Distribution data, threat categories and site evaluation

by Martin C.D. SPEIGHT

Summary

The need for greater standardisation of the way in which distribution data are used as the basis for consigning invertebrates to threat categories, at both national and international levels, is considered. Some suggestions are made with a view to attaining an increase in standardisation. It is pointed out that the term 'threatened invertebrate' has limited value when not backed by generally agreed methods for consigning species to different threat categories. From a consideration of factors which render distribution records of unequal significance it is concluded that considerable caution must be exercised in basing threat categories simply on numbers of records and that the best distribution-data-based measure of a threatened species' status is the number of protected sites from which it is recorded. The need to secure **sufficient** resources to provide for species survival is stressed, as is the responsibility of specialists in advising what quantity and type of resources are required. A proposal on recognition of sites of international importance for protection of invertebrates is used as the basis for discussion throughout, demonstrating the need for decision on definition of terms, criteria etc. if such proposals are to result in production of useful international protocols.

Introduction

The European Invertebrate Survey (EIS) has now existed for more than 20 years, to promote study of the distribution of European invertebrates. But it is only recently that the need for reliable distribution data on European invertebrates has been more widely recognised, in particular by people other than specialists in the study of invertebrates. Recognition of this need is implicit to the act of including invertebrates among the species listed as requiring protection under the Bern Convention (see Appendix I), in the appendices of the draft Habitat Directive of the European Community and the appendices of its ECE (United Nations Economic Commission for Europe) equivalent. On a less legalistic level it is manifest in attempts to use invertebrates in environmental impact surveys and other forms of site evaluation.

The fact that there is a dawning of awareness that the European invertebrate fauna requires to be protected, along with other elements of the European flora and fauna, is clearly a positive development. It brings with it, however, a need for specialists in the study of invertebrate distribution to "get their act together" in ways not previously given much attention. We talk about "threatened species", "sites" and numbers of "distribution records", in reference to individual locations, individual species, national circumstances, the international situation, particular taxonomic groups and, even, all the invertebrates at once. Many of the contributions to this volume of colloquium Proceedings are concerned with precisely this type of topic.

A quick browse through this volume alone demonstrates both that there is still considerable variation in interpretation of much basic terminology and that this variation alone could create problems for those wishing to use the results of more than one study. We, and even more so those who are not specialists in invertebrates, require confidence that we are talking about the same thing when, for instance, we consider threatened invertebrates or internationally important sites. Unless we can agree a common approach to definitions of such basic terms, it is difficult to see how invertebrates will be taken seriously for long. As interest in protection of invertebrates develops, so must generally understood systems for their use.

Some of these problems are considered here, in the context of a proposed basis for recognition of sites as internationally important for protection of invertebrates. The text of this proposal is given in Appendix II. It is extracted from a paper by SPEIGHT *et al.* (in press) presented in June 1991 during the Bern Convention/Ramsar Convention seminar on the Conservation of Wetland Invertebrates, held in Vaduz (Liechtenstein). The question of what is a "European" invertebrate was considered then and will not be addressed here.

What is a Threatened Invertebrate?

The text of the proposal (Appendix II) on sites of international importance for invertebrates makes repeated reference to threatened European invertebrates. Indeed, it is difficult to see how such a proposal could avoid reference to threatened European invertebrates. But what is meant by the term "threatened invertebrate"? There is need both for definitions of degrees of threat to which species may be subject and for mechanisms to use for deciding to which threat category a species should be consigned.

a) The IUCN threat categories

The IUCN has performed a key role in work on faunal and floral protection everywhere, by gaining general acceptance for its "Threat Categories", by which organisms can be classified according to the degree of threat to which they are subject. These IUCN categories have given rise to the term "threatened organism", which refers to any species consigned by status to any of the IUCN threat categories. Essentially, the following categories of threatened organism are delimited by IUCN: extinct, endangered, vulnerable, rare and indeterminate. The IUCN definitions of these categories, as given by WELLS *et al.* (1983), are reproduced here in Appendix III. These categories are being as widely used for invertebrates, as for other organisms. The difficulties arise in trying to decide whether, for example, in the case of some particular invertebrate species, its "numbers have been reduced to a critical level", or whether its populations have merely been "seriously depleted" and, similarly, whether its habitats have been "drastically reduced" or just subject to "extensive destruction". Although a practical basis for application of these status categories has been worked out for birds and to a lesser extent for other vertebrates, the situation is less satisfactory for invertebrates. At the national level, various systems are in operation in Europe for applying IUCN threat categories to invertebrates: indeed it could be said that there are as many systems as there are European States which have tried to produce lists of threatened invertebrates! Even so, one feature these various systems have in common is that they are based on the use of distribution data, rather than population statistics.

