

FIELD METABOLIC RATES AND COHORT ANALYSIS  
IN MICROTINE RODENTS

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Objectives

The 1988 field season turned out to be a most unusual year. Extreme drought conditions prevailed for the entire growing season following an early melt-off. This provided an unprecedented opportunity to analyze cohort responses to an extreme environmental fluctuation in Microtus montanus. The basic objectives of this study are to analyze cohort responses to environmental fluctuations and to compare the energetic expenditures in two species of microtine rodents, Microtus montanus and Microtus logicaudus.

Methods

Livetrapping, marking and recapture on study grids from May to October permits us to analyze cohort recruitment, growth, sexual maturation and longevity. Total energy expenditure in free-ranging Microtus is measured by the doubly-labelled water technique and analysis of blood plasma samples by isotope ratio mass spectrometry.

Results

Analyses of our 1987 and 1988 data for Microtus montanus reveal striking differences in cohort phenotypic responses to environmental fluctuation. In 1987, melt-off was early, followed by favorable precipitation during the growing season. In contrast, an early melt-off in 1988 was followed by unusually dry conditions throughout the summer. In both years, three cohorts were produced but with very different results. In 1987, cohort I and II animals grew very rapidly and most (>90%) were reproductively active (Figs. 1 and 2). On the other hand, in the dry summer of 1988, both males and females in cohorts I and II exhibited sharply arrested growth rates, and only a few early cohort I animals became reproductively active (Figs. 1 and 2). The result was a much reduced

