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POLICY

Habitats Directive species lists: urgent need of revision

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Abstract. 1. The European Habitats Directive is the main legislative work regarding Europe's nature conservation policy. It lists the protected habitats and species in the European Union. The species lists include 122 arthropods.

2. The current lists of arthropods (Annexes II and IV) present, possibly among other, five obvious biases: taxonomic, geographic, range, size and aesthetic biases. Species of selected taxa (Lepidoptera, Coleoptera, Odonata and Orthoptera), from Northern or Central Europe, relatively widespread, of a large body size and attractive are favoured over species of other taxa, from southern and Mediterranean Europe, endemic or relatively small or inconspicuous. Such biases are obstacles to the effective protection of the European fauna.

3. Two main strategies should be followed to avoid these problems and therefore increase the effectiveness of conservation policies: (i) the adoption of objective and transparent criteria for the listing of protected species, and (ii) implement regular updates and amendments to the lists based on such criteria.

Key words. Arthropods, conservation priority, endangered species lists, environmental policy, European Union, insects, LIFE programme, red lists, spiders.

Introduction

European nature conservation policies have evolved enormously during the last decades. Many of the policies are decided at a European level and translated to the appropriate national laws. The Bern Convention (Council of Europe, 1979) was the first step towards a unified body of legislation about the conservation of habitats and species in Europe. It is a voluntary agreement, including not only European Union (EU) countries but also other European countries, African and Middle Eastern countries, constituting no law or obligation. The Bern Convention includes lists of priority species that were periodically updated (Council of Europe, 1992). Building on the Bern Convention, the European Habitats Directive was in the meanwhile approved by the EU (Council of the European Communities, 1992). Contrary to the Bern Convention, this Directive is European law and is mandatorily transposed to national laws of EU countries.

The Habitats Directive is, together with the Birds Directive, the main legislation regarding Europe's nature conservation policy as its annexes list the protected habitats and species in the EU. Being first adopted in 1992, it went through a number of updates and corrections, mainly to the annexes, the last in 2007 with the joining of Bulgaria and Romania to the EU (Accessible online from http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm#enlargement). Annexes II and IV form the basis for the protected species lists in many European countries, which often limit the national lists to what is adopted from the Habitats Directive, without any kind of adaptation or additions. Additionally, Annex V lists species (a few decapods and *Graellsia isabelae*) whose exploitation may be subject to management measures.

The criteria for including taxa in the Habitats Directive are that they are endangered, vulnerable, rare or endemic. However, these classifications are entirely subjective, with no objective assessment of threat, vulnerability, rarity or endemism. The current species lists in Annexes II and IV have a large dominance of vertebrates, with very few arthropods (Council of the European Communities, 1992). This pattern is not unique, as it follows the tendencies of conservation research in general (Clark & May, 2002). With efforts from both the International Union for the Conservation of Nature (IUCN) and the European Invertebrate Survey (EIS), 122 arthropods were ultimately included in the lists (Van Helsdingen, 2000). The Annexes have different reasoning, with Annex II listing 103 arthropod species for which governments have to designate protected areas and Annex IV listing 93 species that are strictly protected, but for which no legal obli-

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gation to protect the habitat exists. Listing a species in Annex II is therefore a more powerful legal instrument. For arthropods, protecting the habitat, often very small areas for the most threatened species, is paramount in species conservation, so the utility of Annex IV is questionable. In practice, the two lists largely overlap, with 74 of the 122 species (61%) being shared. Additionally, Annex II includes a subset of priority species. Although this is the most powerful classification, only 11 arthropods are considered a priority at a European level.

The listed species were chosen according to the existing knowledge at the time, when data on many taxa and countries were largely unavailable, and biases were inevitable. If most arthropod groups are not considered and, even when so, biased towards relatively common species, the usefulness of the Habitats Directive species lists for the protection of European fauna is doubtful. It can only be indirectly guaranteed when threatened arthropods are present in protected habitats or in the same habitats as vertebrates, which, although frequent, is not always the case.

