Contributed Papers

National Threatened Species Listing Based on IUCN Criteria and Regional Guidelines: Current Status and Future Perspectives

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Abstract: *As countries worldwide become increasingly interested in conserving biodiversity, the profile of national threatened species lists expands and these lists become more influential in determining conservation priorities. The World Conservation Union (IUCN) Categories and Criteria for evaluating extinction risk, originally intended for use at the global level, are increasingly being used at the national level. To facilitate this process, the IUCN recently published guidelines for the application of the criteria at subglobal levels. We evaluated the application of these guidelines, focusing on the opinions and experience of the global community of national assessors. To assess the extent to which IUCN criteria have been used in official national listing efforts, we sent a survey to 180 Convention on Biological Diversity national focal points designated by governments. Of the respondents, 77% had developed national threatened species lists. Of these, 78% applied a version of the IUCN criteria, and 88% plan to produce future threatened species lists. The majority of this last group (83%) will use IUCN criteria. Of the countries that have or will develop a threatened species list, 82% incorporated their list or the IUCN criteria into national conservation strategies. We further explored the issues highlighted by the survey results by integrating the experience of assessors that have produced national lists. Most of the problems national assessors faced when applying the IUCN criteria arose when the criteria were applied at the regional level without the IUCN Regional Guidelines and when assessors were confused about the purpose of the IUCN criteria and lacked training in their proper use. To improve their clarity and increase their repeatability, we recommend that the IUCN increase communication and information exchange among countries and between regional and global assessors, potentially through an interactive Web site, to facilitate the development of national red lists and to improve their conservation value within and between countries.*

Keywords: assessment criteria, conservation priorities, endangered species, extinction, red lists, risk assessment, World Conservation Union (IUCN)

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Enlistado de Especies Nacionales Amenazadas con Base en Criterios de IUCN y Directrices Regionales: Estatus Actual y Perspectivas Futuras

Resumen: *A medida que los países incrementan su interés en la conservación de la biodiversidad, el perfil de las listas nacionales de especies amenazadas se expande y estas listas cada vez son más influyentes en la determinación de prioridades de conservación. Las Categorías y Criterios de la IUCN para la evaluación del riesgo de extinción, originalmente pensadas para uso a nivel global, son utilizadas cada vez más a nivel nacional. Para facilitar este proceso, la UICN recientemente publicó directrices para la aplicación de los criterios a niveles subglobales. Evaluamos la aplicación de estas directrices, destacando las opiniones y experiencia de la comunidad global de asesores nacionales. Para evaluar el grado en que los criterios de IUCN han sido utilizados en esfuerzos por elaborar listas nacionales oficiales, enviamos una encuesta a 180 puntos focales nacionales designados por gobiernos en la Convenio Sobre la Diversidad Biológica. Entre los encuestados que respondieron, 77% aplicaban una versión de los criterios IUCN y 88% planean producir listas de especies amenazadas en el futuro. La mayoría de este último grupo (83%) utilizará criterios IUCN. Entre los países que tienen o desarrollarán una lista de especies amenazadas, 82% incorporaron su lista o los criterios IUCN en estrategias nacionales de conservación. Más aun, exploramos los tópicos que sobresalieron en los resultados de las encuestas mediante la integración de la experiencia de asesores que han producido listas nacionales. La mayoría de los problemas enfrentados por asesores al aplicar los criterios IUCN surgieron cuando los criterios eran aplicados a nivel regional sin las Directrices Regionales IUCN y cuando los asesores estaban confundidos por el propósito de los criterios IUCN y carecían de entrenamiento para su uso adecuado. Para mejorar la claridad e incrementar las replicabilidad, recomendamos que la IUCN incremente la comunicación e intercambio de información entre países y entre asesores regionales y globales, potencialmente por medio de sitio Web interactivo, para facilitar el desarrollo de listas rojas nacionales y mejorar su valor de conservación dentro y entre los países.*

