

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

---

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

## ♦ 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

In 1994 *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 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 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

During the spring study period of 1994 there was every indication that the *Microtus montanus* populations would begin a recovery from the crash they had experienced in 1993. This recovery was favored by two major factors - an inordinately early spring and low precipitation in May. Population density in the spring of 1994 was low and animals were found in small, widely separated colonies. Reproduction on a population-wide basis had already begun in April - all females were either pregnant or lactating; litter sizes were large.

Whereas low precipitation in May appears to favor the survival and reproduction of *M. montanus* (Pinter 1988), low precipitation during the summer has the opposite effect (Negus, Berger and Pinter, 1992). During the summer of 1994 the region experienced a severe drought. Consequently, it was not surprising that by the end of the summer population densities of *M. montanus* had barely risen above those seen after the crash of 1993. Indeed, at one of the study sites population density remained unchanged from the 1993 levels.

Reproduction continued throughout the entire summer study period, but litter sizes and the percentage of reproductively active females was small. By the end of the summer study period, reproduction was confined almost entirely to the adult females. Although some of the subadult females would doubtlessly breed in 1994, most of the females born after mid-July would probably not mature until the spring of 1995.

## ◆ CONCLUSIONS

In 1994, populations of *Microtus montanus* showed only marginal recovery from the crash of 1993. Although near-ideal spring conditions permitted highly successful reproduction (early onset of breeding, large litters), the severe drought suppressed reproduction, growth and maturation of *M. montanus* toward the end of the summer. The climatic vagaries of 1994 and the rapid physiological responses of *M. montanus* to these changes underscore the great sensitivity of these rodents to environmental variables. The events of 1994 also support the hypothesis that climatic events are significant modulators of vole population dynamics.

## ◆ ACKNOWLEDGEMENTS

I gratefully acknowledge the availability of the facilities at the University of Wyoming-National Park Service Research Center and the enthusiastic support of the Research Center staff without which it would have been impossible to accomplish this work.

I am particularly grateful to the Steering Committee of the UW-NPS Research Center and to the National Park Service for their cognizance of the fact that the understanding of microtine cycles can be gained only from long-term studies.

## ◆ LITERATURE CITED

- Elton, C.S. 1942. Voles, mice and lemmings. Clarendon Press, Oxford. 496 pp.
- Finerty, J.P. 1980. The Population Ecology of Cycles in Small Mammals. Mathematic Theory and Biological Fact. Yale Univ. Press, New Haven. 234 pp.
- Negus, N.C., P.J. Berger, and A.J. Pinter. 1992. Phenotypic plasticity of the montane vole *Microtus montanus* in unpredictable environments. Can. J. Zool. 70:2121-2124.
- Pinter, A.J. 1988. Multiannual fluctuations in precipitation and population dynamics of the montane vole, *Microtus montanus*. Can. J. Zool. 66:2128-2132.
- Taitt, M.J. and C.J. Krebs. 1985. Population dynamics and cycles In: Biolog of New World *Microtus*. R.H. Tamarin, ed. Spec. Publ. Amr. Soc. Mannual. 8:567-620.