b) Population size v distribution data

The approach used for vertebrates relies heavily upon knowing the number of individuals making up each population of a species. There is a corresponding tendancy for those who do not work with invertebrates to assume that it is also necessary to know the actual population size of an invertebrate species before you can determine whether it is threatened. In reality, the basis normally used for deciding the status of an invertebrate species is the number of different sites it has been recorded from, as expressed in terms of the number of different distribution squares from which it has been recorded. The same approach is used in deciding the status of plant species. The number of sites from which it has been found is argueably a more realistic measure of the status of an invertebrate species than is the size of its population at each site. However, the number of sites from which a species has been recorded is, by itself, only a very crude measure of status and considerable care is needed in interpreting distribution records before they can be used with confidence in deciding whether or no a species is threatened.

c) Interpretation of distribution data

Distribution data are normally presented as though a record for one species is the exact equivalent of a record for another, implying that to compare the status of different species all that is necessary is to compare numbers of records. But records are seldom exactly equivalent to each other and, although this fact has been recognised by many workers with distribution data, it is all too often far from clear whether it has been taken into consideration when species are being consigned to threat categories. As an example, reference may be made to the problem of flight period length, in interpretation of distribution records for Diptera. Distribution records of Diptera are almost invariably based on the adult insect, because the larvae of many species are still unknown or inadequately described. The adult flies are not on the wing throughout the year and each species has a characteristic flight period. Some species are univoltine, while others are polyvoltine and the length of the flight period varies with the species. For instance, in the case of Syrphidae in temperate parts of Europe like Belgium, flight period varies from 8 weeks to 39 weeks. Assuming recording effort is equally intensive from spring to autumn, the chance that an observer will record a syrphid whose flight period is 39 weeks is five times as great as that he will record a species whose flight period is 8 weeks, if the two species are equally widely distributed. In this instance, a record of a species with an eight week flight period is by no means the exact equivalent of a record of a species with a thirty nine week flight period! For each taxonomic group, there are features of the biology and habits of the species which require to be taken into consideration in assessing the status of species based on distribution data, since some species will otherwise be erroneously regarded as more threatened than others, and vice versa. Differences in the character of sites from which a species has been recorded also lead to inequalities in the value of distribution records. This complication to interpretation is considered later in the present account.

d) National threat categories defined on the basis of distribution data

There is no absolute measure of the degree of threat to which a species is subject and neither could there be: the number of species recognised as threatened is heavily dependent on the basis used for defining the status categories and this is as true for threat category definitions based on numbers of distribution records as it is for threat categories defined in any other way. This is illustrated by Table 1, in which, as an exercise, the same distribution data have been used in different ways to define threat categories and these definitions have then been employed to decide how many species are threatened at national level. Not surprisingly, the different definitions give rise to different totals for numbers of species threatened.

Because there is no absolute measure of the degree of threat to which species are exposed there is a danger that the term "threatened species" will come to mean very different things in different countries, because each country will develop its own basis for defining each threat category. This process is well underway, with no two European States using precisely the same basis for estimating degrees of threat. Inevitably, this reduces the credibility of national lists of threatened species and makes it more difficult to decide which species are threatened at the international level. The only practical solution to this problem would be to achieve international agreement on a standardisation of mechanisms to use at national level in defining each threat category, based on:

i) an agreed scale of distribution unit, hereafter called a "square" to be used in threat category assessment (e.g. whether to use 10km, 25km or 50km squares),

ii) an agreed index of frequency of occurrence (e.g. recorded occurrence in no more than 1 square/100 squares classifies a species as endangered, whereas occurrence in 2 squares/100 would categorise a species as vulnerable) to be used in threat category assessment.

e) Internationally threatened species defined using National Red Lists

In studies aimed at deciding which species are threatened at the international level in Europe, a generally used technique has been to put together National Red Lists (a National Red List is a list of species recognised as threatened in the State producing the list) for as many countries as possible and regard the species common to all or most of these Red Lists as threatened. This approach can only be adopted for a limited range of taxonomic groups, because it is rare to find a taxonomic group for which published Red lists are available from many countries. A further complication lies in the fact that most published Red Lists are for small States in W and central Europe, so that there is little or no information available for much the greater part of the surface area of the continent, especially its S and E regions. Finally, it has to be said that, even if Red Lists are available for an appreciable proportion of Europe's surface area, for some particular taxonomic group, there are considerable difficulties in interpreting these lists for use at the international level.

