Vole field effect studies for ERA refinement at higher tiers

How many voles are enough?

Silke Laucht, Dirk Nickisch, Alexander Singer, Oliver Jakoby, Tina Grimm

RIFCON GmbH, Goldbeckstraße 13, 69493 Hirschberg, Germany – silke.laucht@rifcon.de

Meet us at booth 25

Introduction

The current EFSA bird and mammal guidance (2009) gives advice on how potential adverse effects of pesticides on wild vertebrates can be assessed. One option for higher tier assessments is to conduct field effect studies to monitor potential acute or long-term effects on small mammal populations using a capture-mark-recapture design. However, the guidance does not give any details on the desired study set-up, and studies conducted so far vary considerably. Feasibility and effort, restricted due to time and cost constraints, have certainly an impact on the quality of higher tier data from field studies for small mammal risk assessments. One important element in this typical trade-off between needs and feasibility is the number of consecutive trapping events (i.e. number of days/nights of small mammals trapping) within each trapping session, resulting in more or less captured individuals. Combined to trapping session, such individual-based data reflect more or less accurately the respective parameters of the populations inhabiting the fields and their surroundings. Here, we examine how many consecutive trapping events are desirable per trapping session to obtain representative data of such populations.

Analysis

We analysed different common vole trapping data sets to evaluate the effect of additional trapping events:

- The descriptive evaluation of all data sets did not show any obvious treatment effects on common vole populations.
- Subsets of data sets with 3 trapping events were made including only the first, only the first and the second, and all three trapping events.
- Capture-recapture models provided in the RMark package were used to calculate and compare estimates of survival rates, recapture probabilities and abundances.
- Generalised Linear Mixed Effect Models (GLMMs) (Zuur et al. 2009) were used to investigate the implications of number of trapping events on treatment effects.

Example Results

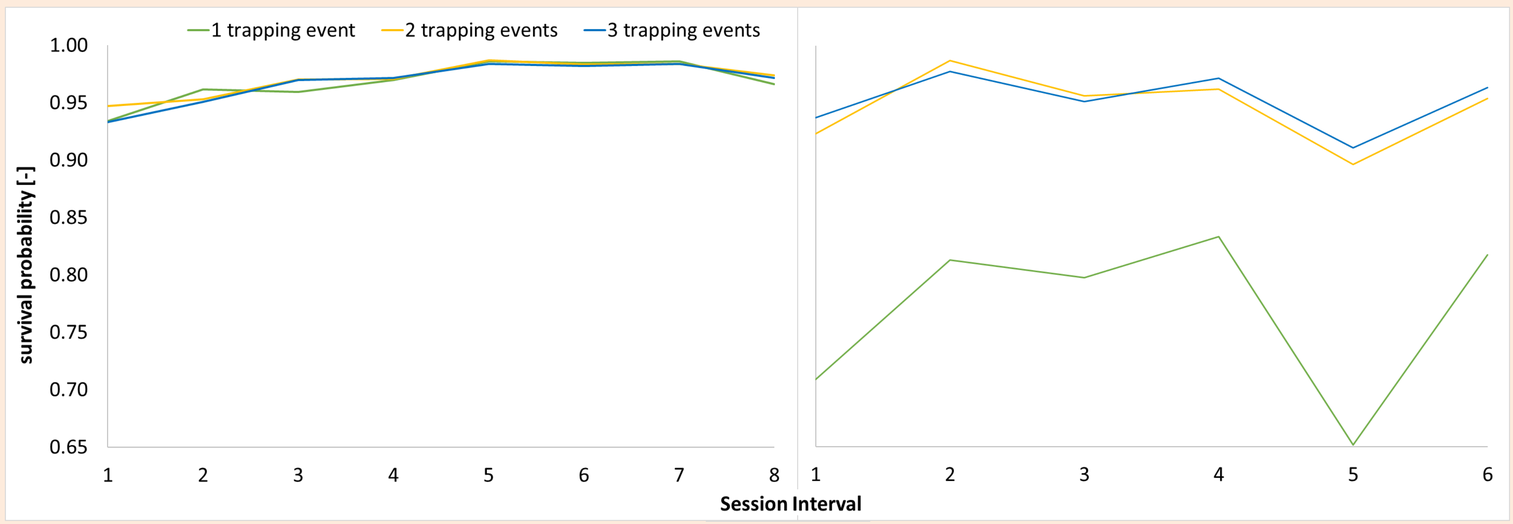
MNA = Minimum Number Alive according to Krebs (1989); common parameter to estimate population sizes based on the sum of all individuals known to be alive during a specific trapping event
Effect size = difference between model estimate on control and treatment plots, on the transformed scale of the GLMM (here: log-link)