Biases in the current lists

The current lists of arthropods (Annexes II and IV) present, possibly among other, five obvious biases: taxonomic, geographic, range, size and aesthetic bias. Any of these are obstacles to the effective protection of European fauna. Because both annexes largely overlap, they follow the same patterns; hence the exact same biases apply.

Taxonomic bias

Almost three-quarters (72%) of the listed arthropod species belong to either Lepidoptera or Coleoptera, with Odonata and Orthoptera representing almost the totality of the remaining taxa (22%; Fig. 1). Butterflies and dragonflies already have European red lists and many species have been classified according to the IUCN criteria (Kalkman *et al.*, 2010; Van Swaay *et al.*, 2010). But these two taxa are mainly composed by large-winged, good disperser, and often widespread species. They can be considered as the *birds* among invertebrates. As birds present the lowest percentage of threatened species among vertebrates (IUCN, 2010), these insects most probably present the lowest percentage of threatened species among invertebrates.

Some of the megadiverse orders such as Diptera and Hymenoptera are not even represented in the current lists. Other diverse and important groups, often mentioned as most sensitive to habitat disturbance (e.g. Araneae, see Cardoso *et al.*, 2010) or good indicators on the trends of other taxa (e.g. Hemiptera, see Duelli & Obrist, 1998; Gaspar *et al.*, 2010), are barely present.

Geographic bias

The current species lists are largely dominated by Central and Northern European species (as listed in Fauna Europaea; Fig. 2; see also Aguilar-Fernandez, 2003). However, the percentage of endemic species in such countries is usually low, with many species rare in a given country being common in neighbouring countries (Kalkman *et al.*, 2010; Van Swaay *et al.*, 2010).

In contrast, southern European, Mediterranean countries are less represented, even though the Mediterranean region is a hotspot of endemics and species richness (e.g. Kalkman *et al.*, 2010; Van Swaay *et al.*, 2010). But the most concerning fact is that there is not a single species from the Macaronesian Islands, part of the same biodiversity hotspot, and a region with thousands of endemic species (Izquierdo *et al.*, 2004; Borges *et al.*, 2005, 2008), many of them endangered or even extinct due to human causes (Cardoso *et al.*, 2010; Triantis *et al.*, 2010).

Range bias

The Habitats Directive species lists are dominated by species that occur at between 2 and up to 31 countries or regions (Fig. 3). Surprisingly, the proportion of species known to exist in at least 32 regions is even higher than the proportion of species

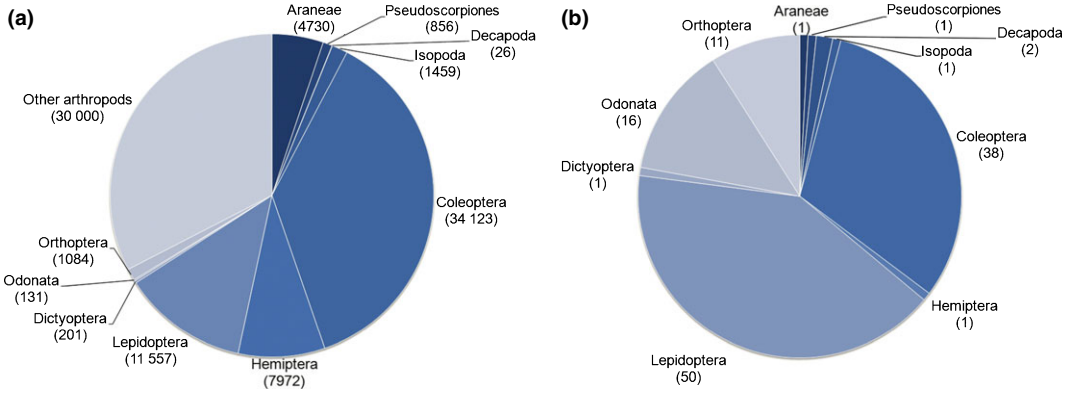

Fig. 1. Number of arthropod species per order: (a) known to occur in Europe (according to Fauna Europaea – http://www.faunaeur.org); and (b) listed in the Annexes II and IV of the European Habitats Directive.

