Mammalian Biology 79 (2014) 349–356

Contents lists available at ScienceDirect

Mammalian Biology

journal homepage: www.elsevier.com/locate/mambio

Original Investigation

Identifying conservation priorities when data are scanty: A case study with small mammals in Italy

Sandro Bertolino[a,*], Marco Girardello[b], Giovanni Amori[c]

[a] Department of Agriculture, Forest and Food Sciences, Via L. da Vinci 44, 10095 Grugliasco, TO, Italy
[b] Ecoinformatics and Biodiversity Group, Department of Bioscience, Aarhus University, DK-8000 Aarhus C, Denmark
[c] CNR National Research Council – Institute of Ecosystem Studies, Viale dell'Università 32, 00185 Roma, Italy

ARTICLE INFO

Article history:
Received 24 January 2014
Accepted 23 June 2014
Handled by Adriano Martinoli
Available online 15 July 2014

Keywords:
Conservation
Erinaceomorpha
Ranking system
Rodentia
Soricomorpha

ABSTRACT

Species prioritisation is an important component of conservation strategies. However, identifying species that are threatened is not easy for many taxa that lack detailed information on distribution and population trends. We propose a ranking system for small mammals, based on their degree of vulnerability and their conservation value. Scores were derived from data on life history traits and ecological requirements of individual species, with respect to their sensitivity to changes in landscape and the composition and qualities of ecosystems. Twelve variables were considered, related to the distribution, demography, ecological adaptability, and their endemism and taxonomic diversification. Rodents with the highest score values were either characteristic of mountain habitats (*Apodemus alpicola*, *Chionomys nivalis* and *Marmota marmota*), typical of lowlands (*Micromys minutus*) or forest species (dormice), and they were also short living, with few reproduction events. Top ranking Soricomorpha were endemic (*Crocidura sicula*, *C. pachyura*), range restricted (*Sorex alpinus*, *Talpa caeca*) and habitat specialists (*Neomys fodiens*, *N. anomalus*), and were further characterised by low reproduction, low dispersal ability, and restricted elevation range. The factors used in the score system were able to emphasise localised endemisms that could be recognised in the future whenever subspecies should be promoted to the rank of species. Soricomorpha, highlighted in the IUCN national red list as nearly threatened or for the absence of information, ranked at the top of our list. The methodological framework proposed here could be used when a pool of species needs to be evaluated for further investigation or conservation actions, helping by focusing on species that are more sensitive to habitat changes or have an intrinsic conservation value.

Introduction

Addressing conservation issues at a regional scale requires strategic planning aimed at identifying species that are threatened, or becoming endangered, and requires management intervention to reverse these negative trends. However, this collides with the lack of detailed information on the distribution and population trends for most species, thereby introducing a high level of uncertainty when evaluating the conservation status and priorities of species groups for which little is known.

Listing species on the basis of their level of threat or likelihood of extinction is one of the main tools used when setting priorities for conservation. The IUCN Red List categories have been widely accepted throughout the world as a reference for conservation planning at the species level (Possingham et al., 2002). These lists mainly evaluate the reduction in the geographic range and population size of a set of species (IUCN, 2001). According to the red list criteria, the absence of data should not deter attempts at evaluating the species status, as methods involving inferences and projections are acceptable, as well as indirect information concerning the deterioration of habitats where species live (IUCN, 2001). For example, during the IUCN European Mammal Assessment, demographic trend information was not available for 33% of the species considered (Temple and Terry, 2007).

The loss of range and populations over a threshold are factors that place a species at risk, but these changes are rarely quantified for secretive species. For instance, these data are not available for small mammal species in many countries. Thus, in many cases the conservation ranking for this group of species is mainly based on expert judgement and not on quantitative assessments (Temple and Terry, 2007). When data are scanty there is a risk of

* Corresponding author at: DISAFA Entomology and Zoology, Via L. da Vinci 44, 10095 Grugliasco, TO, Italy. Tel.: +39 0116708677.
E-mail address: sandro.bertolino@unito.it (S. Bertolino).

http://dx.doi.org/10.1016/j.mambio.2014.06.006
1616-5047/

considering most species safe, because there is no indication of decline. On the other hand, collecting complete information for many secretive species is difficult and costly. A species ranking system based on relatively few data, that can be easily collected, is thus required.

Categorization systems based on the evaluation of biological, ecological and distributional information have been developed for different taxa (Cofre and Marquet, 1999; Filippi and Luiselli, 2000; Andreone and Luiselli, 2000). These systems are usually based on scoring systems, that make use of species data on life history traits and the ecological requirements, related to species' sensitivity to changes in landscape and ecosystem composition and qualities. The basis for this type of species categorisation is that species with low reproductive potential and restricted tolerance to ecological factors should be less adaptable and more sensitive to habitat degradation than more generalist and adaptable species. Here, a similar system is proposed to rank Italian small mammals according to their degree of vulnerability. We chose to use data that well describes the species' biological and ecological constraint, but, at the same time, could be easily derived from the basic knowledge of their natural history. These kind of data are available for many small mammal species, making this ranking system applicable to many countries or regions of the world.

