

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



AELITA J. PINTER ♦ DEPARTMENT OF BIOLOGICAL SCIENCES
UNIVERSITY OF NEW ORLEANS ♦ LA

♦ OBJECTIVES

Multiannual fluctuations in population density ("cycles") of small rodents have been known since antiquity (Elton 1942). Numerous hypotheses have been proposed to explain this phenomenon (for reviews see Finerty 1980, Taitt and Krebs 1985). However, none of these hypotheses, alone or in combination, has been able to 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

Microtus montanus were live trapped 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 with an overdose of Metofane as soon as possible after capture. Animals were aged using weight, total length and pelage characteristics. Reproductive organs, the spleen and the 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 the trapping success in a permanent grid (established in 1970). The grid consists of 121 stations placed in a square, 5 m apart, 11 stations (50 m) 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 livetraps 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 trapping during the spring study period was to determine (on the basis of embryo size) the onset of reproduction on a population-wide basis. The reason for not trapping the grid during the spring study period was to leave the site as undisturbed as possible since the grid is the major source of information on population density. In order to ascertain the effects of habitat/density on population dynamics of *M. montanus* in Grand Teton National Park, populations of these rodents were monitored in both optimal and marginal habitats.

◆ RESULTS

All females trapped during the spring study period were pregnant. None was lactating, indicating that all of these were first-litter pregnancies. The spring breeding population in 1995 was much larger than that in the spring of 1994, although the 1995 population started reproducing later than the 1994 population. Furthermore, whereas precipitation in the spring of 1994 was inordinately low, the spring 1995 precipitation was above the 30-year average for the region. Indeed, extensive portions of the study areas remained flooded for a major part of the spring study period.

As compared with 1994 there was only a slight increase in the mean litter size of *M. montanus* in 1995. However, in 1995 a large percentage of females was reproductively active (pregnant and/or lactating); furthermore, they remained reproductively active throughout the entire 1995 summer study period. This was in dramatic contrast with 1994 when a drought-induced suppression of reproduction in *M. montanus* worsened as the season progressed. Nevertheless, in spite of the apparently successful reproduction in 1995 the population levels of *M. montanus* rose only minimally above the 1994 levels. This was true for populations in marginal as well as in optimal habitats. An explanation for this seeming paradox may lie in the composition of the breeding population. In 1994 the first cohort was well represented in the breeding population at the beginning of the summer study period. At a comparable time in 1995, however, this cohort was virtually absent from the breeding populations. Since the spring of 1995 was inordinately wet the 1995 findings lend support to the hypothesis (Pinter 1988) that wet springs are particularly deleterious to the survival of the first cohort. Furthermore, the apparent failure of the first cohort of 1995 reveals the exceptional importance of this age group in the population dynamics of *M. montanus*: the otherwise extensive reproductive success in the summer of 1995 barely compensated for the loss of what might well be the most significant contributor to population growth in a given season.

◆ CONCLUSIONS

The data from the 1995 season once again point to weather as a significant contributor to population dynamics of *M. montanus*. Mechanisms whereby climate affects population processes in these rodents remain unclear. What is clear, however, is that the amount of precipitation in the spring (Pinter 1988) and the severity of drought in the summer (Negus, Berger and Pinter 1992) are two climatic parameters that have a prompt and profound effect on the reproductive success and population dynamics of *M. montanus*. Continued investigation centering on how breeding success and population dynamics of *M. montanus* respond to climate profiles of individual years is, therefore, the most promising approach to the understanding of the enigmatic cycles of arvicoline rodents.

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