

Classifying threatened species at national versus global levels

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The World Conservation Union (IUCN) criteria for classifying threatened species in Red Lists were constructed to be applied primarily on a global scale. Nonetheless, many nature conservation efforts are conducted at national levels and there is consequently a demand for Red Lists at subglobal scales. In 1999, a working group presented draft guidelines of how to apply the IUCN criteria at such levels. Meanwhile, the 1994 IUCN criteria were the subject of re-evaluation, resulting in the somewhat altered 2001 IUCN criteria. Experiences of applying the suggested guidelines for national Red Lists, particularly from Sweden and Finland, revealed that the system is applicable to a wide range of taxa and geographical scales, even though there are issues that remain to be resolved. A comparison of the classification outcome of species listed both at global and national levels has highlighted some incongruities.

In 1994, after 30 years of qualitatively defined Red List categories, the World Conservation Union (IUCN: see Glossary) adopted new quantitative criteria for classifying threatened species (Ref. 1). The criteria are aimed at identifying species at risk of extinction and placing them accordingly in the Red List categories. Between 1997 and 2000, the system was re-examined and changes in the criteria and categories were adopted². The current categories are extinct (EX), extinct in the wild (EW), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), data deficient (DD), least concern (LC) and not evaluated (NE) (Fig. 1). Species in the LC and NE categories are usually not published in Red Lists or Red Data Books.

Species classified as CR, EN or VU are referred to as threatened. These categories are assigned by one or more of five criteria or decision rules, denoted as A–E (Box 1). Criterion E specifies explicit extinction risk levels within specified time frames. For instance, CR is assigned by criterion E when a 'quantitative analysis shows that the probability of extinction in the wild is at least 50% within ten years or three generations, whichever is the longer (up to a maximum of 100 years)²'. The criteria A–D draw on other warning signals that indicate whether the population is at risk. Thus, criterion A builds on population reduction, B on a small distribution area in combination with fragmentation, decline or extreme fluctuation of the population, C on a small population number in combination with a population decline, and D on an extremely small population. Criterion D2, only applicable for the VU category, builds on an acute restriction in the area of occupancy or in the number of locations². The category NT is used when the species is close to qualifying, or is likely to qualify in the near future, for a threatened category.

Classification at a national level

The IUCN Red List criteria were developed to assess the extinction risk of entire populations, that is, the assessment of species at the global level. To use the criteria at for example, a national scale, poses certain problems³. The most obvious is that a population can be distributed over more than one country, making it difficult, not the least conceptually, to estimate the extinction risk of the part of the population resident within the target country. Another issue is to decide which species are eligible for evaluation, because the fauna and flora of a country might encompass species ranging from those that have evolved *in situ* or colonized the area in prehistoric times, to recently introduced and even nonreproducing species, such as migrants and vagrants. Furthermore, extinction at a national level might be followed by recolonization or even reintroduction, providing the species is extant elsewhere.

A frequently suggested solution is to change the IUCN criteria thresholds when they are used at national levels, 'otherwise every species will be classified as threatened in Liechtenstein and other small countries'. However, such a general measure would be wrong. Other factors being identical³, the extinction risk of a small and isolated population is as high whether it occurs in Liechtenstein or in Russia, or whether it is the only population on Earth. Indeed, putative threatened species do often have isolated populations resulting from habitat fragmentation. There is admittedly a problem, however, for mobile species that have small populations within the target country but that have large and nonthreatened populations in neighbouring countries.

The biologically correct solution would be to not evaluate the extinction risk of anything but entire, totally isolated populations. The dilemma is that much conservation policy is bound within geopolitical borders, including laws, resources available for conservation measures and personal levels of commitment. Thus, even if biologists refused to participate in the production of national Red Lists, they would still be produced by bureaucrats and other interested parties.

