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RELATIVE EFFICIENCIES OF SMALL MAMMAL TRAPS
IN NOATAK NATIONAL PRESERVE, NORTHWEST ALASKA

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The most practical method of determining the abundance or density of small mammals is by trapping. However, the probability of capture by any one trap type or combination of traps varies between species (Brown, 1967) and with species composition of the small mammal community (Calhoun, 1964). In addition, trap response varies within species according to sex, age class (Smith et al., 1975), and social dominance (Summerlin and Wolfe, 1973). Thus, the bias induced by the choice of traps should be an important consideration in the design of small mammal population studies.

The ecological distributions and habitat preferences of small mammals in northwest Alaska are poorly understood. In a 3-year study of nine habitats in the Cape Thompson region, Pruitt (1966) utilized Schuyler and Museum Special traps. Douglass (1984) used only Sherman traps in his 3-year study of 12 habitats in the De Long Mountains. Neither investigator utilized pitfall traps, which have been shown to

catch greater numbers and a greater diversity of small mammals than other trap types (Howard and Brock, 1961, Williams and Braun, 1983). Gardner (1974) used several trap types, including pitfalls, in a survey of mammals in Noatak National Preserve. However, due to the methodology used, his survey did not provide data which would allow analysis of relative trap efficiencies or small mammal habitat relationships.

In this paper we describe the relative efficiencies of pitfall, snap, and Sherman traps in two habitats in Noatak National Preserve. Our objective was to provide data that would allow the comparison of the Preserve's small mammal inventory and population monitoring data with the findings of other small mammal studies in the region.

We conducted our field research near the confluence of the Kelly and Noatak rivers in Noatak National Preserve, Alaska. This area is 145 km north of the Arctic Circle and is at the northern limit of the boreal forest. The climate in the Noatak basin is characterized by long, severe winters. Temperatures ranged from -1° to -40° C in the winter and from 2° to 25° C during August, for the three years of this study (data from on-site weather station, Handar 540 A-1, Multiple Access Data Acquisition System). Annual precipitation is 28 cm, which includes 122 cm of snowfall. Snow is present for approximately 7 months per year with average accumulations of 0.3 to 0.7 m. High winter winds often leave much of the tundra free of snow. Snow accumulations are hard packed with poor insular capabilities. Rainfall is common during the summer months, increasing as the season progresses. (Childers and Kernodle, 1981).

Trapping was conducted in two habitat types, forest and tussock tundra. The

forest site (162° 18' W, 67° 55' N) was located on a south-facing slope and was composed of very open, mature white spruce (Picea glauca) with a well-developed shrub layer of alder (Alnus crispa) and willows (Salix spp.) and a moss-dominated herbaceous layer. The tussock tundra site (162° 16' W, 67° 56' N) was three km northeast of the forest site and was characterized by sedge tussocks (Eriophorum vaginatum) and areas of standing water. Dwarf shrubs were present but rarely exceeded 30 cm in height. The vegetation has been described by Young (1974) and Wiersma et al. (1986).

We trapped three grids in each habitat during August of each year, 1988-1990. New grids were established in both habitats each year except in 1990 when the original (1988) forest grids were re-trapped. Each grid consisted of 25 stations in a five row by five column arrangement with 15 m spacing between stations. A Sherman live trap, a large snap trap, and a pitfall trap (a metal can, 17 cm diameter X 19 cm deep) were placed within two m of each station. The Sherman traps were baited with rolled oats and peanut butter, snap traps were baited with peanut butter, and the pitfall traps were not baited but were filled one-third full with water.

Each grid was trapped for 14 consecutive days. Data recorded at the time of capture included the trap type, species, sex, age class, weight, and reproductive condition. Live mammals were released across the river to prevent their return to the grids.

Due to equal numbers of each trap type, the theoretical frequency of capture was assumed to be equal for each trap type. Deviations from the theoretical frequency were analyzed by the G-test (Sokal and Rohlf, 1981).