This is because each Red List has been prepared on a different basis, so that data regarded as appropriate for consigning a species to the endangered category in one State would not be regarded as appropriate for consigning it to the endangered category in another. This variation is amply illustrated by comparing the criteria used in EHNSTROM & WALDÉN (1986), GEPP (1983) and SHIRT (1987), in deciding which species to consign to different threat categories.

Using a combination of national Red Lists as a basis for deciding which species are threatened internationally makes it possible to avoid the question of how restricted in distribution a species should be, within a land mass the size of Europe, in order to be regarded as threatened. But this question requires to be addressed and, once it has been asked, it can be seen that there are even more anomalies to the use of Red Lists. For instance, using a combination of Red Lists, a species recognised as threatened in 6 small States has a greater chance of becoming recognised as internationally threatened than a species recognised as threatened in 1 large State, even if the combined surface area of the 6 small States is no greater than that of the large State. Clearly, use of combined Red Lists to decide which species are threatened internationally could lead to extremely misleading results.

f) International threat categories defined by use of the 50km UTM square

The 50km UTM square is now recognised as the unit for mapping the European distribution of organisms, so why not use it in defining threat categories? The surface of Europe comprises approximately 5000 50km UTM squares, so no single, simple definition of each category would be possible, based on numbers of squares. However, it should be possible to incorporate relevant numbers of 50km UTM squares into definitions of each threat category.

Table 1. Number of threatened species of Irish Syrphidae (Diptera), calculated in three different ways.

Basis for categorisation	Category	No.squares from which records are required	No.spp. consigned to category
Number of 50km UTM squares from which the species has been recorded since 1950	Extinct	0	4
	Endangered	1	11
	Vulnerable	2	10
	Rare	3	7
	TOTAL		**32**
Number of 10km Irish grid squares from which the species has been recorded since 1950	Extinct	0	4
	Endangered	1	8
	Vulnerable	2	8
	Rare	3	9
	TOTAL		**29**
Percentage of 10km Irish grid squares from which the species has been recorded since 1950 (total = c.1000 squares)	Extinct	0% = 0	4
	Endangered	1% = 1-10	51
	Vulnerable	1-2% = 11-20	27
	Rare	2-3% = 21-30	13
	TOTAL		**95**

As known at present, the Irish syrphid fauna comprises 180 species. The tabulated information is drawn from a database of 12000+ records.

Nonetheless, so far as I am aware, no definition of threat categories for European species employing 50km square units has yet been proposed. The following thresholds would seem worthy of establishment, with a view to gaining agreement at the international level:

i) the maximum number of 50km squares an invertebrate species can be recorded from in Europe, to be automatically considered as a threatened species at the European level,

ii) the maximum number of 50km squares an invertebrate species can be recorded from in Europe, before being automatically excluded from consideration as a threatened species,

iii) the maximum number of 50km squares an invertebrate species can be recorded from in Europe, to be automatically considered as an endangered species at the European level,

iv) the maximum number of 50km squares an invertebrate species can be recorded from in Europe, before automatically being excluded from consideration as an endangered species at the European level.

g) Internationally threatened species defined by Europe-wide study

A more comprehensive approach to deciding which species are threatened internationally can be achieved by first deciding which taxonomic group is appropriate for study and then assigning a specialist in this taxonomic group to conduct a survey of its European species, aimed specifically at investigating their status. If sponsored by an internationally recognised body, this type of study can gain co-operation from private individuals, institutions and governments, and gain access to unpublished as well as published data. This approach also has the considerable advantage that data from all sources can be assessed on the same basis. Data from Red Lists and data on numbers of 50km UTM records can be incorporated into such a survey. This approach has been used by the Council of Europe in compiling existing lists of threatened European butterflies, dragonflies and saproxylic insects. It has also been used in a WWF/Council of Europe study of terrestrial and freshwater molluscs, which is now in its final stages. The fact that the results of these studies are scrutinised by both specialist referees and all member states of the Council of Europe, before a final version is produced, ensures that when they are published, these surveys are as reliable as can reasonably be hoped for, using the available information.