To resolve these issues, the IUCN species survival commission (SSC) appointed a regional application working group (RAWG) in 1998 following the adoption of a resolution on this matter at the first World Conservation Congress in Montreal

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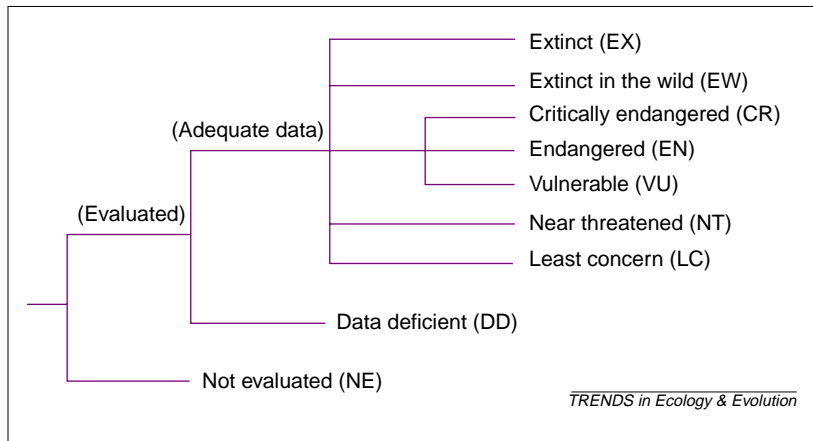


Fig. 1. Structure of the 2001 IUCN Categories. Species in the categories critically endangered (CR), endangered (EN) and vulnerable (VU) are denoted as threatened. Species classified as least concern (LC) or not evaluated (NE) will not usually be published in a Red List. At national or other subglobal levels, an additional category, regionally extinct (RE), has been proposed⁴. Reproduced, with permission, from Ref. 2.

(Resolution D. 1.25). The group put forward a draft set of guidelines⁴ that are currently under review. The main proposal is to determine the national Red List category by a two-step procedure. First, the population should be assessed using the IUCN criteria as though the population were endemic to the country, or completely isolated from other conspecific populations. Second, it should be considered whether the target population is a part of, or in contact with, a more widely distributed population. If the latter is true, the Red List category should be adjusted, usually downgraded, to one that more appropriately reflects the long-term extinction risk of the subpopulation (Fig. 2). RAWG also suggested the use of a distinct category, regionally extinct (RE), for those species that are extinct within, for example, a particular country but that are extant in other parts of the world⁴.

Box 1. Outline of the World Conservation Union (IUCN) 2001 criteria for threatened species

There are five sets of criteria or decision rules for determining the categories critically endangered (CR), endangered (EN) and vulnerable (VU). The following overview provides a brief outline of the full set of criteria, with example threshold values relating to the CR category.

A. Population reduction, as either of the following:

- (1) At least 90% over the last ten years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible, understood and have ceased.
- (2) At least 80% over the last ten years or three generations, whichever is the longer, where the reduction or its causes might not have ceased, be understood or be reversible.
- (3) At least 80%, projected or suspected, within the next ten years or three generations, whichever is the longer (up to a maximum of 100 years).
- (4) As A2 but where the time period includes both the past and the future.

B. Small distribution area measured as either or both:

- (1) limited extent of occurrence (e.g. <100 km²);
 - (2) limited area of occupancy (e.g. <10 km²);
- and at least two of the following:
- severe fragmentation;
 - continuing decline;
 - extreme fluctuations.

C. Small population (e.g. <250 mature individuals) and either:

- (1) continuing decline (e.g. at least 25% within three years or one generation, whichever is the longer, up to a maximum of 100 years); or
- (2) continuing decline and at least one of the following (a or b):
 - (a) population structure in the form of one of the following: no subpopulation contains more than 50 mature individuals;
 - or
 - at least 90% of the mature individuals are in one subpopulation;
 - (b) extreme fluctuations in the number of mature individuals.

D. Extremely small population (e.g. <50 mature individuals).

For category VU, there is a D2 option used when the population has a very restricted area of occupancy (typically <20 km²) or number of locations (typically <five) such that it is prone to the effects of human activities or stochastic events within a very short time period.

E. Quantitative analysis showing a probability of extinction

For example, at least 50% within ten years or three generations.

The full system^a, which must be consulted for any application, is more complex with additional subcriteria that are not outlined here. All the criteria have numerical thresholds, as illustrated for CR in this example. At least one of the criteria A–E should be met for assigning a species to a particular category. No criterion overrules any other. If different criteria suggest different categories, the category expressing the highest risk should be chosen.