Palabras Clave: criterios de evaluación, especies en peligro, evaluación de riesgo de extinción, listas rojas, prioridades de conservación, Unión Mundial para la Conservación (IUCN)

Introduction

The emerging magnitude of the contemporary extinction crisis has inspired a massive effort to evaluate and monitor the risk of extinction faced by species worldwide. Accordingly, global, regional, national, and local lists of threatened species have proliferated over the past 4 decades (Burton 2003). Although the proper role of threatened species lists in conserving biodiversity has been debated (Possingham et al. 2002; Pimenta et al. 2005), these lists have undeniably become valuable tools for conservation (Collar 1996; Lamoreux et al. 2003; Rodrigues et al. 2006). Threatened species lists have been utilized to: (1) inform and influence conservation policies and legislation (national and international); (2) stimulate research and monitoring programs for species and/or habitats; (3) monitor the status of biodiversity and report on the state of the environment; (4) regulate development and exploitation; (5) target geographical areas for conservation planning; (6) increase public awareness of human impacts on biodiversity; and (7) set priorities for the allocation of limited conservation resources (Maes & van Swaay 1997; Bennun et al. 2000; Possingham et al. 2002; Rodríguez et al. 2004; Miller et al. 2006).

The World Conservation Union (IUCN) set a standard for objective, repeatable, and scientifically sound threatened species listing procedures with the publication of the IUCN Red List Categories and Criteria (IUCN 1994, 2001). Today the IUCN Red List of Threatened Species (www.redlist.org) is recognized as one of the most authoritative sources of information on the global conservation status of plants and animals (Lamoreux et al. 2003; de Grammont & Cuarón 2006; Rodrigues et al. 2006). Nevertheless, "it is at regional and local scales that human actions and biodiversity collide" (Pimm et al. 2001), and interest in producing regional and national threatened species lists has soared: 3562 current and historical threatened species lists have been reported for the European nations alone (not counting worldwide lists; Köppel et al. 2003). Because the institutions that most directly influence conservation actions and legislation are national governments, national threatened species lists can be especially influential in the protection and recovery of threatened species. National lists also play a valuable role in informing global conservation efforts, especially when the information they contain is incorporated into the global IUCN Red List (Cuarón 1993; Rodríguez et al. 2000).

Interpreting national threatened species lists is difficult, however, because they are often designed to serve different purposes in different countries and therefore encompass a wide range of methodologies (Burton 2003). A threatened species list may reflect extinction risk, rarity, cultural importance, conservation value, population decline, conservation priorities, international responsibility for protection, or a combination of several of these

factors, and taxonomic representation differs depending on the intent of the list. Further complicating matters, the definition of categories often varies, so that terms such as *threatened* or *vulnerable* may mean very different things on different lists (Schnittler & Günther 1999; Grigera & Ubeda 2002). Moreover, the criteria used are often neither explicit nor transparent (de Grammont & Cuarón 2006). Although a given threatened species listing procedure may be effective within one country, such variation in national listing makes direct international comparisons of status difficult and can hamper efforts to consolidate information from different countries. This can in turn impede species protection on a larger scale, rendering national threatened species lists of limited use as data sources for international conservation policies. Nonetheless, threatened species frequently obtain the strongest legal protection at the national level, and national threat assessments can act as early warning signs of local decline. Sufficient protection of a particular taxon at the national level by multiple countries could, theoretically, prevent or delay species extinction globally.

The IUCN criteria were developed to increase the objectivity and comparability of red lists (Mace & Lande 1991) and have been used in countries around the world to develop regional (e.g., Samways 2002; Golding & Hurtur 2003), national (e.g., Rodríguez & Rojas-Suárez 1995; Molur & Walker 1998; Gärdenfors 2005), and local (e.g., Broughton & McAdam 2002; Patra et al. 2005) lists of threatened species, although many countries still do not use them (de Grammont & Cuarón 2006). Nevertheless, the criteria were originally designed to evaluate the extinction risk of the entire population of a species across its global range and thus often produce incorrect assessments when applied to a regional subpopulation (Gärdenfors 1996). Applying the IUCN criteria only to the portion of a population present within a particular region (here defined as any subglobal geographical area, e.g., a continent, country, or province) artificially divides the biological population into a smaller, more restricted subpopulation. Because small, isolated populations face a higher threat of extinction than large, widespread populations (Lande 1988, 1993; O'Grady et al. 2004), the artificially divided subpopulations may be assessed individually as having a higher risk of extinction than they actually face.