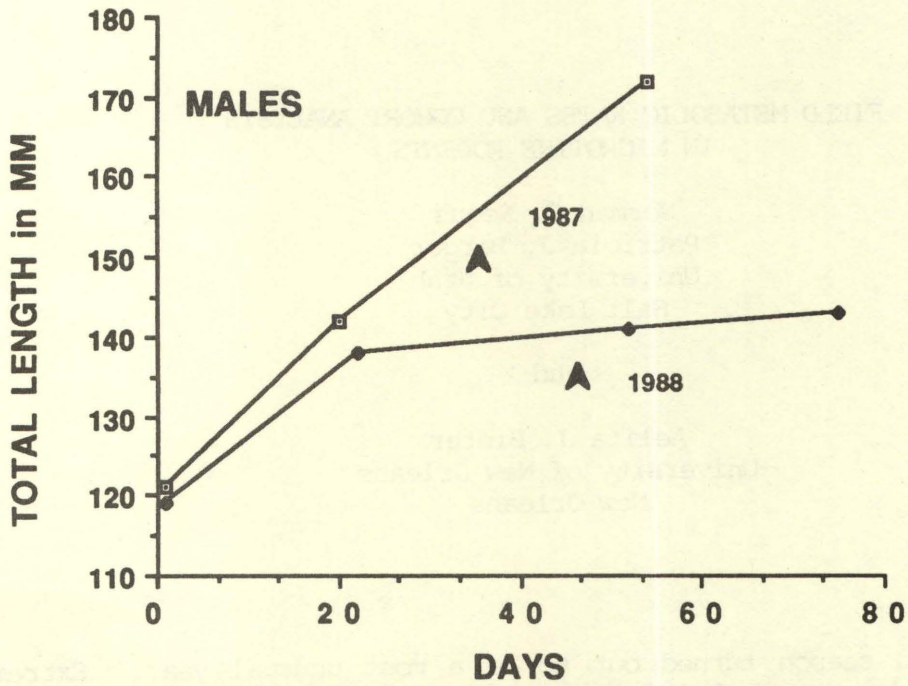


Figure 1: COHORT II GROWTH RATES: 1987 AND 1988

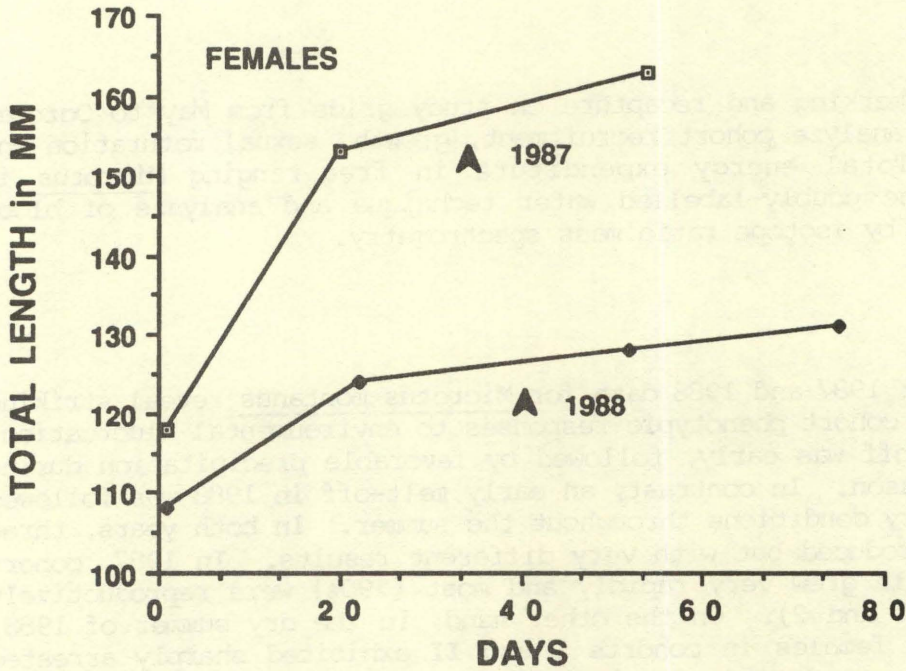


Figure 2: COHORT II GROWTH RATES : 1987 AND 1988

recruitment into cohort III (Fig. 4). These data represent a remarkable example of the extreme phenotypic plasticity that characterizes Microtus montanus. In a typical year such as 1987, cohort I and II animals mature rapidly and reproduce, but do not survive the following winter. Virtually the entire breeding stock the next spring is composed of cohort III animals that typically have high overwintering survivorship (Negus, Berger and Brown, 1986; Negus and Berger 1988). In 1988, all three cohorts delayed sexual maturation and entered the winter as individuals of subadult size. If overwintering survivorship is high in these animals as might be expected, then 1989 may be a year of unprecedented population growth, assuming environmental conditions are favorable.

Our impression is that Microtus logicaudus does not exhibit the cohort phenotypic plasticity that we observe in M. montanus, but our data base at present for this species is weak, primarily due to the fact that logicaudus is never very abundant. However, we have located a rather extensive M. logicaudus population that should yield adequate data in 1989.

Field metabolic rates were measured in 32 Microtus montanus in 1988, using the doubly-labelled water isotope technique. Blood plasma samples from these animals are currently being analyzed in our isotope ratio mass spectrometer at the University of Utah.

#### Literature Cited

- Negus, N. C., P. J. Berger and B. W. Brown. 1986. Microtine population dynamics in a predictable environment, *Canad. J. Zool.*, 64:785-792.
- Negus, N. C., and P. J. Berger. 1988. Cohort Analysis: Environmental cues and diapause in microtine rodents. Chap. 3 in: *Evolution of Life Histories in Mammals*, ed. by M. Boyce. pp. 65-74. Yale University Press.

