IMPORTANCE OF TRAP TYPE

for the detection and conservation of small mammals

By Samantha A. Sedivec and Howard P. Whidden

Introduction

The loss and degradation of habitat poses the single greatest threat to imperiled species in the United States (Wilcove et al. 1998). Limited availability of conservation resources requires conservationists to prioritize areas for protection, and as a result they face the urgent task of determining the geographic distributions of imperiled taxa (Groom et al. 2006). For many rare small mammals, however, such distributional data are incomplete and additional inventories are warranted if their critical habitats are to be identified and preserved.

Multiple sampling techniques and protocols are often necessary for a comprehensive mammal inventory.

The literature thoroughly documents trap type as an important variable in the capture of small mammals (e.g., Sealander and James 1958; Wiener and Smith 1972; Kalko and Handley 1993; Kirkland and Sheppard 1994; Francl et al. 2002; Umetsu et al. 2006). A number of factors may predispose a species to be captured more often in one trap type than another, including body size and behavior. For example, some shrews may be too small to engage the trigger mechanism of a typical live trap, whereas saltatory species (those adapted for jumping or hopping) such as jumping mice may be reluctant to enter the confined space of a live trap. Consequently, multiple sampling techniques and protocols are often necessary for a comprehensive mammal inventory (Jones et al. 1996).

Study

We conducted an inventory of small mammals along the Appalachian National Scenic Trail corridor in Pennsylvania, New Jersey, New York, and Connecticut. The Appalachian National Scenic Trail is a unit of the National Park System that passes through 14 states. The width of the trail corridor varies, but it averages 1,000 feet (305 m). Our primary goal was to acquire baseline data on the distributions of eight target taxa (species or subspecies) listed by NatureServe as critically imperiled, imperiled, or vulnerable in the four states we studied (NatureServe 2004; see table 1). We used NatureServe Explorer to identify target taxa because it provided a consistent ranking system for the different states and it was the most reliable and readily available source; none of our target taxa were federally listed as threatened or endangered. A secondary objective was to inventory all small mammals present in the study area. To obtain a comprehensive inventory, we used a combination of Sherman live traps, Museum Special snap traps, and pitfall traps (fig. 1). Our study design allowed us to compare the effectiveness of these different trap types for documenting the presence of small mammal populations along the Appalachian Trail.

Methods

We reviewed the literature to identify known distributions and preferred habitats for each of our target species, many of which are habitat specialists. We then developed a GIS project that included National Land Cover data (Multi-Resolution Land Characteristics Consortium), National Wetlands Inventory data (U.S. Fish and Wildlife Service), topographic maps, and orthophotos (aerial photos corrected for the effects of tilt and relief). We used this approach to identify more than 100 potential study sites that appeared to provide suitable habitat for our target species, including boggy wet meadows and areas of moist wooded talus. Subsequent field checking allowed us to reduce this list to 33 sites for sampling (fig. 2).

Table 1. Species targeted for inventory along the Appalachian National Scenic Trail in Pennsylvania, New Jersey, New York, and Connecticut

Common Name	Scientific Name	PA Rank	NJ Rank	NY Rank	CT Rank
Long-tailed shrew	*Sorex dispar*	S3	S1	S4	–
Maryland shrew	*Sorex fontinalis*	S3S4	–	–	–
Water shrew	*Sorex palustris*	SNR	SU	S4	S3S4
Least shrew	*Cryptotis parva*	S1	SU	SH	S1
Kittatinny red-backed vole	*Clethrionomys gapperi rupicola*	S3	–	–	–
Southern bog lemming	*Synaptomys cooperi*	S4	S2	S4	S3
Rock vole	*Microtus chrotorrhinus*	S2	–	S4	–
Deer mouse	*Peromyscus maniculatus*	S5	SU	S5	S3

Note: Data on state ranks from NatureServe (2004).
State rarity rank codes: S1 = Critically Imperiled; S2 = Imperiled; S3 = Vulnerable; S4 = Apparently Secure; S5 = Secure; SH = Possibly Extirpated; SNR = Not Yet Ranked; SU = Under Review; – = not listed as present.