To resolve the problem of incorrect regional assessments, the IUCN developed the IUCN Regional Guidelines, which adapt the criteria for use at the regional level by taking into account the effect that subpopulations outside a region have on the likelihood of that subpopulation's extinction in the region (Gärdenfors et al. 1999, 2001; IUCN 2003). The process has two stages. First, the IUCN criteria are applied to the regional population as if it was completely isolated, and a preliminary category is assigned. Then the effect of populations in neighboring regions is taken into account, and the preliminary category is up- or downlisted, if appropriate. Thus, the final categorization reflects the extinction risk of species within a particular region because it considers potential interactions with populations outside that region. The only instances in which the IUCN criteria can be applied at a regional level without also applying the regional guidelines is if the regional population is endemic or completely isolated from all other conspecific populations, in which case the criteria may be applied without modification (IUCN 2003).

The IUCN Regional Guidelines have now been tested in several countries, which has brought to light some of their strengths and weaknesses and generated several suggestions for improvements (Gärdenfors 2001; Bauer 2003; Köppel et al. 2003; Eaton et al. 2005; Keller et al. 2005; Milner-Gulland et al. 2006). Nevertheless, they have undergone no formal review. Furthermore, although a general demand for regionally applicable IUCN criteria exists, no systematic study has been conducted into how extensively the IUCN criteria have been used in different countries or what needs regional users of the criteria may have (but see de Grammont & Cuarón 2006). Our study was designed to: (1) determine the current and potential use of the IUCN criteria and IUCN Regional Guidelines in national red-listing procedures; (2) assess the needs of regional users of the criteria; (3) evaluate the feasibility of the application of the regional guidelines; and (4) explore the ways in which national threatened species lists and the IUCN criteria have been incorporated into national conservation policies and priority-setting activities.

Methods

Our study had two components: a survey designed to assess the current and future demand for regionally applicable IUCN criteria, and an in-depth analysis of the utility of the IUCN criteria and regional guidelines at the national level, based on experiences of national red listing in a series of test countries around the world.

Between July and October 2004, we sent a survey through email and/or post to the 180 Convention on Biological Diversity (CBD) national focal points for which updated contact information was available (CBD 2004). The CBD focal points were a natural choice because they represent countries that have made a commitment to conserve biodiversity and use it sustainably and to reduce the current rate of biodiversity loss in their countries (CBD 1992, 2005). After receiving the completed surveys, we phoned or emailed most respondents to obtain more information regarding their threatened species listing procedures.

The main points addressed in the survey included (the full questionnaire is available from http://intranet.iucn.org/webfiles/doc/SSC/RedList/iucn_red_list_survey.pdf): (1) Has the country developed, or are they planning to

develop, a national list of threatened species? (2) Are they, or will they be using IUCN criteria? Why or why not? (3) Have they adopted the IUCN Regional Guidelines or developed their own set of regional guidelines? (4) If the IUCN criteria were used, what sorts of modifications were made, if any, to adapt them to a national context? (5) What problems or issues have been encountered (related to IUCN criteria, regional guidelines, national listing in general, etc.)? and (6) How have the national red list and/or the IUCN criteria been incorporated into national conservation policies?

We provided a series of responses for each question, along with an "other" option. We selected the questions and their responses based on feedback the IUCN has received regarding the criteria and the regional guidelines and on published sources (e.g., Palmer et al. 1997; Pinchera et al. 1997; Gärdenfors 2001; Bauer 2003; Maes et al. 2003). Although some countries have several threatened species lists, we considered that a country used the IUCN criteria if these criteria were used for at least one list. When referring to the use of the "IUCN criteria" in a national context, we were not implying that the regional guidelines were used as well. Likewise, when considering whether countries used the regional guidelines, we did not assume that they also used the IUCN criteria. We restricted our study to responses pertaining to threatened species lists produced for entire countries, not subdivisions of them.

