

Population dynamics and dispersal patterns of common voles (*Microtus arvalis*)

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Abstract

Outbreaks of common voles (*Microtus arvalis*) can cause significant losses in agriculture and forestry. To minimise damage it is useful to prevent voles from dispersing from refuges to arable land (Lidicker, 1975; Singleton et al., 2003). To apply timely and spatially targeted management methods, sound knowledge about the distribution patterns of voles at field-refuge-boundaries is required. Field sites for this study, funded 2009-2012 by the German Federal Environmental Foundation (DBU) are located in Saxony-Anhalt, Germany. Circular grassland areas below wind energy plants are used as replicated experimental refuges. Barrier fences were installed in 10 of 16 refuges that allow immigration but prevent emigration. Capture-mark-release revealed a population expansion August 2010. Individual number rose higher in refuges without barrier fences. Mowing in June and September 2010 had a negative effect on vole abundance. Aerial pictures and telemetry studies are used to detect vole distribution onto the field. The analysis of dispersal dynamics will be continued and appropriate management methods will be tested in the last year of the study.

Keywords: capture-mark-release, common vole, dispersal pressure, distribution patterns, management methods, *Microtus arvalis*

Introduction

At high abundances, common voles (*Microtus arvalis*) can cause significant losses in agriculture and forestry, because they can disperse from refuges (e.g. field edges) to arable land. This study, funded 2009-2012 by the German Federal Environmental Foundation (DBU), aims to investigate population dynamics and distribution patterns of common voles at field-refuge-boundaries as a basis to develop methods for sustainable vole management. Field sites are located in Saxony-Anhalt, Germany. Grassland areas (320 m²) below wind energy plants, from which common voles invade fields, are used as experimental refuges (n=16). To measure dispersal pressure, barrier fences were installed at 10 refuges that allow immigration but prevent emigration. Since October 2009, population dynamics and dispersal rate from refuges to fields are surveyed monthly.

Materials and methods

Capture-mark-release was used to measure population size; body weight, sex and reproductive status of each individual were assessed. Additionally, weather parameters, vegetation height and cover were measured. Radio-telemetry was applied to reveal individual dispersal dynamics to the field. With the help of aerial pictures, possible vole activity on adjacent fields was surveyed to analyze distribution patterns on the population level.

Results

More than 800 individuals have been marked so far. Recapture probability within a trapping session was >50%. Extrapolated vole density in refuges with barrier fence averaged 150–300 ind./ha (October 2009 to July 2010). In May, reproductive activity started and resulted in up to 850 ind./ha in August 2010 (extrapolated). As predicted by the Chitty-effect (Krebs, 1978), average body weight was highest in the phase of high population density (Burthe, 2010). Population size in refuges without barrier fence was slightly lower in spring, but higher in autumn compared to the fenced areas. Mowing in June and September 2010 reduced vole abundance both in refuges with and without barrier fence remarkably, whereas effects were more distinctive for the latter. In 2010, 20 adult voles were equipped with a radio-collar and released outside the refuge. However, all returned to the refuge within two days. Consequently, no vole activity could be noticed in the field so far by means of aerial pictures. Over-

wintered voles in spring 2011 were on average 5 g heavier compared to voles in the previous year, while the proportion of juveniles increased to 20%.

Discussion

A reasonable population increase could be detected in August 2010, but did not lead to a dispersal of voles onto the field so far. It can be assumed that the maximum population density in the refuges is not yet reached. The observed negative influence of shortening vegetation on the number of individuals has been shown in other studies before (Jacob and Hempel, 2003). Higher population sizes in refuges without barriers compared to refuges with barrier fence in autumn 2010 could be a result of higher immigration rates. Subsequent DNA-analyses (microsatellites, parentage exclusion) will reveal new individuals in refuge populations. Influence of field cultivation (ploughing, fallow) could be one reason for the lack of established vole populations on the field so far (Jacob and Halle, 2001). The analysis of dispersal dynamics will be continued and appropriate management methods (barrier fences and -furrows, pit fall traps) will be tested in the last year of the study.

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