A COMPARISON OF METHODS USED TO EXAMINE SNOWSHOE HARE HABITAT USE

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Direct and indirect methods are employed to investigate mammalian habitat use. Direct methods include observation, capture, and radiotelemetry, whereas indirect methods are dependent on some evidence of mammalian activity (e.g., browsing, tracks, feces) within available cover types. Various methods are often assumed to provide the same information, but only a few studies have attempted to determine if they do (Biggins and Pitcher 1978, Collins and Urness 1981).

Snowshoe hare (*Lepus americanus*) habitat use patterns have been investigated using fecal pellet counts (Adams 1959, Wolff 1980, Pietz and Tester 1983), snow track counts (Brocke 1975, Conroy et al. 1979), and livetrapping (Wolff 1980). Our objective was to apply these three methods simultaneously while studying snowshoe hare in Maine to determine if they provided similar information on habitat use.

STUDY AREAS AND METHODS

Habitat use by snowshoe hare was studied in two locations during September 1981 to May 1983. One area (Pierce Pond; 45°15′N, 70°10′W) was located in the western mountains of Maine. Dominant vegetation included spruce-fir (*Picea* spp.–*Abies balsamea*) and northern hardwood associations (*Acer* spp., *Betula* spp., *Fagus grandifolia*) (Lull 1968). Logging has resulted in dense stands of regenerating spruce-fir and hardwoods in portions of this area. A coastal study area (Cherryfield; 44°35′N, 67°55′W) was located approximately 190 km east of Pierce Pond. Hardwoods were abundant and conifers were common in poorly drained sites. Logging operations were scattered throughout the area and commercial blueberry (*Vaccinium angustifolium*) barrens were maintained by biennial burning. Snowshoe hare were the only leporids in each study area. A detailed description of the areas was provided by Litvaitis (1984).

Previous investigators have indicated that understory density was the principal feature influencing hare habitat use (Adams 1959, Brocke 1975, Wolff 1980, Pietz and Tester 1983). Therefore, we compared the distribution of hare pellets, snow tracks, and captures to understory stem density.

Pellet Counts

We selected two 49-ha sampling areas within each study area that contained a variety of understory densities. Within each sampling area, seven 700-m transects were established at 100-m intervals. Fifteen 1-m-radius plots were marked with a wooden stake at 50-m intervals along each transect. Understory stem (woody plant, dbh ≤7.5 cm, >0.5 m tall) density was sampled within two 15 × 0.5-m plots at each pellet plot. Understory sampling plots were perpendicular to the transects. Fifty additional pellet plots were stratified within each sampling area by understory stem density during the 2nd year of the study. Stratification was based on pellet distribution in relation to understory stem density. Pellets were counted within each plot and removed during spring (Apr–May) prior to leaf emergence and in late summer (Sep) prior to leaf fall. Four counts were made on each sampling area during the study.

Track Counts

Hare tracks in the snow were counted on each transect along the 50-m segments between pellet plots ($N = 14$ segments/transect). Track counts along these segments were considered to occur in the understory type (density) identified at the pellet plot preceding the segment. We considered understory patches to be large enough to permit this. Transects were surveyed within 40 hours of a snowstorm, including one complete night without snowfall, to permit the accumulation of tracks (Brocke 1975). Counts

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Table 1. Distribution (observed/expected) of three indices used to examine snowshoe hare understory use in eastern (Cherryfield) and western (Pierce Pond) Maine, 1981–83. Observed index totals greater or less than expected are indicated by + or −, respectively ($P < 0.05$).

