Live-trapping studies - How to estimate two small rodents densities using spatially explicit capture-recapture (SECR) model

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Introduction

Management agencies and quantitative ecologists need robust estimates of population density. The best way of converting population estimates of live trapped small mammals to population density is not clear. The main aim of this study was to use spatially explicit capture recapture model (SECR) to estimate the densities of two sympatric Mongolian rodents (*Apodemus peninsulae, Microtus fortis,* Fig. 1, 2) using grid live trapping in different habitats of taiga climatic zone of West Khentey region Northern Mongolia.

Fig. 1. *Apodemus peninsulae* density was decreased dramatically in 2011 when the density of *M. fortis* increased

Fig. 2. *Microtus fortis* –Regional status is data deficient but this species preferred open meadow habitats

Methods

In August and September 2010 and in July and August 2011, we catched individuals with live traps arranged in a grid of 100 x 100 m each with 121 Sherman traps, operating each for a five days period monthly. The animals were individually marked by toe clipping and their density was estimated using likelihood-based spatially explicit capture-recapture (SECR) model in program DENSITY 4 using two heterogeneity estimators: M_0 (Null) and M_h (Jackknife). We compared mean of M_0 and M_h estimations with the help of Spearman rank correlation coefficient tests.

Results

For *A. peninsulae* we trapped 35.9 ind./ha in 2010 and 22.8 ind./ha in 2011. For *M. fortis* were 22.5 ind./ha in 2010 and 57.7 ind./ha in 2011. SECR–analysis revealed similar density estimations for each species using both estimators M_0 and $M_{h,}$ resp. (Table 1). Densities of *M. fortis* were significantly higher than *A. peninsuale* (r_s = 0.97, p < 0,0001). Between years density differed in both species.

Species	Mean ind./ha ± SE M_0 (Null)	M_h (Jackknife)
Myodes rufocanus	13.2 ± 2.5	12.6 ± 2.1
Microtus fortis	18.3 ± 3.6	16.4 ± 2.3

Table 1. Summaries of spatially explicit capture-recapture model parameters for *A. peninsulae* and *M. fortis* densities with live trapping grid in West Khentey, Northern Mongolia

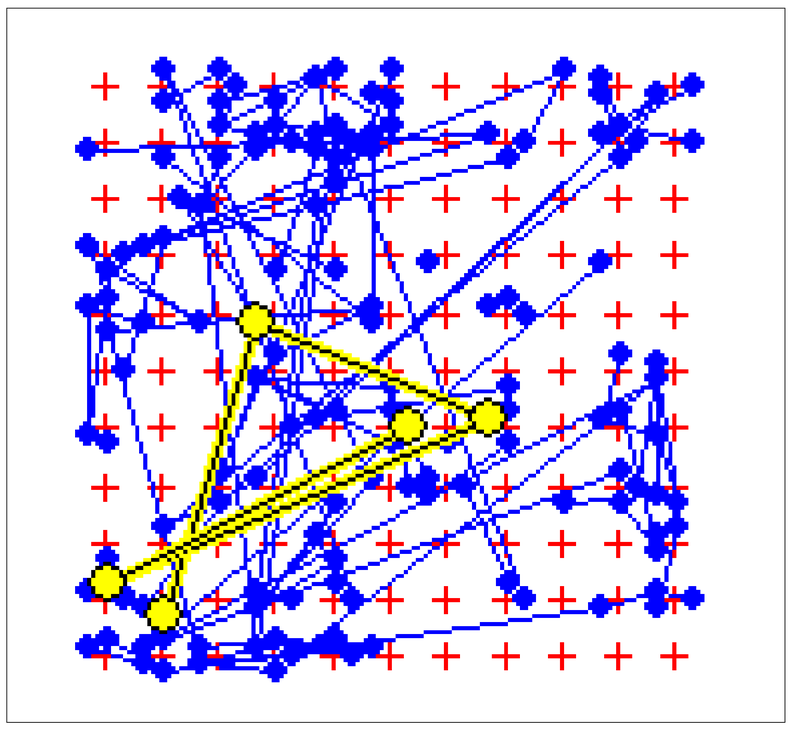

Fig.3 Trapping grid with one trap at each +. Blue dots represent capture events on our trapping grids. Yellow dots represent captures of a male *M. fortis* compared to all *M. fortis* captures (blue). Lines represent the recaptures history for different individuals.

Study area

The study area is a part of the West Khentey Mountain Range, which is located to the south of Lake Baikal, near the border between Mongolia and Russia. The study site is in the transition zone between the southern extension of the Siberian taiga and the forest steppe. In the region, western Siberian dark taiga forests meet the eastern Siberian light taiga forests and the vegetation is heterogeneous with various types of forests, shrubs and meadows.

Discussion

We present the first robust density estimate for these two small rodents from West Khentey. This indicates a substantial *A. peninsulae* and *M. fortis* population within mountain taiga forest of Mongolia. SECR models offer powerful tools for estimating densities of individually identifiable species using individual-based models of the capture process. We suggest that maximum-likelihood methods provide a perfect tool to estimate densities of the rarely studied small mammals in Taiga forests.

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