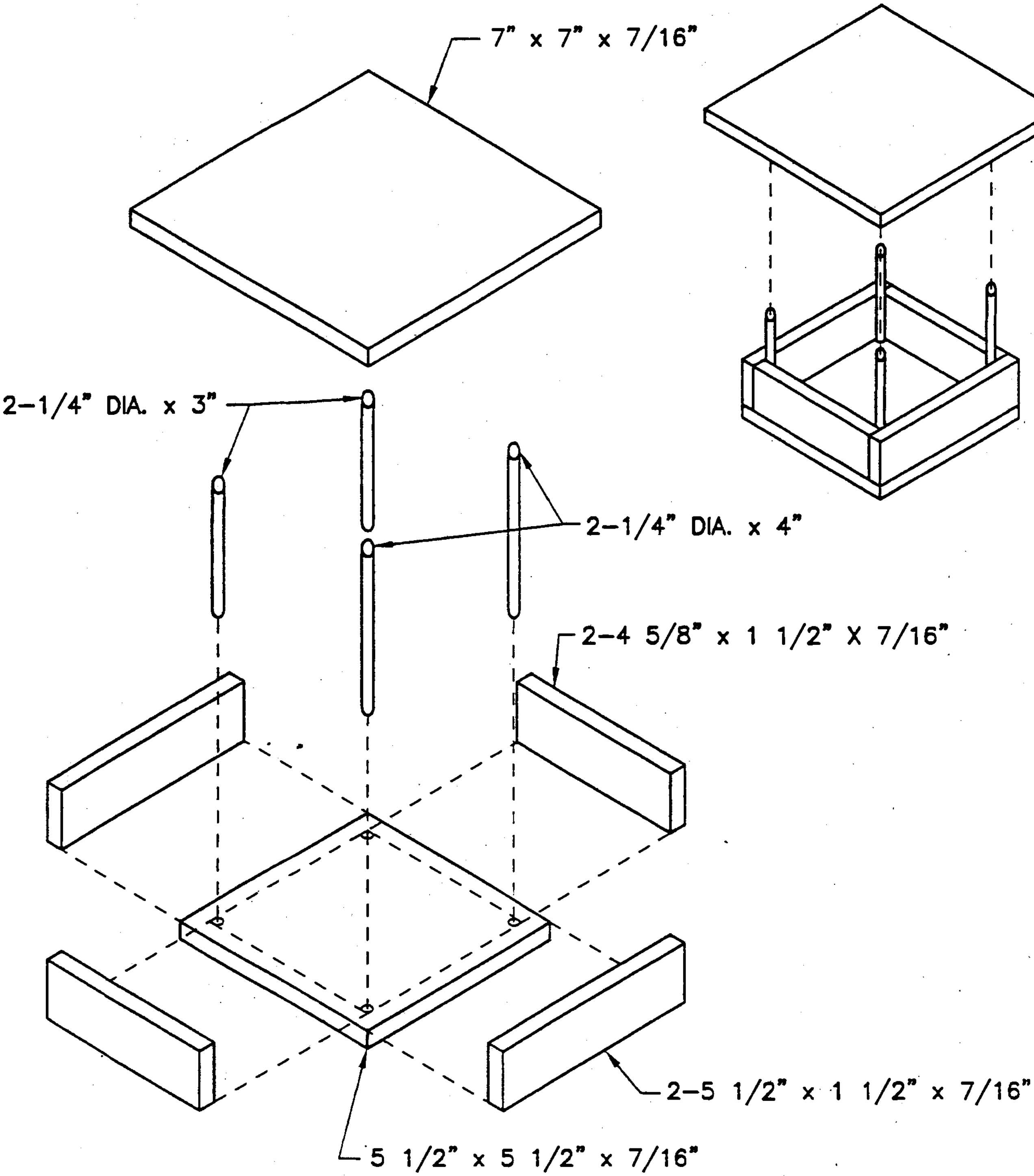

Fig. 1. Exploded view of floating shelter for 18.9-liter pitfall traps.

Shelters were constructed of polystyrene, wood doweling, and nontoxic glue (Fig. 1). All joints were glued and left to cure for 48 hours. We tested the shelters by placing them in a 18.9-L bucket filled with 20 cm of water for 48 hours. To simulate rodent occupancy, we placed a 100-g mass within the shelter during the test.

Dry, sterile cotton batting was placed in each shelter before the shelters were placed in the pitfall traps. Pitfall traps and shelters were checked daily to insure that they remained dry or to note the level of water accumulated in each trap. All vertebrates captured were measured and identified to species (Ingles 1965, Stebbins 1985) and released on-site. Invertebrates were left in the traps and not identified. Cotton batting was replaced following the capture of small mammals. To test the efficacy of our design in maximum exposure to rainfall, we did not suspend covers above the open pitfall traps.

RESULTS

No amphibians were trapped during the survey. Eleven vertebrates, including 7 western harvest mice (*Reithrodontomys megalotis*), 1 California vole (*Microtus californicus*), 2 southern alligator lizards (*Elgaria multicarinata*), and 1 western fence lizard (*Sceloporus occidentalis*) were captured incidentally. All except 1 of the captives were found in or on the shelters.

Rain showers occurred during the trapping period. Thirteen traps accumulated less than 5 mm of water, 2 traps accumulated 5-10 mm of water, and 1 trap remained dry. The shelters remained intact during the entire trapping period. However, the glue we used gradually softened in the wet traps and weakened the structures. Of the 11 vertebrates captured, 5 were found in wet pitfall traps. With the exception of the shelter occupied by a California vole, all of the shelters and cotton batting remained dry. In the shelter occupied by the California vole, the cotton was saturated, but the vole was dry.

DISCUSSION

Two components of our shelter design should be modified to insure structural integrity. First, because we were concerned about rodents gnawing at the structures, we used a nontoxic adhesive. This glue was not appropriate for the wet environment, and other adhesives should be considered. Second, because we observed more than 1 animal in a single trap, we recommend replacing the base with thicker polystyrene to improve the buoyancy of the shelters.

The concept of providing shelter for use in pitfall traps is not new. In smaller pitfall traps used to capture invertebrates, Haberl (1993) used polystyrene to provide footing as an escape for incidentally captured shrews (*Sorex* spp.). Since initiating the use of polystyrene, Haberl (pers. comm.) has not observed mortalities of nontarget species in his pitfall traps. Similarly, we observed no mortalities with the use of floating shelters.

However, for several reasons, we cannot conclude that the survival of the animals captured in our study was directly attributed to the shelters. Air temperatures did not fall below 15°C, and very little water accumulated in the traps during the study. In addition, we had a small sample size without a control study on which to base our results.

Under conditions of minimal precipitation, the shelters and cotton batting provide cover and insulation. The shelters provided a dry site where animals that fell into wet traps could climb out of the water and dry themselves off. Most of the rodents were found burrowed in the cotton, which may indicate that they used it as bedding material. In the case where the cotton batting was soaked, we were unable to determine if the water was from the trap, the vole's wet fur, or urine.

Because no target species were captured, we do not know if our shelters limit the efficiency of pitfall traps in capturing amphibians. Shelters may provide an escape mechanism, especially for saltatory amphibians, by reducing the effective depth of the traps. In addition we do not know if these devices would benefit species such as shrews that are more vulnerable to exposure. Depending on the pitfall trap dimensions and the limitations of the study, there may be other designs suitable for sheltering target and nontarget species. With the modifications recommended above, we think our shelter design will help researchers reduce the number of unnecessary mortalities in pitfall traps.

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