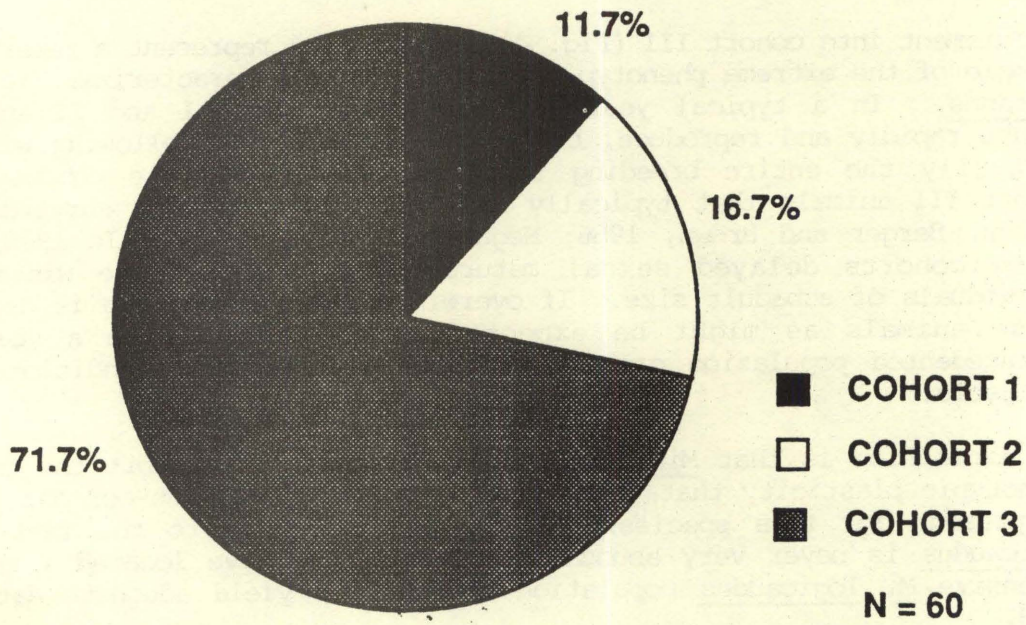


Figure 3 : COHORT COMPOSITION FALL 1987

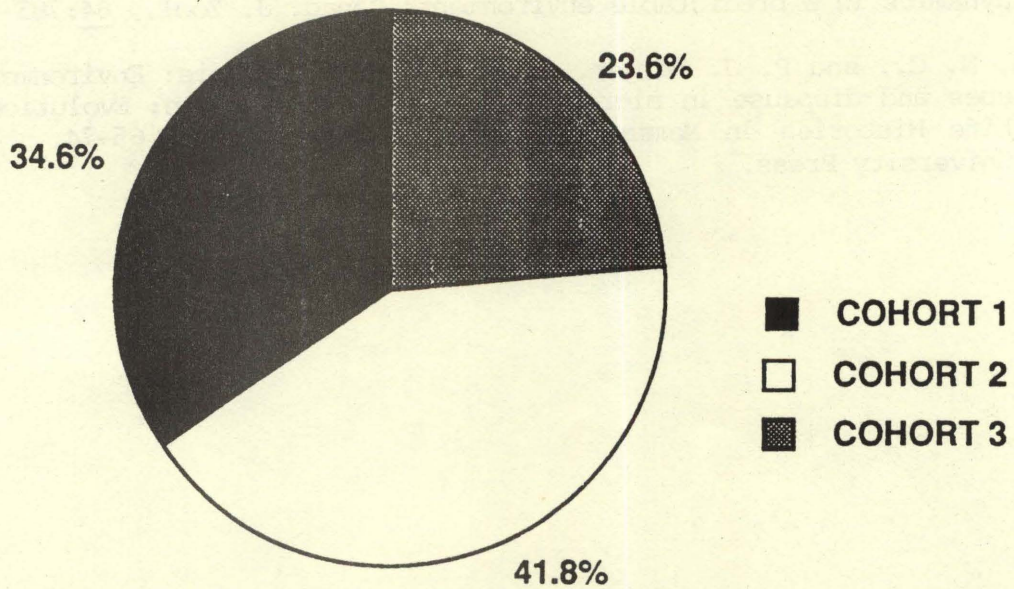


Figure 4 : COHORT COMPOSITION FALL 1988