Population Dynamics – Session 2

Multi-scale density-dependent dispersal in spatially structured populations

Xavier Lambin[1], Chris Sutherland[2], David Elston[3]

[1]University of Aberdeen, Aberdeen, UK, x.lambin@abdn.ac.uk
[2]University of Massachusetts-Amherst, Amherst, USA
[3]Biomathematics and Statistics Scotland, Aberdeen, UK

In spatially structured populations, dispersal is context-dependent and related both to local conditions (within patches) and to the metapopulation as a whole. Density-dependence experienced at different scales likely plays a role in initiating dispersal and determining dispersal success. This multi-scale density-dependence has hitherto received little attention despite its potential to produce spatiotemporally heterogeneous dispersal rates and fundamentally alter predictions about metapopulation dynamics and persistence. We developed a spatially explicit metapopulation model to quantify dual-scale density-dependence using data from a metapopulation of water voles *Arvicola amphibius* in Assynt North West Scotland where those rodents grow up to 300 g, live in small colonies and occupy 8% of the 860 km waterway network with slow flowing water and vegetated banks. Average dispersal was large scale with a colonization halving distance of 4.14 km. The per capita probability that a dispersal event resulted in successful establishment, or prevented extinction via the rescue effect, was higher for juveniles living in source patches with larger population sizes, i.e., consistent with positive local density-dependent emigration, and higher in years when the number of occupied sites in the metapopulation was lowest, i.e., consistent with negative regional density-dependence. In model simulations, multi-scale density-dependent dispersal induced increased variability in metapopulation dynamics and hence increased extinction risk. This was offset by increased dispersal success in low occupancy years. Thus, negative density dependent dispersal at the metapopulation scale partly counters the heavily destabilising impact of positive density dependence at the local scale. We suggest that metapopulations can only persists where those influences counter each other.

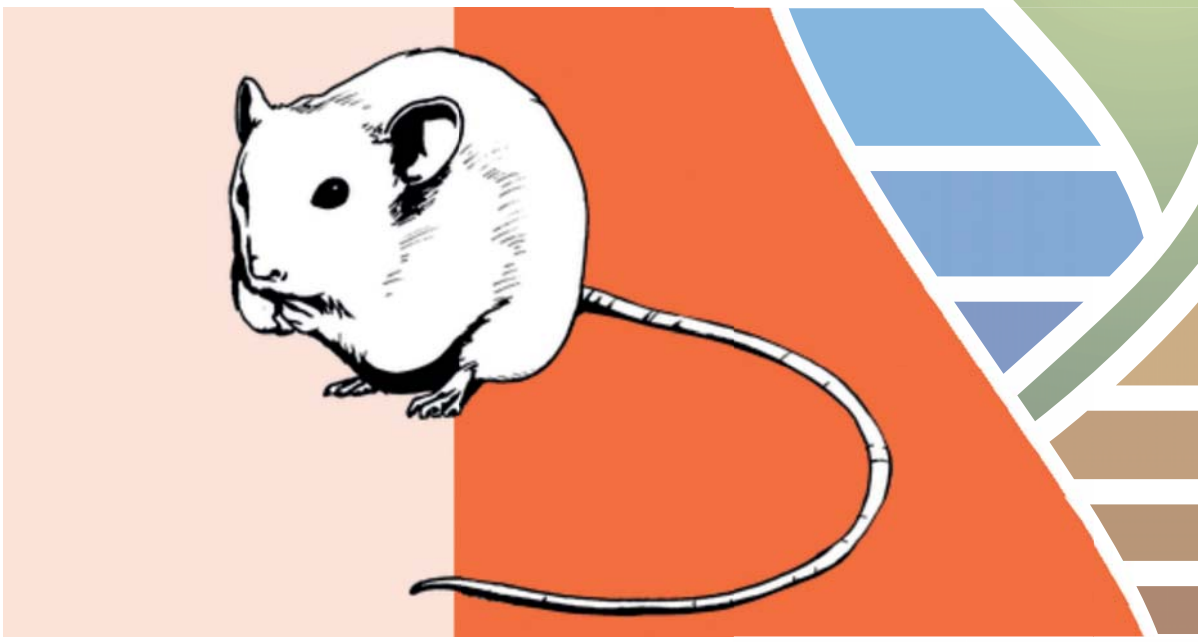
459
Julius-Kühn-Archiv

Jens Jacob, Jana Eccard (Editors)

6th International Conference of Rodent Biology and Management and 16th Rodens et Spatium

Potsdam, Germany, 3-7 September 2018

Book of Abstracts



Julius Kühn-Institut
Bundesforschungsinstitut für Kulturpflanzen

459
Julius-Kühn-Archiv

Jens Jacob, Jana Eccard (Editors)

6th International Conference of Rodent Biology and Management and 16th Rodens et Spatium

Potsdam, Germany, 3-7 September 2018

Book of Abstracts

Julius Kühn-Institut
Bundesforschungsinstitut für Kulturpflanzen

Editors:
Jens Jacob[1] and Jana Eccard[2]
[1]Julius Kuehn Institute, Federal Research Centre for Cultivated Plants,
Institute for Plant Protection in Horticulture and Forests, Vertebrate Research,
Toppheideweg 88, 48161 Münster, Germany
[2]University of Potsdam, Institute of Biochemistry and Biology,
Animal Ecology Group, Maulbeerallee 1,
14469 Potsdam, Germany

Bibliografische Information der Deutschen Nationalbibliothek
Die Deutsche Nationalbibliothek verzeichnet diese Publikation
In der Deutschen Nationalbibliografie: detaillierte bibliografische
Daten sind im Internet über http://dnb.d-nb.de abrufbar.

ISSN 1868-9892
ISBN 978-3-95547-059-3
DOI 10.5073/jka.2018.459.000

Printed in Germany by Arno Brynda GmbH, Berlin.