Threatened species and site evaluation

The proposal (Appendix II) on recognition of sites as internationally important for invertebrates makes a strong link between site evaluation and threatened species, essentially making site categorisation heavily dependent upon the number of threatened species found there. To attempt to measure site quality in this way is not perhaps ideal, but at least it would provide an explicit role for invertebrates in the process of site evaluation at international level and provide a basis upon which sites important for conservation of invertebrates can be brought to the attention of conservation agencies. In the current state of knowledge it is also argueably the only way in which invertebrate data can easily be incorporated into site evaluation processes at the international level at present.

Further, whether we do or do not condone the practise, it is the way in which lists of threatened invertebrates are already being used in site evaluation. This is true not only at local and national levels, but also at the international level, for instance in the CORINE programme of the European Community and in the European Community's draft Habitat Directive. The lack of any agreement on what constitutes a site of international importance for protection of invertebrates, or even what constitutes a threatened invertebrate, makes present use of invertebrates in site evaluation a somewhat haphazard process, with the frequently disastrous result that sites are undervalued due to doubt about the status of the invertebrates recorded.

a) Existing lists of threatened species

In order to operate successfully any site evaluation method based largely on threatened species there is obviously a need for adequate lists of threatened species. At the national level adequate lists do exist in some instances. For example, the British lists of invertebrates threatened at national level, compiled by BRATTON (1991) and SHIRT (1987), are particularly comprehensive and are already being systematically used to identify sites of national importance. At European level the situation is far less encouraging. The lists currently available comprise butterflies derived from the study by HEATH (1981), dragonflies derived from the study by VAN TOL and VERDONK (1988), selected saproxylics derived from the study by SPEIGHT (1989) and the species listed in the Bern Convention appendices (see Appendix 1). Among these, the only list being used consistently in site evaluation processes is the Bern Convention list. Unfortunately, the Bern list was not compiled with such usage in mind and is not very useful for site categorisation procedures, particularly since it includes some species selected more because they are popular than because they are threatened.

b) Priority studies aimed at augmenting lists of internationally threatened species

The compilation of additional lists of invertebrates threatened at European level is now urgent, if they are to play a credible role in invertebrate protection, especially through site selection procedures. Considering the existing lists and their potential role, they provide some information on the state of terrestrial herbivore and detritivore faunas and some information about the state of the aquatic predator fauna. They provide no data on terrestrial predators, aquatic herbivores or aquatic detritivores. It is possible to recognise invertebrate taxonomic groups potentially appropriate for attention, using the approach suggested by SPEIGHT (1986). One taxonomic group which matches the criteria is the Mollusca, and a study of threatened European terrestrial and freshwater molluscs is now happily virtually complete. A second appropriate group is the Trichoptera, and it is possible that a European study of these aquatic detritivores will commence in the not too distant future. But coverage of additional groups is needed: in particular some group of primarily terrestrial predators, like the Carabidae (Coleoptera) or spiders (Aranaea), is a priority.

A complementary approach would be to establish lists of threatened European invertebrates associated with biotopes or habitats of critical importance to invertebrates. It was this logic which led to the study of threatened European saproxylic invertebrates carried out by SPEIGHT (1989), based on the singular significance of ancient forest in providing invertebrate habitats. A second biotope of particular significance to invertebrates is cave systems, and a study of Europe's threatened cavernicolous fauna is needed as a matter of priority.

What is a site?