Certain changes to the 1994 IUCN Red List categories and criteria^b have been introduced^a. Criterion A now has four subcriteria (1–4) allowing a shifting time window or higher population reduction thresholds where the causes of the reduction are clearly reversible, well understood and have ceased. The population reduction threshold for VU has been raised from 20% to 30%. Criterion B has been changed to make the use of 'extent of occurrence' and 'area of occupancy' more explicit. Under criterion C, an additional option, 'extreme fluctuations in number of mature individuals', has been included and the requirement for all individuals to be in one subpopulation has been changed to a sliding scale of 90, 95 and 100% for CR, EN and VU respectively. The area of occupancy under criterion D2 has been changed to typically <20 km². Under criteria A, C and E, projection of extinction risk is capped at a maximum of 100 years. In addition, several minor changes to the system, including definitions, have been made in the 2001 system.

References

- a IUCN Species Survival Commission (2001) *IUCN Red List Categories: Version 3.1*. IUCN (<http://www.iucn.org/themes/ssc/redlists/ssc-r1-c.htm>)
- b IUCN Species Survival Commission (1994) *IUCN Red List Categories*, IUCN

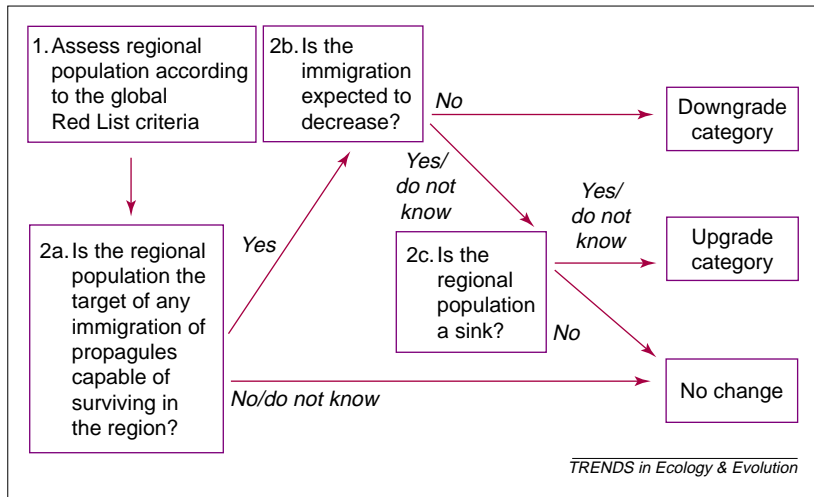


Fig. 2. Proposed conceptual scheme of the procedure for assigning an IUCN Red List category at a national or regional level. (1) In the first step, the target population should be viewed as if it was isolated from other populations and evaluated against the global IUCN Red List criteria. (2) In the second step (i.e. 2a, 2b and 2c), an assessment should be made of whether there are any populations outside the country/region that could affect the extinction risk of the target population. If so, the category should be adjusted to a level that more appropriately reflects the extinction risk. In the draft guidelines, a set of more detailed questions are supplied that assist the assessor to answer the questions posed in the flow chart. The scheme will be developed further, particularly with respect to migratory species, in the next version of the guidelines, currently being prepared by the RAWG. Reproduced, with permission, from Ref. 4.

Red List category versus priority for measures

This procedure means that species with small isolated populations in the target country, but which occur in other parts of the world, are still eligible for the national Red List. From a national point of view, this is correct, because the Red List should reflect the risk of extinction in the target area. But to decide which species should be the target for receipt of limited conservation resources (i.e. setting conservation priorities), several additional factors must be considered⁵: for example, what proportion of the global population occurs within the country; what is the risk of extinction in other parts of the world⁶; is there taxonomic⁷, genetic or ecological uniqueness to consider; and what logistical problems exist⁴? Such conservation priorities will be established in different ways in different countries and, in contrast to the objectively scientific process of assigning species to Red Lists, will often involve political as well as logistical considerations.

Experiences at the national level

The 1994 IUCN Red List criteria have been applied in several countries to various taxa. To my knowledge, only Switzerland (195 bird species; V. Keller *et al.*, unpublished), Sweden (approximately 20 000 species evaluated representing a wide array of taxa)⁸ and Finland (approximately 19 000 species evaluated from a similar array of taxa; <http://www.vyh.fi/eng/environ/naturcon/threat/2000/2000.htm>) have applied the proposed guidelines for adjusting each category at national levels. Canada has a national system (using the IUCN criteria as guidelines) for

identifying threatened species (<http://www.cosewic.gc.ca/COSEWIC/Terms.cfm>). It has tested the second step of the process (i.e. adjustment of category as a result of contact with extra-national populations) in the proposed regional guidelines (108 species or subspecies of vertebrates, insects, molluscs, vascular plants, mosses and lichens considered to be at risk; C. Hyslop *et al.*, unpublished).

