

CLIMATIC FACTORS, REPRODUCTIVE SUCCESS AND POPULATION
DYNAMICS IN THE MONTANE VOLE, MICROTUS MONTANUS

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Objectives

Multiannual fluctuations in populations density ("cycles") of small rodents have been long recognized (Elton 1942). Numerous hypotheses have been proposed to explain this phenomenon (for reviews see Krebs and Myers 1974, Finery 1980, Taitt and Krebs 1985). However, none, alone or in combination, explain the causality of cycles.

The objectives of this long-term study are to determine whether environmental variables, possibly acting through reproductive responses, contribute to the multiannual fluctuations of the montane vole, Microtus montanus.

Methods

In 1989 Microtus montanus were livetrapped at two times of the year: the second half of May (spring study period) and mid-July to mid-August (summer study period). Animals were killed as soon as possible after capture. Animals were aged using weight, total length, and pelage characteristics. Reproductive organs, the spleen and adrenal glands were collected from all animals and preserved in Lillie's buffered neutral formalin for further histological study. Flat skins were prepared from all animals.

Population density was estimated on the basis of trapping success in a permanent grid (established in 1970). The grid consists of 121 stations, placed in a square, 5m apart, 11 stations (50m) on a side. Each station is marked with a stake. Trapping in this grid was performed only during the summer study period. One unbaited Sherman livetrapp was set at each station. Additional trapping was carried out in nearby meadows to obtain additional females for litter size determination. In these areas traps were not set in a regular pattern; rather, they were placed only in locations showing recent vole activity (cuttings, droppings).

During the spring study period trapping was carried out in a number of sites, all well removed from the permanent grid. The objective of spring study trapping was to determine (on the basis of embryo size) the onset of reproduction on a population-wide basis. The reason for this was to leave populations at the grid site as undisturbed as possible since the grid is the major source of information on population density.

Results

Meltoff - and the onset of reproduction in Microtus montanus - was much later in 1989 than it was in 1988. Nevertheless, during spring trapping all females were pregnant with their first litter. However, there appeared to have been a major decline in vole density. Whereas there was abundant evidence that vole populations had been high during the winter, large numbers of animals had apparently perished before the onset of the spring study period. This was not surprising based on the precipitation patterns during the previous winter and early spring. Winter snowpack had been above average and the snow water equivalents also had been high. Consequently, by the onset of spring trapping the study areas had received a large amount of meltwater. Furthermore, the spring precipitation in 1989 had been much higher than that recorded in the spring of 1988. These observations support my hypothesis (Pinter 1988) that wet springs are correlated with a decline in the population density of Microtus montanus.

At the onset of summer trapping it was evident that the vole population had, indeed, suffered a dramatic decline. This decline was observed at all the study sites. In all cases animals were localized in small pockets within the habitat. The role of the habitat quantities in the multiannual fluctuations of this microtine population dynamics was clearly apparent: the severity of the decline was directly proportional to quality. For example, a population from a particularly luxuriant area declined by a factor of 7; in the most marginal habitat the population decline was only by a factor of 2.4. It is noteworthy that the decline in population density of Microtus montanus in Grand Teton National Park was also observed in other parts of Wyoming, thus suggesting geographic synchrony in Microtus cycles.

Conclusions

Despite the large numbers of animals entering the winter of 1988, a dramatic decline in population density had occurred by the spring trapping in 1989. This decline was correlated with winter and spring precipitation in 1989. The geographic synchrony that was observed further supports the contention (Pinter 1988) that weather patterns may be a major contributor to microtine population dynamics.

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