Data set	1 trapping event	2 trapping events	3 trapping events
	No. of captures / individuals	No. of captures / individuals	No. of captures / individuals
A	370 / 240	860 / 360	1410 / 470
B	350 / 240	840 / 380	1360 / 480
C	2720 / 1540	5770 / 2130	8810 / 2500
D	560 / 340	1140 / 450	1750 / 540
E	70 / 50	150 / 80	240 / 100

Trapping grid on bare soil and Ugglan live trap in detail

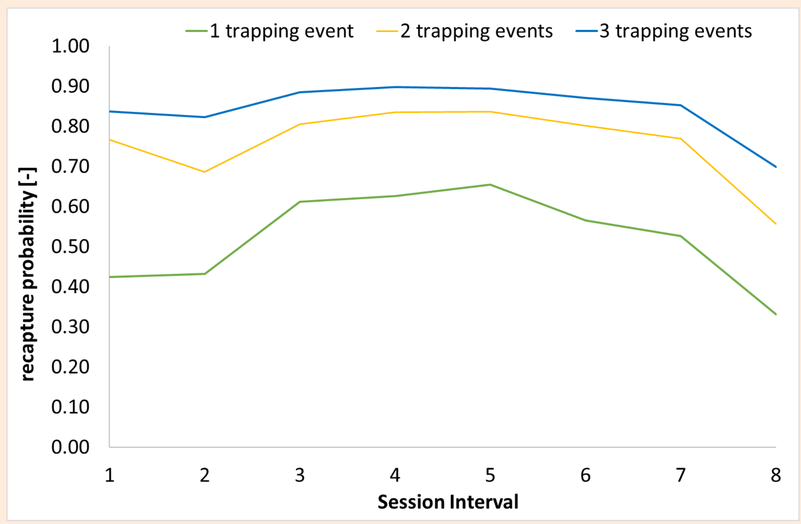
Data set	1 trapping event	2 trapping events	3 trapping events
	Effect size / p	Effect size / p	Effect size / p
A	1.00 / 0.16	0.66 / 0.39	0.73 / 0.33
B	0.62 / 0.33	0.66 / 0.24	0.66 / 0.24
C	-0.33 / 0.01	-0.19 / 0.23	-0.16 / 0.32
D	0.11 / 0.77	-0.01 / 0.98	0.06 / 0.87
E	-0.33 / 0.53	-0.19 / 0.75	-0.15 / 0.78

Effect sizes and p-values are results of GLMMs of MNA in relation to treatment.



Data set C - a high number of captures

Data set B - a low number of captures



Data set C - a high number of captures

Survival and recapture probabilities were estimated with RMark ('CJS Model') and evaluations were done for three different subsets considering 1, 2 and 3 trapping events

Conclusion And Outlook

- One trapping event is a good indicator for trends, but can result in misleading interpretations of the data (pseudo-effects).
- Two trapping events are in all investigated cases sufficient for appropriate data evaluation & interpretation.

To be investigated:

- Are data collected from several trapping sessions with short inter-session intervals of better quality compared to data collected from several trapping events within one session?
- Does the questioned relationship vary between different combinations of species and habitats (e.g. voles in meadows or wood mice in cereal fields)?

Common vole
Microtus arvalis

References

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Zuur, A., Ieno, E.N., Walker, N., Saveliev, A.A. & Smith, G.M. (2009). Mixed Effects Models and Extensions in Ecology with R. Springer, New York.

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