Because the Swedish and Finnish Red List processes were fairly extensive and encompassed the evaluation of taxa ranging from vertebrates and vascular plants to bryophytes, fungi, lichens, algae, insects and other invertebrates, including marine taxa, the procedures and some of the experiences gained from these countries are discussed here in some detail.

The evaluations were made by specialist groups. For example, in Sweden 14 groups, encompassing approximately 100 specialists, plus a similar number of external consultants under the assistance of the Threatened Species Unit, made the evaluation and a detailed set of written guidelines was used⁹. In both countries, the evaluations were based on the (anticipated) IUCN 2001 Red List categories², but still used the 1994 criteria¹. The 2001 Red List criteria could not be used because they were neither finalized nor adopted by the IUCN at the time the Nordic Red Lists were produced.

The DD category, defined by the IUCN in 1994 to be used to describe a taxon 'when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status...', was interpreted rather differently by the two countries. In Sweden, it was assumed that a species classified as DD, given more data, could probably have been classified in any Red List category from NT to RE-EX (i.e. would not qualify for LC). In Finland, the category DD was used less restrictively (i.e. the 'true' classification could be anywhere from LC to RE-EX). Notably, this meant that Finland chose not to include DD species on the published Red List.

The eligibility rules mainly followed those of the RAWG draft⁴. However, visiting species (e.g. nonreproducing migrants) were not evaluated, although the RAWG draft guidelines offer the possibility to do so. This is an aspect that will be developed further in the next version of the guidelines, currently being prepared by RAWG (Ref. 10).

Applicability of the criteria

When using the known data for a species, consideration was given to the level of knowledge about that particular species. Thus, for species for which there were only poor data, it was often assumed that the actual number of locations or total population size was larger than suggested by the data. These assumptions were accounted for in the short documentation supplied for each of the species listed⁸.

Table 1. Overview of the criteria applied in classifying threatened species in the Swedish Red List^{a,b}

Taxonomic group	Criterion					Total	Number of threatened species	Average number of criteria per species
	A	B	C	D	E			
Vascular plants	50	201	51	100	0	402	326	1,2
Cryptogams	267	118	46	362	0	793	520	1,5
Vertebrates except fish	26	8	20	54	2	110	71	1,5
Fishes	12	3	4	0	0	19	13	1,5
Invertebrates	265	785	201	174	0	1425	1023	1,4
Total	620	1115	322	690	2	2749	1953	1,4

^aMore than one criterion was frequently met for an individual species justifying the assigned Red List category: the average number met is specified in the last column.
^bData taken from Ref. 8.

Criteria A–D were widely used in the assessments (Table 1), whereas criterion E was only met twice, although it was tested for in 12 species^{8,11}. All criteria posed certain difficulties. Criterion A was often met at the VU level (a population reduction by at least 20% over the last ten years or three generations, whichever was longest) for common and apparently nonthreatened species for which there were good quality data. The lack of a defined grid size when applying 'area of occupancy' under criterion B was an obvious problem. Both countries, however, chose to use 5 × 5 km² grids, except for the CR category, where 2 × 2 km² grids were used (because the threshold for CR is 10 km²), and for those vertebrates with extremely large home-ranges where larger grids had to be used. In criteria C and D, one of the most problematic issues was how to define individuals of, for example, bryophytes, lichens, fungi and vegetatively growing vascular plants. Criterion E presupposes high quality or highly specific data, which limits its applicability.

These issues and many others have been the subject of thorough evaluation at workshops during the international review process¹². Despite this process, it has not been possible to provide a fully satisfactory solution to all the problems encountered² (Box 1).

Similar outcome in different countries

The outcome of the Red List process was surprisingly similar in both Sweden and Finland (Table 2). For instance, 10% and 8% of the evaluated species were classified as threatened (i.e. falling into categories CR, EN or VU) in Sweden and Finland, respectively. Such a difference would be expected, because the majority of threatened species in Sweden are found in the southern parts of the country, whereas the conditions in the northern parts, which are more similar to those in Finland, have a lower proportion of threatened species.

In Sweden, the second step in the two-step procedure resulted in 32 of the species categories being downgraded from the estimates made after the first step: one mammal, 25 bird, two fish, one hoverfly (Syrphidae), and two dragonfly (Odonata) species.

