

Effects of Environmental Variables on Some Physiological
Responses of Microtus montanus under Natural Conditions

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Project Number 173

This is a continuation of a long term study of multiannual cycles in population density of Microtus montanus in Jackson Hole. Attempts are being made to determine whether a link exists between such cycles, several environmental variables, and the physiological responses of Microtus to such variables. The present report summarizes field data collected during 1971. Methods employed in this work were essentially the same as those outlined in the 1969 report.

Field observations.

In 1971 field observations at the Research Station were carried out over two study periods: spring (May), and summer (July and August).

The populations of Microtus montanus in Jackson Hole had undergone a precipitous decline ("crash") during the winter of 1969-70. The study period covered by the present report therefore represents the second year following the crash. This is an important phase in the multi-annual population cycle of Microtus. It not only expresses the immediate recovery rate of the population from its minimum levels, but also suggests some of the principal mechanisms whereby such recovery is achieved.

Spring study period.

As expected, Microtus populations were still at low levels in the spring of 1971. A number of observations substantiated this expectation:

- (a) Trapping success was significantly higher than that in the spring of 1970, yet still remained significantly below the 1968 and 1969 levels.
- (b) In the meadows voles still occurred in small localized groups, a situation characteristic of low population densities.
- (c) Large amounts of dead herbaceous vegetation could be found in the meadows following snow melt-off. The relatively small over-wintering population of M. montanus apparently had not consumed the grass crop. This was in sharp contrast to the conditions recorded in the spring of 1970 when the meadows were virtually denuded of all vegetation.

Nevertheless, evidence was present already during the spring study period that the population of M. montanus was headed for a rapid buildup during the 1971 breeding season:

- (a) Reproduction on a population-wide scale had begun considerably earlier in 1971 than in 1970. By the end of the spring study period of 1970 (late May-early June) only 75% of the females were found to be pregnant. In contrast, during the 1971 spring study 100% of the females were already pregnant between the second and third week in May.
- (b) Litter sizes (based on embryo counts) were significantly higher in the spring of 1971 than in the spring of 1970. These were first litter pregnancies of the year (none of the females were lactating or showed placental scars). Since litter sizes in the spring of 1970 also represented the first litters of the year only, the data from the two years are strictly comparable.

The high level of reproductive activity in the population of spring 1971 alone would lead to a considerable increase in animal numbers. In addition, however, the breeding season started early. This means that offspring from the first litters would be able to enter the breeding population earlier in the season and could produce more litters during the 1971 breeding season.

Summer study period.

As expected, the most remarkable aspect was a significant increase in the population density of Microtus over the levels recorded in the summer of 1970. Although voles still occurred predominantly in small groups, there was a definite trend toward decentralization. Furthermore, for the first time since the crash extensive runways could once again be located. This feature was virtually absent during the summer of 1970.

Litter sizes were determined on the basis of embryo counts and/or placental scars. For adult females mean litter sizes did not differ significantly from those observed during 1970. However, litter sizes for subadult females were significantly higher than those observed for this age group in 1970. In Microtus montanus litter size is related to the parity of the female (increase in litter size up to the fifth litter). It might be argued that the earlier onset of breeding might have resulted in a smaller number of primiparous females at a comparable time in 1970 and in 1971, and that the increase in mean litter size is an artifact due to the fact that more subadult females would already be pregnant with their second litter. However, this explanation is not valid, since the increase in litter size was found both in primiparous and in multiparous females.

The rate of population growth in 1971 was therefore speeded by two factors: (1) a significantly greater breeding population in 1971 than in 1970, and (2) a significant increase in the mean litter size (females of both age groups considered together). The impact of these two parameters was actually reflected in the population density of Microtus. By the end of the summer the population had approximately quadrupled over the 1970 levels.

Another factor that undoubtedly contributed to the population buildup was possibly some decrease in predation pressure. Weasels (Mustela erminea and M. frenata) were very abundant in the study areas in 1969 and 1970. A significant decrease in the weasel populations had apparently occurred during the winter of 1970-71. This is in agreement with well documented observations that predator cycles lag behind those of their prey by approximately one year.

Materials collected during the spring and summer of 1971 are currently being processed at Louisiana State University in New Orleans. The results were not yet available at the time this report was due. Consequently, no data are available that would enable a correlation of reproductive responses of Microtus to environmental variables.

Note: In the summer of 1969 a mutant M. montanus male was collected from one of the study areas. Breeding experiments are not yet complete, however, results obtained so far indicate that this mutation (white spotting) is dominant and that the original animal was heterozygous for the condition. Several dominant white spotting mutations are known in mammals. However, the one now being studied in Microtus does not appear to be homologous to any known coat color mutation. There is also some indication that the homozygous dominant condition may be semilethal. Individuals of this genotype are pure white with black eyes. They are significantly smaller than their littermates (both spotted and wild type). Many of them die shortly after birth and a deviation from the expected ratio suggests that some individuals may die in utero. White individuals that do attain adulthood appear to be sterile.

Assisted by Mrs. Janet R. Smith and Mr. K. Dale Engler.
Supported by the New York Zoological Society.