Figure 1. The researchers used three trap types in this inventory. The left photo shows a trapping station with Sherman live trap (at left) and Museum Special snap trap (at right); the right photo shows a pitfall array with drift fence, after Handley and Varn (1994). Sherman live traps generally catch animals alive so they can be released whereas Museum Special snap traps are lethal. Animals can be released alive from pitfall traps if the traps are checked frequently enough. HOWARD P. WHIDDEN (LEFT), SAMANTHA A. SEDIVEC (RIGHT)

We used traplines of Sherman live traps and Museum Special snap traps as the main inventory technique to document small mammals at all sites. At each study site, the two trap types were baited with a mixture of peanut butter and rolled oats and placed together in pairs at 40 stations along a transect for four consecutive nights. In addition, pitfall traps were installed at 13 sites, either as terrestrial arrays following the recommendations of Handley and Varn (1994) or as lines targeted at water shrews following the recommendations of the Resources Inventory Committee (1998).

We used a Wilcoxon test for matched pairs to compare the effectiveness of Sherman live traps to Museum Special snap traps for capturing small mammals. Pie charts were used to compare trap efficacy of the three sampling techniques based on trap-nights of effort (fig. 3, page 70). Capture rates for the two types of pitfall arrays were similar, and because we had limited numbers of total pitfall trap nights we lumped the terrestrial pitfalls and streamside pitfalls for this comparison.

Results

We recorded 11,182 total trap nights and captured 318 small mammals, including 9 total species and 4 of our target taxa (table 2, page 70). We captured four of our target taxa in the Museum Special snap traps (Maryland shrew, water shrew, southern bog lemming, and Kittatinny red-backed vole), whereas only one target taxon was captured in the Sherman live traps (Kittatinny red-backed vole). Museum Special snap traps were significantly more effective than Sherman live traps (227 vs. 67 total captures) for capturing small mammals in general ($T = 16$, $P < 0.001$, Wilcoxon's test for matched pairs). Pitfall traps were five times more effective at capturing shrews in the genus *Sorex* than the other trap types on a per-trap-night basis (fig. 3). Furthermore, the pitfall traps successfully captured both red-backed voles and woodland jumping mice.

Figure 2. Map of project area and locations of 33 sites sampled along the Appalachian National Scenic Trail from May 2005 to February 2006.