During the three years of this study, a total of 1,270 small mammals were captured in 18,900 trap nights. Masked shrews (Sorex cinereus), dusky shrews (S. monticolus), arctic shrews (S. tundrensis), brown lemmings (Lemmus sibericus), northern red-backed voles (Clethrionomys rutilus), and tundra voles (Microtus oeconomus) were captured in both the tundra and the forest, while singing voles (Microtus miurus) were captured only in the forest.

Overall, pitfall traps were the most effective trap, accounting for 60.8% of the total captures. Trap response varied between species and, for northern red-backed voles, between habitats (Fig. 1). All of the shrews captured in the forest and 97.8% of the shrews captured in the tussock tundra were captured in pitfall traps. Brown lemmings were also caught almost exclusively in pitfalls, which accounted for 98.2% and 91.9% of the captures in the forest and tussock tundra, respectively. Most (> 65%) of the tundra voles and singing voles were caught pitfall traps.

In the tussock tundra, slightly more northern red-backed voles were captured in pitfalls than in snaps or Sherman traps. However, the differences were not significant ($G = 2.66$, $P > 0.1$). In the forest, significantly more red-backed voles were captured in snap and Sherman traps than in pitfalls ($G = 33.83$, $P < 0.005$).

When we compared abundance indices (captures per 100 trap nights) from our study to data from Pruitt (1966) and Douglass (1984), we found several differences (Fig. 2). In the tussock tundra, we found brown lemmings to be the most abundant species, whereas Pruitt (1966) and Douglass (1984) reported capturing few to no brown lemmings in this habitat. Another difference was the much higher abundances

of arctic shrews and tundra voles found in our study. All three studies indicated few dusky shrews and singing voles and only moderate numbers of masked shrews in tussock tundra.

In North America, pitfall traps are rarely used in conjunction with other traps for small mammal surveys. Pitfall traps are generally considered to be effective for capturing shrews (Fowle and Edwards, 1954, Brown, 1967, Pucek, 1969, and Williams and Braun, 1983), but ineffective in capturing rodents (Sealander and James, 1958, Pucek, 1969, Andrzejewski and Rajska, 1972). Other studies have shown that pitfalls are efficient rodent traps when partially filled with water (Pankakoski, 1979, Williams and Braun, 1983, this study) or made deep enough to prevent rodents from jumping out (Andrzejewski and Wroclawek, 1963 and Boonstra and Krebs, 1978).

Based on the results of the present study, it is apparent that Pruitt (1966) and Douglass (1984), due to their omission of pitfall traps, underestimated the numbers of most of the small mammal species present in their study areas. In addition, the trap types used in their studies were shown to be negatively biased for the capture of brown lemmings, tundra voles, and shrews. Thus, their conclusions regarding relative abundance, densities, and species habitat associations of small mammals in northwest Alaska should be interpreted with caution.

Although pitfall traps were the most effective trap type used in the present study, sampling of Alaskan small mammals with only one trap type would have resulted in biased abundance estimates. For example, in the forest, snap and Sherman traps were much more effective than pitfalls in capturing northern red-backed voles, while, in the tussock tundra, trap efficiencies were similar. If pitfalls

had been the only trap type utilized, this species would have appeared to be of minor importance in the forest habitat.

Edwards (1952) observed that estimates of the relative abundance of small mammals may be influenced as much by trapping method as by the actual population density. The comparison of the present study with the studies of Pruitt and Douglass supports that observation. From the present study, it is apparent that small mammal sampling methods that do not utilize pitfall traps in combination with Sherman and or snap traps may greatly underestimate the numbers of many of the species which occur in northwest Alaska.

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Figure 1. Percent captured by trap type in two habitats in Noatak National Preserve, Alaska, 1988 - 1990. Data is based on a total of 9,450 trap nights in each habitat. Values above bars are the total number of each species captured.

Figure 2. Population indices from three studies in northwest Alaska. Trap types in each study were: Pruitt (1966) --Schuyler and Museum Special; Douglass (1984) -- Sherman; and the present study -- pitfall, Sherman, and rat size snap. Sc = Sorex cinereus; Sm = S. monticolus; St = S. tundrensis; Ls = Lemmus sibericus; Cr = Clethrionomys rutilus; Mm = Microtus miurus; Mo = M. oeconomus.