There is an understandable tendency for specialists in invertebrates to consider site quality simply in terms of the interest of its invertebrate fauna, without giving due consideration to other aspects of site variability. This problem may be illustrated by reference to site area. Many sites too small to be maintained are nonetheless regarded as important and requiring protection. For instance, there are various small pieces and scraps of woodland in Europe today with an area of less than 100 hectares, which still retain elements of an interesting old-forest invertebrate fauna and which, on that basis, require protection. But protection of such small pieces of woodland in order to conserve the old-forest invertebrates found there can only be a largely self-defeating exercise, because it is so difficult to maintain all phases of the woodland regeneration cycle within such small areas: once the present generation of old trees dies, there is no longer any possibility of maintaining habitat for old forest species on site. An extreme example is provided by MARTIN (1989), who shows that the elaterid beetle *Lacon lepidoptera* was recorded repeatedly in Denmark from one particular grid square during the early part of the present century, demonstrating the presence there of a self-maintaining breeding population. However, all the records are derived from a single ancient oak (*Quercus*), still alive but now isolated among very young saplings. There is no way in which an adequate quantity of its senescent tree habitat can be maintained for *L. lepidoptera* in this, its one Danish locality. So not only has the beetle to be regarded as threatened in Denmark, but also it is unrealistic to argue that its last remaining site there is in any way secure or important to the long-term survival of the species in Denmark, however large its population may be in that old oak tree and whether or no it seems to be undergoing noticeable decline there at present. It is not sufficient to consider the importance of a site for invertebrate protection solely in terms of the threatened invertebrate species, or interesting invertebrate communities the site supports at present. It is also necessary to consider how large an area of appropriate habitat is needed to ensure the survival of that habitat, on site, for an appreciable period of time. There is then a link between site quality and site size. This, in turn, has an influence upon the interpretation of distribution records. If the sites upon which distribution records are based are not all of equal significance in determining the status of a species, the distribution records themselves are not all of equal significance in determining the status of a species.

When distribution records are used as a basis for assessing the status of an organism, one of the basic assumptions made is that the number of records available for a species is the primary determinant of its status. This is normally expressed in terms of the number of distribution "squares" from which a species has been recorded, as considered earlier in this account. But, as alluded to above, "sites" are unfortunately not standard units of reference. The Proceedings of this colloquium themselves demonstrate this, with the faunas of gardens compared with those of nature reserves, urban parks with fields and a universal use of ownership units, or administrative units, rather than ecological units, as individual "sites". Not only do these sites differ from one another in size, they differ also in ecology, manageability and the degree to which they are protected. An equivalently varied array of "sites" lies behind distribution records, making the equally sized spots on distribution maps of very unequal meaning and vastly complicating their interpretation. In essence, it has to be concluded that all apparently threatened species are to some extent more threatened than the number of their distribution records might suggest, except in cases where all the records are based on protected sites of adequate size. The heterogeneity of the other records ensures that a proportion of them are based on sites that are either themselves threatened or in some way to a significant extent inviable as habitat for the recorded species. This problem of variation in the quality of distribution records, caused by variation in site quality, clearly requires to be taken into account in efforts to standardise distribution-record based criteria to use for consigning species to threat categories, at both national and international level.

An attempt has been made to address the problem of scale in relation to site quality in Appendix II, though it has to be admitted that reference to the figure 100 ha, as the desired minimum size for sites of international importance, could well be more a recipe for universal discord than international agreement! Nonetheless, if specialists in the study of invertebrates cannot agree how large a site should be to ensure the survival there of target invertebrate species, they cannot expect conservation agencies or land managers to successfully deduce how large a piece of land should be protected, or managed in some particular way, in order to successfully ensure the survival of those species there.

When is a threatened Invertebrate no longer threatened?

To judge from events to date, it might with some justification be argued that the only time an endangered invertebrate is likely to become reclassified into a different threat category is when it becomes extinct! However, if there is any point at all to the process of trying to identify and protect sites in order to safeguard their invertebrate fauna it follows that, at some point in the future, species now threatened should, as a consequence of protection, become sufficiently widespread and numerous that they no longer require to be classified as threatened. It also follows that there is need to consider what scale of effort is required in order to stop the decline of a species, or to reverse its decline. Essentially, this is another aspect of the problem referred to in the previous paragraphs, considering the implications of variation in site quality to the question of what represents an adequate resource for ensuring the survival of a threatened species at European level.

