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The stag beetle: a collaborative conservation study across Europe

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Lucanus cervus L. (the stag beetle) is found across much of Europe where, throughout its range, it is a species of restricted abundance and conservation interest. However, to date a great deal of the work undertaken on the insect has been carried out by individuals or groups working separately in each country (e.g. Harvey, 2007; Thomaes *et al*., 2008). At best, this approach may lead to uncoordinated repetition of techniques, whilst at worst, it may fail to identify the needs of a species, if these differ across regions, resulting in population declines that cannot be reversed.

Furthermore, as with many rare insect species, the European distribution of *L. cervus* is believed to be made up largely of metapopulations, i.e. discrete local populations connected by dispersal (Leisnham & Jamieson, 2002). In these, each of the local contributing populations will be different in terms of age, genetics, biotic and abiotic influences, meaning that each may face a different risk of extinction (Hanski, 1999). Therefore, as population persistence depends on the quantity, quality and connectivity of habitats, it is essential that the correct habitat structure is maintained in all areas where such species exist (Hanski, 1999). Increasing fragmentation of the landscape in urban areas, a major part of the habitat of *L. cervus* across parts of Europe, may lead to habitat density decreasing, with consequent reductions in dispersal rates, and a decline in the rate of establishment of new populations. For an insect that has a long life cycle (up to 6 years in the larval stage) and limited dispersal (Rink & Sinsch, 2006), habitat colonisation rates may commonly fall below a threshold necessary to sustain the metapopulation and extinction will follow (Hanski, 1999).

Whilst *L. cervus* seems to exist in metapopulations, it is clear that those who monitor the species often do not. In this volume are presented the results of a collaborative conservation study of the species across Europe, with information shared across entomologists in a metapopulation-like fashion. The need for such an effort was identified by the fact that previous conservation strategies were determined on a countrywide basis, informed by research carried out within limited geographical areas. Often these were based on single reports of favoured habitats that may be unusual across the range of the species. Such an example is Tochtermann (1992) which reports that the favoured habitat of the insect is oak woodland. Whilst this appears to be true in some parts of the European range, in other areas the beetle seems commoner in urban environments, where oak is rare (Percy *et al*., 2000). Thus, for successful insect conservation, collaboration and information sharing amongst researchers is crucial, as it not only serves to establish protocols, but also, more importantly, highlights differences in the biology of a species across the whole of its range and prevents folklore from becoming 'fact'.

Trying to establish the life cycle and requirements of many saproxylic and subterranean organisms, including *L. cervus*, presents problems since the protracted larval stage, followed by a short crepuscular adult phase, make research that is statistically and biologically significant difficult to achieve. In this issue, Harvey *et al*. (2011a) present a variety of novel, non-invasive methods for its detection and quantification, which should result in an improved knowledge of the species' abundance. These techniques should be applicable to a wide range of subterranean and saproxylic species, whose larvae are invisible within a solid substrate.

Successful conservation programmes must not just take into account prevailing circumstances, but also look to the future, when environmental and climatic conditions may be different. Predicted climate changes may have an enormous impact on the ecology and distribution of many organisms (Walther *et al*., 2002). Here, Rink and Sinsch (2011) outline the adverse effects of increasing temperature on *L. cervus* by considering life condition and activity period. This paper highlights the importance of considering abiotic influences on all stages of an insect's development. Whilst the subterranean larvae may be buffered against temperature changes, it is clear that the adults are quite sensitive to abiotic effects.

There are very few reports in the literature of collaborative initiatives covering the entire range of an endangered species, a notable exception being Ranius *et al*. (2005) who described the distribution and conservation strategies for another rare beetle, *Osmoderma eremita*. This multi-author paper is an excellent example of information sharing amongst laboratories leading to a comprehensive conservation plan. Here, Harvey *et al*. (2011b) present a similar analysis of the bionomics and distribution of *L. cervus* across 41 countries. Such projects allow the organism's biology to be understood on a regional scale, thus enhancing the prospects of successful conservation. Biological differences revealed at these scales may lead to population genetics studies that can inform conservation strategies.

It is hoped that the papers in this issue will stimulate other cross-country studies of insect conservation across large areas.