The corresponding figures for Finland, which has a comparatively smaller proportion of physical barriers to bordering territories compared with Sweden (which is less land-locked), were 68 species, represented by four mammal, 19 bird, two beetle, 22 butterfly and moth, and 21 vascular plant species. In both countries, several additional species originally qualified as NT, and in a few cases VU, but were downgraded to LC and therefore not listed at all. One would have expected that, among the marine invertebrates (from the taxa Echinodermata, Mollusca and Malacostraca, which were evaluated in Sweden), several species with mobile larvae should have been downgraded. However, the marine invertebrate specialist group found that knowledge of these species was too poor to make such a decision. Consequently, they had to follow the precautionary principle and make a more conservative judgement (Fig. 2).

The similar exercise for breeding birds in Switzerland, a completely landlocked country, resulted in a downgrading of 40 species and an upgrading of nine species (five of which were from LC to NT), out of a total of 195 species evaluated (V. Keller *et al.*, pers. commun.). The Swiss evaluators developed the second step of the procedure into a formalized set of criteria, which included whether the population is threatened at the European level, if the Swiss population is declining, is stable or is increasing, and so on. In particular, it should be observed that the criteria for upgrading a species classification differ from those proposed by RAWG⁴.

In Canada, a test of 108 taxa considered to be at risk resulted in a downgrading for three species (one fish, one butterfly and one orchid; C. Hyslop *et al.*, pers. commun.) because of a possible rescue effect from populations in the USA.

Outcomes at national versus global levels

By comparing the status of endemic animal species among several South American national Red Lists and the global 1996 IUCN Red List of threatened animals¹³, several incongruities in the classifications were found¹⁴. Only one quarter of the taxa listed in any of the national or global lists were

Table 2. Overview of the evaluated and classified number of eukaryotic species (excluding Protista) in Sweden and Finland, and the number of evaluated bird species in Switzerland in the different Red List categories^{a,b}

Country	RE	CR	EN	VU	% threatened/ evaluated	NT	DD ^c	Total number red-listed	LC	Number of evaluated species	NE ^d	Total number of species
Sweden												
Vascular plants ^e	30	58	111	157	13	136	13	505	2016	2521	200	2721
Cryptogams	46	86	158	277	9	386	169	1122	4468	5590	8540	14 130
Vertebrates (except fish)	10	9	17	45	22	35	7	123	207	330	9	339
Fish	1	3	3	7	8	7	12	33	126	159	5	164
Invertebrates	171	123	281	618	9	793	351	2337	8819	11 156	22 344	33 500
Total	258	279	570	1104	10	1357	552	4120 (3568)	15 636	19 756	31 098	50 854
Finland												
Total	186	249	452	804	8	1060	3662	2751 (6413)	12 330	18 743	24 257	43 000
Switzerland^f												
Total	6	9	18	44	36	24	0	101	94	195	18	213

^aData taken from Ref. 8; V. Keller *et al.*, unpublished and the Finnish Red List website (<http://www.vyh.fi/eng/viron/naturcon/threat/2000/2000.htm>).

^bAbbreviations: regionally extinct (RE), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), data deficient (DD), least concern (LC) and not evaluated (NE).

^cSpecies assigned to the DD category are included on the Swedish but not the Finnish Red Lists, hence the alternative figures (in parentheses) in the totals.

^dIn the Swedish and Finnish Red Lists NE encompasses species that have yet to be evaluated in addition to species that are not eligible for the Red List because they were originally introduced or only occasionally breed in the respective country. In the Swiss figures, NE only encompasses the latter category of species.

^eFigures for vascular plants include a limited number of subspecies and apomictic taxa.

^fIncludes birds only.

present in both lists, in spite of the fact that all taxa should have been included in both because they were all endemic to single countries. It was argued that national assessments tend to incorporate data from global assessments, whereas the reverse is much less frequent¹⁴. However, a further study of these data¹⁵ concluded that only nine out of the 70 different assessments tabulated were the result of differing information about species, whereas many differences resulted from the different choice of taxa for consideration. Nevertheless, the view that it is crucial to improve the flow of information between national and global Red List assessments is highly relevant¹⁴.

