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Robert K. Rose

*Georgetown University*

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## POPULATION DYNAMICS AND REPRODUCTION IN VIRGINIA MEADOW VOLES

Robert K. Rose  
Assistant Professor of Biology  
Georgetown University  
Washington, D.C. 20057

This paper describes changes in important demographic parameters of a grassland (non-orchard) population of the meadow vole (*M. pennsylvanicus*) studied since November 1974 near Charlottesville in piedmont Virginia. (This study was supported by the Dept of Biology of the University of Virginia until August 1976, and is now the joint project with Ray D. Dueser, Dept of Environmental Sciences, UVA, and is supported by our respective departments.) Methods used are similar to those of C.J. Krebs, and require weekly live-trapping during which each vole is weighed and assessed for reproductive state and new voles are tagged. Such information has been summarized using Krebs' demographic programs and gives population information on density (minimum number known to be alive), growth and survival rates for each sex, plus movement and other data. The patterns reported here are those of the two control grids, and are repeated in principle on four experimental grids on the same (Birdwood) research tract.

In addition, between October 1974 and August 1976, I collected monthly samples of voles for autopsy, used to provide the details of changing reproductive effort. Such voles also provide an independent sample for estimating density or examining body weight dynamics.

Results: Vole density, highest in late autumn, was twice as great (136 voles) the first compared to the second and third winters. Vole numbers may recover slightly in late spring. High autumn densities and substantial attrition throughout the winter months is the pattern of the so-called "annual" species.

This population shows little or no evidence of a seasonal delay in growth rates. Except for one month for males and four months for females, the regressions of growth rates on body weights are positive. The populations of young voles (those weighing less than 30 g) always have positive growth rates, even during the wintertime, and for both sexes.

Survival rates for both sexes fluctuate, with summer and winter having higher rates for both sexes compared to spring and autumn. Furthermore, there appears to be a relationship between the drop in survival of adult males and the recruitment of juveniles into the population. Young seem to grow up only when adult survival is low. An experiment, using altered densities of adult males, is in progress to test the possible relationship between adult male survival and the rate at which young are recruited.

Except for the winter of highest numbers when the proportion of nonfertile voles was high, reproductive effort in this population has been at a high level. Beyond February 1975, and including the six months in which the population was still in a sharp decline in numbers, more than 80 percent of males were fertile,

and except for January 1976, at least one-third of the females greater than 19 g were pregnant.

Voles of the demographic grids confirm this observation--of a high level of reproductive effort, yet young are successfully incorporated into the population only during periods of reduced survival of adults, especially males. What results, then, are periods in the year when the population turns over, as indicated by sharp (11 g) drops in the mean weights of samples from October to November 1975, and March to April 1976.

Conclusions: There are periods during the year (in late summer and late winter, especially) when the population is very unbalanced and made up exclusively of large adult voles, many of which are near the end of their normal field lives. Methods of treatment may be hard to administer during the winter months, but the population may be most susceptible then, particularly so because individuals are much more diurnal at this time of year. In the summertime, voles have their trappability reduced substantially, to the lowest level observed throughout the year. Yet voles are extremely sensitive to heat stress, and will die of heat prostration within minutes if left exposed to the midsummer heat. Meadow voles are much more nocturnal during the summer or warmer months, and probably spend a portion of each active period underground losing heat.