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Indeed, such projects can arise from very little research funding, as the majority of data can be shared using internet resources. If we are to be successful in the conservation of rare insects then we must conduct studies at scales that are meaningful to the species concerned, rather than artificial ones arising from political boundaries.

References

Hanski, I. (1999) *Metapopulation Ecology*. Oxford University Press, Oxford, UK.

Harvey, D.J. (2007) *Aspects of the Biology and Ecology of the Stag Beetle (Lucanus cervus (L))*. Unpublished PhD thesis, University of London, London, UK.

Harvey, D.J., Hawes, C.J., Gange, A.C., Finch, P., Chesmore, D. & Farr, I. (2011a) Development of non-invasive monitoring methods for larvae and adults of the stag beetle, *Lucanus cervus*. *Insect Conservation and Diversity*, **4**, 4–14.

Harvey, D.J., Gange, A.C., Hawes, C.J., Rink, M., Abdehalden, M., Al-Fulaij, N., Asp, T., Ballerio, A., Bartolozzi, L., Brustel, H., Cammaerts, R., Carpanetto, G., Cederberg, B., Chobot, K., Cianferoni, F., Drumont, A., Ellwanger, G., Ferreira, S., Grosso-silva, J., Gueorguiev, B., Harvey, W., Hendriks, P., Istrate, P., Jansson, N., Jelaska, L., Jendek, E., Jovic, M., Kervyn, T., Krenn, H., Kretschmer, K., Legakis, A., Lelo, S., Moretti, M., Merkl, O., Mader, D., Palma, R., Neculiseanu, Z., Rabitsch, W., Rodriguez, S., Smit, J., Smith, M., Sprecher-Uebersax, E., Telnov, D., Thomaes, A., Thomsen, P., Tykarski, P., Vrezec, A., Werner, S. & Zach, P. (2011b) Bionomics and distribution of the stag beetle, *Lucanus cervus* (L) across Europe. *Insect Conservation and Diversity*, **4**, 23–38.

Leisnham, P.T. & Jamieson, I.G. (2002) Metapopulation dynamics of a flightless alpine insect *Hemideina maori* in a naturally fragmented habitat. *Ecological Entomology*, **27**, 574–580.

Percy, C., Bassford, G. & Keeble, V. (2000) *Findings of the 1998 National Stag Beetle Survey*. People's Trust for Endangered Species, London, UK.

Ranius, T., Aguado, L.O., Antonsson, K., Audisio, P., Ballerio, A., Carpaneto, G.M., Chobot, K., Gjurašin, B., Hanssen, O., Huijbregts, H., Lakatos, F., Martin, O., Neculiseanu, Z., Nikitsky, N.B., Paill, W., Pirnat, A., Rizun, V., Ruicănescu, A., Stegner, J., Süda, I., Szwako, P., Tamutis, V., Telnov, D., Tsinkevich, V., Versteirt, V., Vignon, V., Vögeli, M. & Zach, P. (2005) *Osmoderma eremita* (Coleoptera, Scarabaeidae, Cetoniinae) in Europe. *Animal Biodiversity and Conservation*, **28**, 1–44.

Rink, M. & Sinsch, U. (2006) Radio-telemetric monitoring of dispersing stag beetles: implications for conservation. *Journal of Zoology*, **272**, 235–243.

Rink, M. & Sinsch, U. (2011) Warm summers negatively affect duration of activity period and condition of adult stag beetles (*Lucanus cervus*). *Insect Conservation and Diversity*, **4**, 15–22.

Thomaes, A., Kervyn, T., Beck, O. & Cammaerts, R. (2008) Distribution of *Lucanus cervus* (Coleoptera: Lucanidae) in Belgium: surviving in A Changing Landscape. *Revue D'Ecologie la Terre et la Vie*, **63** (Suppl. 10), 147–152.

Tochtermann, E. (1992) Neue biologische fakten und problematik der hirschkäferförderung. *Allemagne Forst Zeitschrift*, **47**, 308–311.

Walther, G.-R., Post, E., Convey, P., Menzel, A., Parmesan, C., Beebee, T.J.C., Fromentin, J.-M., Hoegh-Guldberg, O. & Bairlein, F. (2002) Ecological responses to recent climate change. *Nature*, **416**, 389–395.

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