Sweden and Finland have extremely few endemic taxa; therefore, globally threatened species occurring in either of these two countries are usually found in other countries. Consequently, for such species, one would expect that the risk level should be lower (expressed as a lower or equal Red List category) at the global level compared with the national level. In such a comparison, one should, however, be aware that the IUCN criterion A (decline rate) might result in a lower threat category at the national level: for example, a population might be stable within the target country while populations elsewhere in the world are severely declining, giving an average overall decline.

Seventy-one animal taxa* reproducing in Sweden⁸ were listed on the 2000 IUCN Red List of threatened species¹⁶ (Table 3). In 23 cases (32%), the Red List category was lower (in 20 cases classified as LC) on the Swedish Red List than on the global list. At first, this might seem alarming. However, a closer

Table 3. Comparison of classification of those 71 threatened animal species listed in both the global Red List and in the Swedish Red List^{a-c}

Difference in risk category	Number of cases
Risk category lower at national level	23
Risk category equal at national and global levels	17
Risk category higher at national level	21
LC at national, DD at global level	3
DD at national, NT at global level	2
CR-NT at national, DD at global level	5
Total	71

^aData taken from Refs 8,16.

^bIn this comparison, the conservation dependent (LR/CD) category was regarded as expressing the same risk level as NT.

^cAbbreviations: critically endangered (CR), data deficient (DD), least concern (LC) and near threatened (NT).

examination of the discrepancies reveals the following: (1) 16 out of the 23 cases are taxa classified as LC in the Swedish and NT or CD[†] at the global level (i.e. categories without any clear guiding criteria); (2) six out of seven species classified as globally threatened (i.e. EN-VU) but with a lower national risk level (i.e. VU-NT) were classified according to criterion A; and (3) the majority of discrepancies constitute invertebrate species, where

* Excluding two nonreproducing species and one subpopulation not evaluated in the national Red List.

[†]A lower-risk subcategory used in the 1994 IUCN Red List system for taxa that are the focus of a conservation programme that prevents them from entering into a threatened category.

available data at the global level are generally poor. Nevertheless, I believe that there are several apparent misclassifications in the global list. This highlights the importance of enhancing the bidirectional transfer of information between specialist groups at the national and global level. The Species Information Service (SIS) currently under development will hopefully be one important tool for achieving this.

Concluding remarks

There are both conceptual and practical obstacles in applying the IUCN Red List criteria at national and other regional levels. Further discussion and tests of how to evaluate the extinction risk of subpopulations are needed. One aspect to be investigated is the effect of scale on risk assessments in a set of geographically nested areas, from tiny localities to the world as a whole. Another issue to explore, by using metapopulation models, for example, is the long-term rescue effect of regularly or irregularly immigrating propagules on target populations under various conditions. Of course, there is also a great need for empirical (including genetic) data on dispersal rates and frequency in most taxa.

However, the experiences from Sweden and Finland show that, even at this stage, it is possible to cope with these issues in a generally satisfactory way. It is particularly encouraging that, with specific guidelines, it has been possible to apply the IUCN criteria to a wide range of organisms, from mammals to birds, vascular plants, insects,

Glossary

IUCN: the World Conservation Union. The IUCN was founded in 1948 and has its headquarters in Gland, Switzerland. It currently has approximately 960 members and some 10 000 scientists and experts from 181 countries, representing governments as well as nongovernmental organizations and affiliates. Its mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable

(<http://www.iucn.org/2000/about/content/index.html>).

SSC: Species Survival Commission. One of six commissions within the IUCN. The SSC is the body responsible for the IUCN Red Lists. It has almost 7000 members, which each belong to one or more of the 115 Specialist Groups, most of which are involved with assessing the extinction risks of taxa. Further details are available at the SSC website (<http://www.iucn.org/themes/ssc>).

RAWG: Regional Application Working Group, appointed by the SSC in 1998 to formulate guidelines on how to apply the IUCN criteria at national and other regional levels.

SIS: the Species Information Service. The SIS is a worldwide species information resource (interlinked databases of species-related information) being developed by the SSC. It will be a decentralized means of sharing current species information at different geographical scales. Standardized information management tools will allow the exchange of data and information across the Internet. Further details are available at the SIS website (<http://iucn.org/themes/ssc/programs/sisindex.htm>).

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marine invertebrates, fungi and algae. When consistent guidelines have been produced for both regional and the global Red List processes, information transfer has been improved between national and global levels, and species specialists have obtained more experience in applying the criteria, the Red List system will be both efficient and consistent.

Erratum

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