In the Europe of today, the survival of threatened species cannot be assured outside protected sites, so that, effectively, the number of protected sites supporting populations of a threatened species provides the most accurate distribution-data based measure of its status. Distribution records of threatened species from sites of unknown status, or sites known not to be protected, are thus of lesser value in assessing the status of species. Even a record from a protected site means little, unless there is evidence that the site is of a sufficient size to support an adequate quantity of the species' habitat more or less in perpetuity. The proposal on recognition of sites of international importance for invertebrate protection (Appendix II) attempts to address this issue, by suggesting that an endangered species should continue to be regarded as endangered within a State until 500 ha of land where it occurs has been included within protected areas in that State. Whether or no the figure 500 ha is regarded as reasonable, the fact remains that for a species to survive in some part of its range an adequate supply of its habitat has to be available to it there, whatever may, or may not, be available elsewhere. In order to be successful, international effort to protect a threatened invertebrate species must result in *adequate* measures wherever protection is attempted: a State which takes steps to protect some particular invertebrate habitat, without ensuring sufficient of that habitat is protected, could fail to prevent extinction as surely as if it took no action at all. But how are conservation agencies to know what represents an adequate quantity of some particular habitat? If specialists in the study of invertebrates cannot agree some figure for the minimum amount of territory an invertebrate species requires in order that its survival may be ensured within some particular State, it is not reasonable to expect conservation agencies or managers of protected areas to successfully deduce what scale of effort is necessary to protect that species.

Tailpiece

In order to avoid considerable complication in presentation, it has been necessary to consider many of the points made in this text through the medium of discussing individual species. This has given rise to some distortions, for instance perhaps implying that separate protected areas are required for each threatened invertebrate. Not only would any such approach to protection of threatened European invertebrates be laughably impractical, it would also be unnecessary. One of the highest priorities of any programme seeking to identify sites of international importance for protection of invertebrates should be to identify those sites where maximum numbers of threatened species occur together and in company with well differentiated faunas of less threatened species. Such sites exist. Indeed, it would be highly exceptional that a threatened invertebrate species required sites to be protected for it alone.

A similar distortion has entered the text through consistent use of Appendix II as a vehicle for demonstrating the need for more generally agreed terms and criteria in the analysis and interpretation of invertebrate distribution data. The reality is that the proposal made in Appendix II happens to be the *only* one available, which attempts to address some aspect of the use of invertebrates in efforts to conserve Europe's flora and fauna at international level. The problems alluded to in the text inhibit the use of invertebrates in international and national efforts to conserve nature and consequently diminish their role, not only in respect of invertebrate conservation, but conservation in general. We need more reliable and comprehensive lists of internationally threatened invertebrates, not so much in order to get longer lists of invertebrates requiring special efforts to be made for their protection, but much more so that invertebrates can play their rightful role in processes of site evaluation. Unfortunately, legislators have yet to design legislation which will allow the latter without requiring the former. But such legislation is now desperately needed. We need long lists of threatened invertebrates validated as appropriate for use in recognising sites as of international and national importance.

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Appendix I:

Invertebrates named in the appendices of the Bern Convention

Invertebrates are included in appendices II and III of the Bern Convention. Appendix II lists "Strictly protected fauna species". These are species to be protected against all forms of killing or destruction and whose habitat is to be protected.
Appendix III lists "Protected fauna species". These are species whose exploitation is to be regulated in order to keep the population out of danger and whose protection is to be ensured.

In the following list, the species included in Bern Convention appendices II and III are listed together. The species from Bern Convention Appendix III are distinguished by the suffix (III) following their names.

ANNELIDA

Hirudinea

Hirudinidae: *Hirudo medicinalis* (III)

MOLLUSCA

Gastropoda

Arionidae: *Geomalacus maculosus*
Elonidae: *Elona quimperiana*
Helicidae: *Helix pomatia* (III)

Madeiran Gastropoda

Caseolus calculus
C. commixta
C. sphaerula
Discula leacockiana
D. tabellata
D. testudinalis
D. turricula
Discus defloratus
D. guerinianus
Geomitra moniziana
Helix subplicata
Leiostola abbreviata
L. cassida
L. corneocostata
L. gibba
L. lamellosa

Bivalvia

Margaritiferidae: *Margaritifera auricularia, M. margaritifera* (III), *Microcondylaea compressa* (III)
Unionidae: *Unio elongatulus* (III)

ARTHROPODA

Crustacea

Astacidae: *Astacus astacus* (III), *Austropotamobius pallipes* (III), *A. torrentium* (III)

Arachnida

Dipluridae: *Macrothele calpeiana*

Insecta

Mantodea:

Mantidae: *Apteromantis aptera*

Orthoptera:

Tettigoniidae: *Baetica ustulata, Saga pedo*

Odonata:

Aeschnidae: *Aeschna viridis*

Calopterygidae: *Calopteryx syriaca*

Coenagrionidae: *Coenagrion freyi, C. mercuriale*

Cordulidae: *Macromia splendens, Oxygastra curtisii*

Corduligastridae: *Cordulegaster trinacriae*

Gomphidae: *Gomphus graslinii, Lindenia tetraphylla, Ophiogomphus cecilia, Stylurus (= Gomphus) flavipes*