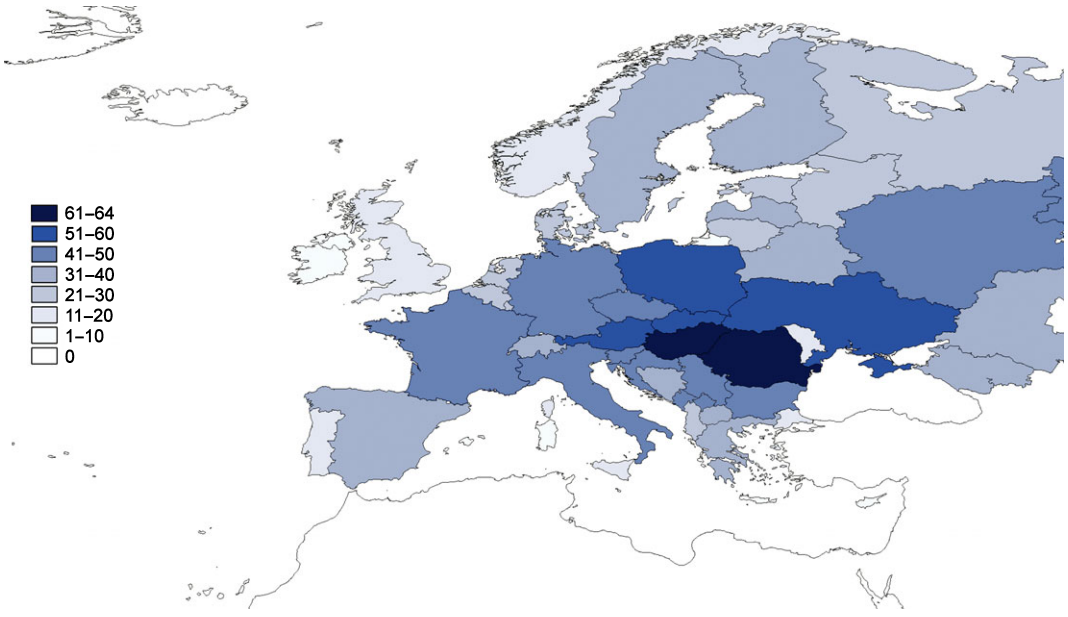

Fig. 2. Number of listed arthropod species occurring at each European country/region (according to Fauna Europaea – http://www.faunaeur.org).

classified as endemic to a single region. Priority species, the ones with higher protection, follow a similar pattern (Fig. 3).

Although there are several forms of rarity (Rabinowitz, 1981) they are often correlated, being the species with restricted distribution also rare in terms of abundance (Brown, 1984). In addition, strict endemics, limited in their distribution to a single region or country, are usually the species in higher danger and the ones that dominate protected species lists based on scientific criteria (e.g. Martín *et al.*, 2010). Strict endemics are, however, almost absent from the Habitats Directive annexes.

Size bias

Large species are apparently more easily listed than small species. As an example, in spiders, the only species listed is also one of the larger, if not the largest, European spider, *Macrothele calpeiana*. Although it is endemic to the southern Iberian Peninsula, with deep fragmentation of its populations (Arnedo & Ferrández, 2007), it does not meet the IUCN criteria to be considered threatened (M.A. Ferrández & P. Cardoso, unpubl. data). The fact that it is the largest spider in Europe does not seem to be a coincidence for being under protection.

Small species can, however, be at least as endangered. The smallest European spider, *Anapistula ataecina*, also a southern Iberian species but limited to 1 km^2 in area of occupancy (Cardoso & Scharff, 2009), is the only European spider listed as Critically Endangered by the IUCN (IUCN, 2010). Being a cave species, its small size may in fact be one of the reasons why it is able to subsist in extremely reduced and possibly fragmented areas, given that a large species would probably need larger areas to maintain viable populations. Small areas do, nevertheless, equate to proportionately larger threats, as a single event may drive an entire species to extinction.

