EFFECTS OF ENVIRONMENTAL VARIABLES ON SOME PHYSIOLOGICAL RESPONSES OF *MICROTUS MONTANUS* UNDER NATURAL CONDITIONS

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Objectives

Cyclic fluctuations in the population density of microtine rodents have been known since antiquity. However, factors responsible for this phenomenon are not known.

The objectives of this long term study are essentially fourfold. First, to characterize the environmental variables that might affect *Microtus* in different seasons of the year. Second, to record the growth, maturation and reproductive activity of *Microtus montanus* under natural conditions. Third, to determine the maturational, as well as, seasonal pelage changes of these rodents. Fourth, the data resulting from the execution of the first three objectives would be correlated in an attempt to determine the causes underlying the multiannual fluctuations in population density of these microtine rodents.

Methods

Microtus montanus were livetrapped and sacrificed as soon as possible after capture. Age estimation for all animals was based on weight, total length, and pelage characteristics. Reproductive organs, the spleen and the adrenal glands were collected from the animals and preserved in Lillie's buffered neutral formalin for further histological study. Flat skins were prepared from all animals. All tissues are currently being processed at the Department of Biological Sciences, University of New Orleans.

In 1981 field observations in Grand Teton National Park were carried out over two study periods: spring (23-29 May) and summer (11 July - 11 August).

Results

The spring 1981 trapping effort resulted in the lowest spring trapping success ever recorded since the study began in 1969. Of course, spring trapping success is characteristically variable. At this time of the year *Microtus* frequently are found in very small, widely scattered

colonies. Such colonies are sometimes difficult to locate, especially in years of low dinsity. However, in the spring of 1981 virtually no voles could be found. The low trap yields could have been attributed partially to the almost continually cold and rainy weather throughout the entire spring study period. Nevertheless, the unexpected absence of any sign pointed to the possibility of a severe "crash". Reproduction apparently had begun during the second half of April. Indeed, one of the females was pregnant with the second litter. This is a relatively early onset of breeding for Microtus montanus at the north end of Jackson Hole. However, the early onset of breeding was not altogether unexpected, since the spring of 1981 was also relatively early in this area.

Trapping results from the summer study period immediately confirmed the spring findings: a major decline ("crash") had, indeed, taken place. The population density of Microtus in the summer of 1981 was the lowest since the density recorded eleven years earlier, in the summer of 1970. However, the severity of the 1970 crash was not repeated in 1981. For example, in the grid 344 trap nights were needed to trap one vole in 1981, whereas it took 818 trap nights to trap an animal in 1970.

As is common in years of very low population density, all voles could be found only in very small discrete colonies. In such colonies the few runways were confined to an area not exceeding ten meters in diameter. Generally the area covered by such runways in a given colony was in the neighborhood of three meters. Individual colonies were spaced at distances ranging from approximately thirty to eighty meters. The exceptionally luxuriant vegetation of 1981 made the location of these colonies particularly difficult.

As indicated, virtually all Microtus collected this summer were trapped within the boundaries of such colonies. The few voles taken at some distance from a colony were invariably adult males. This observation supports the contention that adult male Microtus range more widely than do adult females or immature animals of either sex.

Mean letter size was 5.7 for subadult females and 6.0 for adult females. These values approximate the mean litter sizes characteristic of subadult and adult females at this time of the year. It is noteworthy that the lowest litter size observed during the summer of 1981 was five - a high value for the smallest litter size in the summer. Furthermore, all females trapped (with the exception of very young juveniles) were either pregnant or lactating. In other words, reproductive activity was at a high level - only the size of the breeding population was very small. Nevertheless, the conditions were favorable for the breeding season in 1981. Furthermore, as observed in previous years of this study, animals that are born roughly before the first week in July enter the breeding population in the year of their birth. In 1981 a female that started to breed in mid-April could produce three litters that would enter the breeding population in 1981. Not only that - the young from the first litter of the year would even have time to produce a litter of their own

that would have time to produce a litter that would also enter the breeding population in 1981! Additionally, in distinct opposition to the summer of 1980, there probably was lower predation pressure from weasels and coyotes in the summer of 1981. No weasels were trapped in the grid. Only one Mustela frenata and two Mustela erminea entered the unbaited Sherman traps in the other study areas. No coyotes were sighted in the study area on a regular basis. Similarly, no traps were carried off by coyotes - a characteristic problem of other years, especially whenever pups are being raised in the immediate vicinity of the study area.

As a result, it is expected that there will have been a dramatic increase in population density of Microtus montanus by the time of the next proposed sampling in 1982.

Conclusions

A "crash" - similar to that in 1970 - took place in the population density of Microtus montanus in 1981. However, the circumstances in 1970 and 1981 were vastly different. The 1970 "crash" followed a year of high population density. The 1981 "crash" represented the second consecutive year of a decline in the population density of M. montanus. No explanation is available for this unexpected phenomenon.

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