Lestidae: *Sympecma braueri*

Libellulidae: *Brachythemis fuscopalliata, Leucorrhinia albifrons, L. caudalis, L. pectoralis*

Coleoptera:

Buprestidae: *Buprestis splendens*

Carabidae: *Carabus olympiae*

Cerambycidae: *Cerambyx cerdo, Rosalia alpina*

Cucujidae: *Cucujus cinnaberinus*

Dytiscidae: *Dytiscus latissimus, Graphoderus bilineatus*

Lucanidae: *Lucanus cervus* (III)

Cetoniidae: *Osmoderma eremita*

Lepidoptera:

Lasiocampidae: *Eriogaster catax*

Lycaenidae: *Lycaena dispar, Maculinea arion, M. nausithous, M. teleius, Plebicula golgus*

Nymphalidae: *Apatura metis, Euphydryas (Eurodryas) aurinia, Fabriciana elisa, Hypodryas maturna*

Papilionidae: *Papilio alexanor, P. hospiton, Parnassius apollo, P. mnemosyne, Zerynthia polyxena*

Satyridae: *Coenonympha hero, C. oedippus, Erebia calcaria, E. christi, E. sudetica, Lopinga achine, Melanargia arge*

Saturniidae: *Graellsia isabellae* (III)

Sphingidae: *Hyles hippophaes, Proserpinus proserpina*

Appendix II:

A proposed basis for recognition of sites as internationally important for protection of Invertebrates

Considering for purposes of this proposal a European invertebrate to be any invertebrate species whose world range is predominantly or entirely within the area of the member States of the Council of Europe and a site is an area of not usually less than 100 ha;

Considering also any European invertebrate to be threatened if it is so designated by any Europe-wide study which has been set up to identify threatened species, and whose results have been scrutinised and accepted by an international group set up for the purpose by some body recognised by the Council of Europe as competent in this field;

1. any site in a member State known to support either/or
    a) two or more invertebrate species threatened in Europe and a good representation of the nationally recorded species associated with the biotopes present,
    b) one of the five most important European populations of a threatened European species, taking into consideration the need to protect as wide a range as possible, both ecologically and geographically, of the sites supporting the species,

should be regarded as of international importance for protection of invertebrates and as a candidate site for inclusion on lists of sites recommended for protection.

Considering also any threatened European invertebrate to be regarded as endangered within a Council of Europe member State from which it is recorded until and unless a minimum of 500 ha of appropriate habitat on sites supporting the species have achieved protected status within that State and are being managed in a fashion consistent with the needs of the species;

Considering also that extinction of a threatened European invertebrate species, which is the only known species in the world representative of some particular genus or higher taxonomic grouping, would represent a more serious evolutionary loss than would extinction of a representative of a polytypic genus or higher taxonomic grouping;

2. any site in a member State known to support either/or
    a) a population of any threatened European species not known from protected sites in that State totalling more than 500 ha of appropriate habitat,
    b) a population of a threatened European species which is the only known species of its genus or of some higher taxonomic grouping,
    c) a population of a threatened European species which is known from five or less sites in Europe,

should be regarded as of international importance for protection of invertebrates and as a priority site for inclusion on lists of sites recommended for protection.

Appendix III:

IUCN status categories

The definitions of these categories given here are taken from WELLS *et al.* (1983).

Extinct
Species not definitely located in the wild during the past 50 years (criterion as used in the CITES Convention).

Endangered
Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating.

Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that are possible already extinct but have definitely been seen in the wild in the past 50 years.

Vulnerable
Taxa believed likely to move into the 'Endangered' category in the near future if the causal factors continue operating.

Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security has not yet been secured; and taxa with populations which are still abundant but are under threat from severe adverse factors throughout their range.

Rare
Taxa with small world populations that are not at present 'Endangered' or 'Vulnerable', but are at risk.

These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

Indeterminate
Taxa known to be 'Endangered', 'Vulnerable' or 'Rare' but where there is not enough information to say which of the three categories is appropriate.

Martin C.D. SPEIGHT
Research Branch
Nat. Pks & Wildlife Service
51 St.Stephens Green
DUBLIN 2 - IRELAND