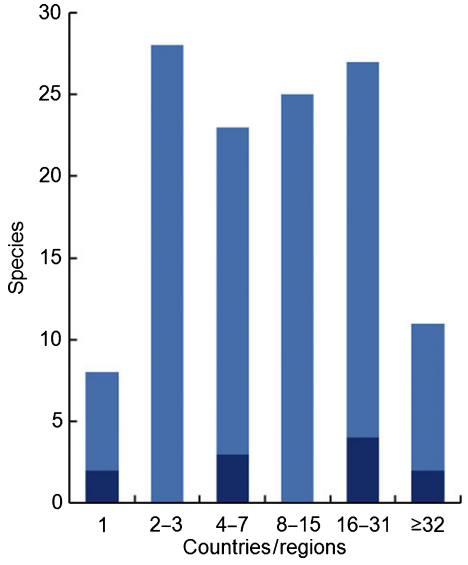

Fig. 3. Number of listed arthropod species occurring in different numbers of European countries/regions (according to Fauna Europaea – http://www.faunaeur.org). Darker tones represent the 11 priority species.

Aesthetic bias

Species such as the stag beetle *Lucanus cervus* or the large blues butterflies of the genus *Phengaris* (*Phengaris arion,*

Phengaris nausithous and *Phengaris teleius*, previously in *Maculinea*) have an obvious public appeal. Despite being insects, they can be seen as *cute* or at least attractive. In fact, attractive organisms have higher chances of being protected, as people are more willing to voluntarily contribute to their protection (Martín-López *et al*., 2007). However, according to the IUCN Red List (IUCN, 2010), none of the *Phengaris* species is threatened. This suggests that attractiveness may have been a determinant factor for species listing in the Habitats Directive in the past. Arguably, a legal list of protection should not be strongly influenced by mere public appeal (although it could be one of the criteria).

Less appealing or unnoticeable species are, however, among the most endangered. That is the case for troglobionts, such as the above-mentioned *A. ataecina*, among many others. Troglobionts typically have restricted distributions and suffer from a number of threats, mainly habitat destruction (e.g. mining activity) and degradation (e.g. percolation of pollutants). They often have no eyes, no cuticle pigmentation, have large appendices and a great development of sensory hairs, characteristics that may be considered repulsive by most people. They are also hidden from sight, in places inaccessible to the general public. They are therefore usually neglected.

Improving the lists

Even though the European fauna is considerably better known than the fauna of other regions (most notably the tropics), there are still many gaps in our knowledge. However, the gaps in information are nowadays smaller than when the Habitats Directive lists were first proposed. Particularly relevant, several public databases are permanently updated by expert scientists and these allow knowing the species distribution even if at a coarse scale (e.g. http://www.faunaeur.org; http://www.azores-bioportal.angra.uac.pt) and often other relevant information such as species ecology (e.g. http://www.naturdata.com). Even if much more remains to be known, it would be possible with current knowledge to considerably update and reduce the bias in the annexes. Although I do not dispute the importance of many species included in the current lists, it is obvious that, unfortunately, they do not represent the current knowledge of European (arthropod) fauna. The current lists are far from being representative of the most endangered, vulnerable, rare or endemic species. With such strong biases, the lists seem to have no scientific support at all, and this is not desirable for a document that, as already noted, is the basis for Europe's nature conservation policy.

The same biases found in the arthropod lists occur with other invertebrate taxa, such as molluscs (Bouchet *et al*., 1999). Bias also occurs, although probably in a lesser degree, with relatively well-known organisms such as plants (Lozano *et al*., 1996). It seems therefore that the Habitats Directive species lists are in urgent need of revision for a number of different taxa, not only arthropods.