Understory density (stems/ha)	Cherryfield			Pierce Pond		
	Pellets (497)[a]	Tracks (936)[b]	Captures (3,930)[c]	Pellets (517)	Tracks (868)	Captures (3,920)
Open (<700)	−1/59	−11/30	0/5	−233/673	−52/118	69/72
Sparse (700–7,000)	−156/789	−264/405	−35/60	−1,183/2,515	−284/497	157/175
Moderate (7,000–20,000)	+998/861	392/414	77/71	−3,120/3,760	705/681	−282/319
Dense (≥20,000)	+2,113/1,558	+869/688	+144/120	+8,871/6,457	+1,342/1,087	+501/443

[a] Sample plots × replicates.
[b] 50-m segments × replicates.
[c] Total trap-nights.

($N = 5$/sampling area in Cherryfield, $N = 4$/sampling area in Pierce Pond) were made from January through March 1982 and 1983.

Livetrapping

Single-door box traps were placed at 100-m intervals along the seven transects of each sampling area ($N = 7$ traps/transect) at 1–5 m from the pellet plots. Traps were baited with alfalfa (*Medicago sativa*) and set for 8–16 days during April–May and October–November 1981–83, resulting in four trapping periods per sampling area. We assigned the number of captures at each trapping site to the understory type at the trap site.

Analysis

Because the actual proportion of time that hare spent in available understory types was unknown, we could only compare the distribution patterns of the three indices. To avoid incorporating seasonal shifts in habitat use by hare (Wolff 1980, O'Donoghue 1983), we compared only those data collected when deciduous leaves were absent (Oct–May). This included the spring pellet counts, all track counts, and all live captures. Data on the two sampling areas within a study area were combined prior to analysis. A χ^2 and z statistics (Neu et al. 1974) were used to compare the distribution of pellets, tracks, and captures to available understory types.

RESULTS AND DISCUSSION

All three indices were distributed disproportionately among available understory types in both study areas ($P < 0.01$). Pellet counts, track counts, and live captures increased with understory density. The distribution of the three indices in Cherryfield and Pierce Pond indicated that dense understories (≥20,000 stems/ha) were used more than expected by the availability of this understory type ($P < 0.05$) (Table 1). In Cherryfield, the use of open (<700 stems/ha) and moderate (7,000–20,000 stems/ha) understories were not consistently different from expected (Table 1). The use of open, sparse (700–7,000 stems/ha), and moderate understories in Pierce Pond also were not consistently identified as different from expected. However, at least two of the three indices indicated the same use pattern (i.e., used more than, less than, or similar to availability) for an understory type in seven of the eight comparisons (Table 1). We did not observe a situation where one index indicated a preference while another indicated avoidance for an understory type.

The basic assumption of these indices, if they do represent hare habitat use patterns, is that each index should increase with the amount of time hare spend within an understory type. However, pellet counts, track counts, and captures may vary irrespective of time. Collins and Urness (1981) observed that the defecation rates of tame mule deer (*Odocoileus hemionus*) varied with activity and cover type occupied and that they were highest during activity and immediately following resting. We are not aware of comparable information for hare defecation rates.

Track counts represent the distance traveled within an understory type and may not directly correspond to time spent. Such counts may overestimate the time spent in large, unproductive patches if hare travel through these to reach small, productive feeding areas where hare movement (tracks) is limited.

During preliminary trapping, we observed higher capture rates when traps were baited with alfalfa than when they were baited with apples, or vanilla, or not baited. However, the distance hare traveled to reach the alfalfa or other bait was unknown. These factors may explain some of the variation in the three indices.

Our data indicate that pellet counts, track counts, and captures provide similar information on the use of understory types by snowshoe hare. Biologists should select a method based on other study objectives or budget constraints. Track counts are inexpensive for large areas but cannot provide information on seasonal habitat use. Livetrapping is costly and labor intensive and usually restricted to small areas. Livetrapping does provide data for mark–recapture estimates of hare populations. Pellet counts are inexpensive for large areas (Orr and Dodds 1982), and they may be useful in revealing seasonal changes in hare habitat use (Adams 1959, Wolff 1980, O'Donoghue 1983) and examining the relative abundance of snowshoe hare (Hartman 1960).

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