An increasing number of new species have been described in recent years as a result of the development of DNA techniques. Within this context, a proposed ranking system has to be flexible for the incorporation of new taxa, when these are described and accepted by the scientific community. To verify whether our ranking system is adaptable to the description of new species, the scoring system was also applied to possible cryptic species.

Material and methods

Species considered

Species present in Italy belonging to the orders Rodentia (rodents), Erinaceomorpha and Soricomorpha were considered (Amori et al., 2008a). *Arvicola scherman* was excluded from this analysis because the species is known from Italy only for few records at the border with Slovenia (Amori et al., 2008a). *Microtus brachycercus* was not considered here because its specific status is still debated (Castiglia et al., 2008). *Sorex arunchi* was not considered as a recent genetic study did not support its specific status (Yannic et al., 2012). As a first step, the subspecies division was not considered, nor were taxa that have not yet been clearly recognised as valid species. The nomenclature follows Wilson and Reeder (2005).

Cryptic species

The increase of nuclear and mitochondrial DNA studies on European mammals have provided more accurate information on the genetic structure of populations. Such information has been used for the reconstruction of the phylogeographic history of many taxa, as well as for the identification of cryptic species (Ferguson, 2002). As a result, more mammal species are now recognised in Europe than a few years ago, and other proposed cryptic species are still waiting for an evaluation. To verify whether this ranking system is adaptable to the description of new species, the scoring system was applied to possible cryptic species. To identify the phylogroups with a high probability of representing true species, a literature search was performed for genetic studies focused on small mammal species present in Italy. In a second step, we used the criteria proposed by Baker and Bradley (2006) to identify new mammal species under a genetic species concept. We considered as cryptic species from those taxa that were identified by the authors as having a genetic distance between allopatric or parapatric phylogroups equal or greater to the mean value found for sister species belonging to the same genus or family.

According to these criteria, the Calabrian red squirrel (*Sciurus vulgaris meridionalis* Lucifero 1907) and the Sicilian population of Savi's vole (*Microtus savii nebrodensis* Minà Palumbo 1868) may be considered as endemic cryptic species for Italy. The genetic distance calculated with the entire cytochrome-*b* distance between *M. s. nebrodensis* and the cluster formed by other *Microtus savii* taxa ranged from 7.4 to 7.9% (Castiglia et al., 2008). The genetic lineage of *S. v. meridionalis* is significantly different from the rest of Italy and Europe, providing evidence for distinct histories throughout the Pleistocene era (Grill et al., 2009). Cytochrome-*b* net genetic distance between Calabrian squirrels and red squirrels from the rest of Europe was 2%, and within-group means were 0.3% for the European clade, and 0% for the Calabrian clade.

The use of these taxa as possible cryptic species was an exercise to test the robustness of the scoring system and should not be considered as an endorsement to the hypothesis that the two subspecies should be promoted to the rank of species.

Factors and variables

Italian small mammal species were ranked according to their potential vulnerability and conservation value. Twelve variables related to the distribution, demography, ecological specialisation, and conservation values of each species were considered. Each variable was categorised in four ranks (0–3), ranging from the lowest (0) to the highest (3) risk. The final score for each species was the mean of the scores across all of the variables, with higher values implying a higher priority for conservation. The breath of the categories of a given parameters was not kept constant; instead it was adapted according to our interpretation of the influence that a particular variable may have on the species. For instance, the distributional breadth of occupancy was split into four equal ranges of 25% wide, while the home range diameter was split considering 10 m, 50 m, and 100 m as limits to the vagility of different species. We acknowledge that this is a subjective choice, but in our opinion not all the parameters can be split into equal ranges.

By far, the most important threat to European terrestrial mammals is habitat loss and degradation, followed by pollution and human disturbance (Temple and Terry, 2007); habitat loss is the most severe threat also at the global level (Vié et al., 2009). Generally, those species that are characterised by a restricted range, low abundance and habitat specificity, are expected to be more vulnerable to habitat disturbance (e.g. habitat loss and degradation) and prone to extinction than species that are widely distributed, habitat generalists and abundant (Rabinowitz et al., 1986; Davidson et al., 2009). A set of variables related to species distribution, demography and ecological adaptability were considered. These were complemented with information on the conservation value of the species based on their level of endemism and taxonomic diversification. The variables are reported below with an explanation of the rationale for their choice; rank values are explained in Table 1.

Distributional criteria: Italy is a long and narrow peninsula, with a strong north-south gradient in environmental parameters. Thus, species with a large distribution are potentially more adapted to different ecological and climatic condition (Slatyer et al., 2013). Island species are generally more vulnerable to extinction because they have a small geographic range that is limited to the island and may be more easily affected by habitat alteration due to human activities. Short dispersal distances mean that declining populations may not be sustained by immigration, and that recolonisation following local extinction may not occur (Brown and Kodric-Brown, 1977). Considering that dispersal distances are not available for