The purpose of the second component of this project, carried out in a 6-day workshop in Venezuela in January 2005, was to conduct a thorough evaluation of the regional guidelines, explore in detail the issues raised in the surveys, and propose solutions to those issues. The workshop was attended by 10 specialists from seven countries or regions (the authors) with experience in applying the IUCN criteria and IUCN Regional Guidelines: Canada, Sri Lanka, Sweden, Switzerland, United Kingdom, Venezuela, and South Asia (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka). We also invited one representative from the IUCN Red List Programme office.

Results

The Constituency

We received 47 responses to the survey (26% return rate). The countries that responded were well distributed globally and represented a wide range of sizes, degrees of geographic isolation, and degrees of development (see Supplementary Material; Miller 2005; Miller et al. 2005). We recognized the potential for bias in the respondents because the countries most likely to respond may be those with threatened species lists and those that are either pleased or dissatisfied with the IUCN criteria. Nevertheless, such responses are potentially more informative than neutral reactions to the criteria. We also received several responses from countries interested in learning more about the IUCN criteria or receiving direct assistance from the IUCN in their national listing processes.

Most of the countries that responded had produced a national threatened species list, and the majority of these countries incorporated the IUCN criteria into their listing procedures (Table 1). Nevertheless, a far smaller proportion followed the IUCN Regional Guidelines when developing their lists (Table 1). Many countries have different lists for different taxonomic groups, and the IUCN criteria are often used for some lists but not others. Many of the countries that responded (88%) plan to produce a new list, update an existing list, or both, and most (83%) will use the IUCN criteria (Table 1). A higher proportion plans

Table 1. Results of a survey on the use of the World Conservation Union (IUCN) criteria and IUCN Regional Guidelines to produce national threatened species lists.

Question	*Number of responses*	*Yes (%)*	*No (%)*	*Other (%)*
Has a threatened species list been developed?	47	36 (77)	11 (23)	NA
Do you plan a new or updated list?	34	30[a] (88)	2 (6)	possibly 2 (6)
Of those that have a national threatened species list				
Was the list developed recently[b]?	36	29 (81)	7 (19)	NA
Were the IUCN criteria used?	36	28 (78)	8 (22)	NA
Were the IUCN Regional Guidelines used?	33	8 (24)	22[c] (67)	Impossible yes[d]: 3 (9)
Of those which intend to produce a new list				
Will you use the IUCN criteria?	29	24 (83)	1 (3)	possibly 4 (14)
Will you use the IUCN Regional Guidelines?	16	15 (94)	1[e] (6)	NA

[a] *In an additional question, these 30 respondents were asked when the new or updated list was likely to be prepared. All 22 that responded intended to do so before 2010.*
[b] *We considered "recently" to be after 1990.*
[c] *Many of these countries produced their lists before the IUCN Regional Guidelines were published.*
[d] *These countries indicated that they had used the IUCN Regional Guidelines, but their lists were developed before the guidelines had been published.*
[e] *This country has adopted guidelines modeled after the IUCN Regional Guidelines.*

to use the regional guidelines in the future than has used them in the past; however, not all respondents that will use the IUCN criteria also plan to use the regional guidelines (Table 1). Only two respondents indicated they have no current threatened species list and no plans to develop a list in the future.

The most common, and presumably most important, reasons for using the IUCN criteria were their objectivity, reputation, and ease of use. The fact that they have been applied widely at global and regional levels, their quantitative nature and the increased comparability of threatened species lists with other countries that also used the IUCN criteria were also important. Using the IUCN criteria so that national assessments may be considered for inclusion in the global IUCN Red List or to evaluate or apply the IUCN Regional Guidelines were considered less important.