The LIFE programme is the main financial instrument supporting nature conservation projects in European countries. Starting in 1992, it has co-financed thousands of projects, summing approximately €2 billion. The LIFE Nature sub-programme specifically supports conservation projects directed towards listed habitats and species. Species that are not listed cannot be used as justification for project support and are therefore neglected in both conservation policy and financing. Hence, the biases in the species lists have deep legal and financial implications.

A combination of clear scientific and political agendas is needed to best achieve a species priority ranking that is both objective and practical (Bottrill *et al*., 2008; Schmeller *et al*., 2008). Such criteria must be well supported by scientific evidence, clearly explained to all parties involved and publicly known. If species listing is based upon criteria that have been previously agreed between scientists and managers, then three requirements for effective conservation can be met. Firstly, species should be ranked according to their priority for management in view of limited resources. Investment in non-threatened, often common, species is an obvious waste of time, money and personnel. On the other hand, investment in species with a low probability of avoiding extinction or which require an extreme amount of resources for their recovery might not be the optimal conservation strategy. Because resources are limited, to focus all efforts on a single or a few species will necessarily condemn other species. Secondly, *ad hoc* conservation of species that have priority due only to their charisma should be avoided. Using flagship species and assuming they may serve as umbrella species, clearly fails in many situations (Simberloff, 1998; Muñoz, 2007; Cabeza *et al*., 2008; Roth & Weber, 2008; Martín *et al*., 2010). Finally, threatened species lists should be converted into legally protected species lists. Although the former are useful for raising awareness and even lobbying (Rodrigues *et al*., 2006), they do not equate to the latter. After red-listing, it may, however, be easier to include a species in conservation priority lists with legal support.

Martín *et al*. (2010) implemented an objective and transparent process to reach management priority lists for the European archipelagos of Macaronesia (Azores, Madeira, Selvagens and Canary Islands). This work took into account both the protection priority of species and their management feasibility. Hundreds of taxa, from bryophytes to vertebrates, were scored by species experts according to a number of criteria, including ecological value, singularity, public institutions' management responsibilities, social value, threats knowledge and control feasibility, external socio-economical support for management and biological recovery potential. Environmental managers, usually from governmental institutions responsible for executing conservation policies, weighted the same criteria according to their management importance. This process allowed the independent participation of scientists and conservation managers, the inclusion of criteria on both protection priority and management feasibility and the reached species lists are taxonomically and geographically unbiased. These lists include mostly endemic species, those considered to be in greater need of protection. They are now being adopted by the respective regional governments as legally protected species lists. This work is an example of what can be done with current knowledge, easily adapted and adopted for larger scales, such as the entire EU.

Using such strategy would greatly decrease the current biases, which are undoubtedly both favouring vertebrates over

invertebrates (see also Clark & May, 2002) and some invertebrate taxa over other invertebrate taxa. It would allow including more species from largely neglected taxa and from Southern European or Mediterranean countries (including the Macaronesian archipelagos). It would favour strict endemic species over widespread ones; and it would avoid favouring large or attractive species just for the sake of being large or attractive.

Besides following objective and transparent criteria, the lists should also be subject to regular updates and amendments. In its article 19, the Habitats Directive predicts the need for amendments to the different annexes as necessary to accompany technical and scientific progress. Although additions have been made each time new countries joined the EU, apparently no considerable amendments have been made solely as a consequence of new knowledge. Given the rapid advancement of information on arthropod species and respective distributions and ecology, a regular, mandatory revision should be made every few years. Only in this way it will be possible to change lists not only according to new knowledge but also according to changes in species status. In fact, it is very common that because of efforts towards the conservation of some species they improve their situation or, on the contrary, because of continuous negligence, the species experience a considerable deterioration in their conservation status.

In conclusion, obvious biases are currently present in the Habitats Directive protected species lists. Two main strategies should be followed to avoid such biases and therefore increase the effectiveness of conservation policies: (i) the adoption of objective and transparent criteria for the listing of protected species, and (ii) implement regular updates and amendments to the lists based on such criteria.

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