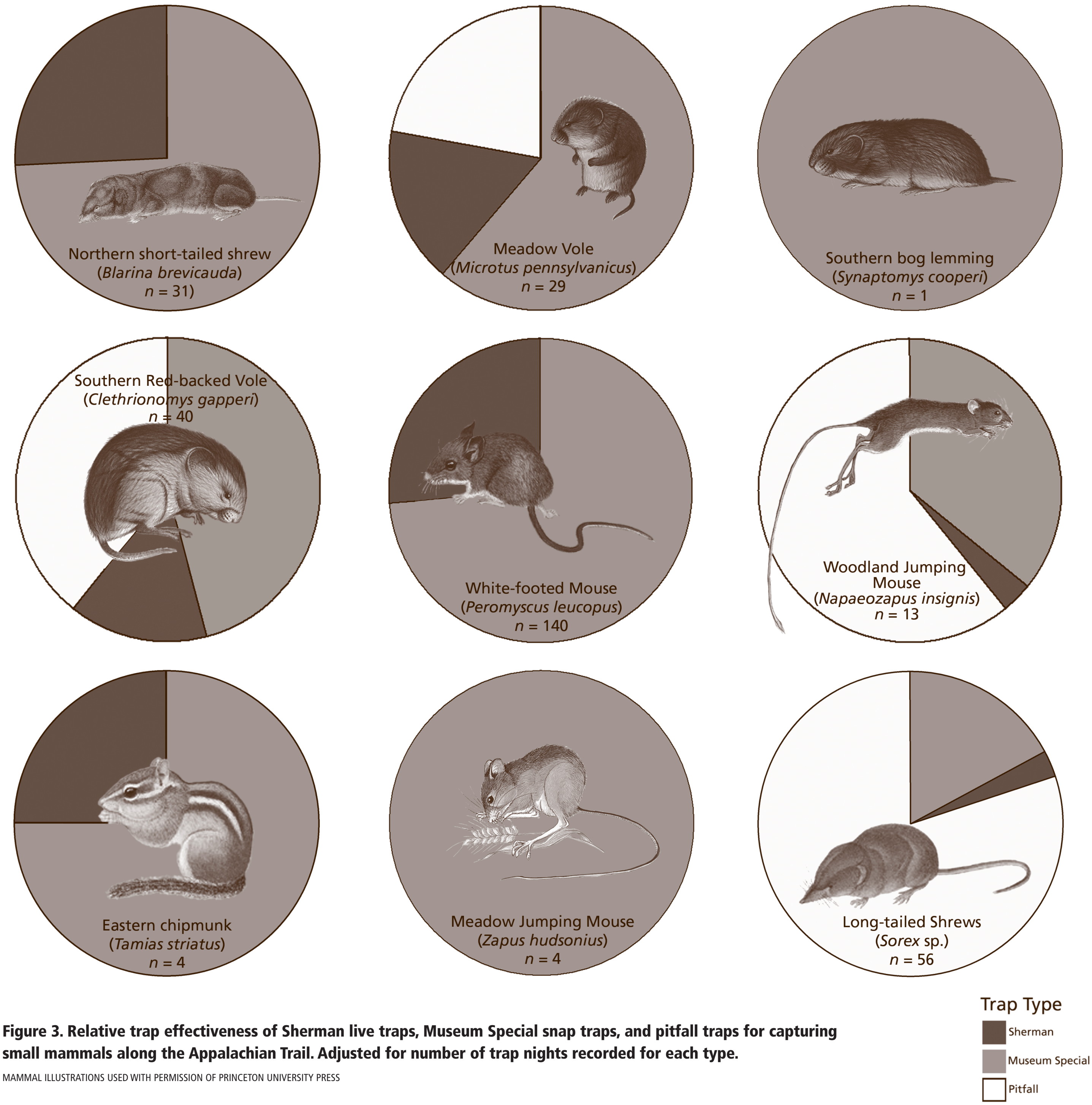

Figure 3. Relative trap effectiveness of Sherman live traps, Museum Special snap traps, and pitfall traps for capturing small mammals along the Appalachian Trail. Adjusted for number of trap nights recorded for each type.

Table 2. Number of small mammals documented using three trap types: live traps, snap traps, and pitfall traps

Trap Type	Trap Nights	*Sorex* sp.[a]	*Blarina brevicauda*	*Microtus pennsylvanicus*	*Clethrionomys gapperi*	*Peromyscus leucopus*	*Zapus hudsonius*	*Napaeozapus insignis*	*Tamias striatus*	*Synaptomys cooperi*	Total
Museum Special	5,280	33[b]	23	22	28[c]	103	4	10	3	1	227
Sherman	5,280	5	8	6	9[d]	37	0	1	1	0	67
Pitfall	622	18	0	1	3	0	0	2	0	0	24
Total	11,182	56	31	29	40	140	4	13	4	1	318

[a]Includes *S. cinereus*, *S. fontinalis*, *S. fumeus*, and *S. palustris*.
[b]Includes 1 specimen of *S. fontinalis* and 1 specimen of *S. palustris*.
[c]Includes 2 specimens of *C. g. rupicola*.
[d]Includes 1 specimen of *C. g. rupicola*.

Discussion

Proper management of rare and declining species requires knowledge of their distributions and habitat preferences. Our results suggest that Museum Special snap traps and pitfall traps are more effective than live traps for documenting some species of small mammals. Park personnel and other land managers may be reluctant to conduct inventories that involve the killing of small mammals. However, accurate distributional data are necessary for conservation efforts, and the importance of obtaining these data with a minimum of time and effort must be balanced against the sacrifice of some animals. By removing our traps after capture of a target species, we never collected more than one individual of a target species at a site. Such judicious inventory trapping will likely have minimal impact on the populations of target species, and may provide the data needed to manage these populations.

A further consideration is that some at-risk small mammals are difficult to identify in the field (e.g., Maryland shrew and long-tailed shrew), and a definitive identification of some taxa may require laboratory examination of the skull and teeth. In addition, vouchers (specimens retained for documentation) obtained through trapping provide a permanent record of a taxon's presence, and can always be examined by future researchers if the identification or taxonomic status of a specimen is ever in doubt.

Conservationists, park managers, and policy makers are often faced with the difficult task of prioritizing areas for the protection of imperiled species. Our data reaffirm the importance of using multiple trap types for comprehensive and efficient inventories of small mammals. Inventories that rely solely on live traps may fail to identify at-risk populations or may require substantially greater trapping effort to document these populations. It is our hope that these results will help inform the design of future small mammal inventories and thereby assist conservation efforts aimed at protecting small mammal populations.

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