Finally, 82% (36/44) of the countries that have or will produce a threatened species list incorporated the list and/or the IUCN criteria into their national conservation strategies. This was done primarily by considering species' national threat status when designating conservation priorities, planning conservation efforts and/or allocating conservation funds (27 countries), and using threatened species lists to divert or mitigate development (16 countries). Thirteen countries adopted the IUCN criteria to produce their legal list of threatened species. (In 11 countries the legal list is a subset of the list developed using the IUCN criteria.) Other uses of lists included considering the national threatened species list in legislation development and biodiversity status reporting, preparing management plans, directing recovery programs, conducting environmental impact assessments, and in other protective and priority-setting activities (Miller et al. 2005).

The Issues

Many national assessors believe the IUCN criteria require modification for use at the national level. Of the 36 countries that addressed this issue (including some that already have lists and some that are planning new ones), 15 (42%) modified the IUCN criteria (Miller 2005). Four countries (11%) used the IUCN Regional Guidelines but modified the criteria (Miller 2005). One country developed its own regional guidelines, modeled after the IUCN Regional Guidelines but added life-history parameters. The most common ways of altering the criteria included: adding categories (e.g., species of national responsibility or cultural value); eliminating categories; adding criteria, especially formalizing criteria for the near threatened category; eliminating criteria (particularly criterion E); and basing the final threat status on additional criteria (e.g., Convention on International Trade in Endangered Species of Wild Fauna and Flora [CITES] status). Assessors considered a range of variables when modifying the criteria, including perceived threat status (which often differs from the status obtained with the criteria), conservation priority, biogeographical information, country size (particularly in small countries), degree of endemism, and pattern and rate of decline. External factors, such as threat status or population status in neighboring countries and global threat status, were not considered particularly important when modifying the criteria (see Supplementary Material; Miller 2005; Miller et al. 2005).

"Special restrictions" was the most common reason for not using the IUCN criteria, generally relating to incompatibility with existing threatened species listing legislation, lack of infrastructure to assess and manage biodiversity, or the perception that the criteria are unsuitable for small countries. Despite the existence of the regional guidelines, there is still a strong belief that using the criteria in small regions will result in too many species qualifying as threatened. Poor data availability and inadequate classification of certain taxonomic groups were additional reasons for not using the criteria (also see de Grammont & Cuarón 2006). A small percentage of countries rejected the criteria because they do not encompass conservation priority setting (see Supplementary Material; Miller 2005; Miller et al. 2005).

Many of the difficulties reported with applying the IUCN criteria echo the reasons for not using them. The primary complaint was that the criteria exaggerate threat status when applied in a national context, leading to alarmist or inaccurate threatened species lists (see Supplementary Material; Miller 2005; Miller et al. 2005). Many national assessors had trouble accessing data from neighboring countries (important when applying the regional guidelines), applying the criteria with little available data, and interpreting terms (e.g., individual, location, generation time), or applying concepts from the IUCN criteria (especially measuring area of occupancy when applying criterion B). Applying the criteria to invertebrates, fungi, nonvascular plants, and some migratory and marine species proved troublesome in part because of difficulties fitting certain IUCN definitions to the natural history of these species and a general lack of knowledge. Finally, many countries were frustrated that the data from their national assessments were rarely incorporated into the assessments for the global IUCN Red List. These issues were not isolated to a particular country profile; the same problems were reported from countries across the spectrum of size and degree of development (see Supplementary Material; Miller 2005; Miller et al. 2005).

Discussion

Most of the issues highlighted in the CBD surveys do not represent innate shortcomings in the IUCN criteria. Rather, they reflect valid concerns that arise when the

criteria are used at the regional level without the regional guidelines, confusion regarding the purpose of the IUCN criteria (in particular the distinction between assessing threat status and setting conservation priorities), and lack of training in the proper use of the criteria and regional guidelines.

Surprisingly, no specific problems with the regional guidelines were mentioned. Rather than implying the guidelines are flawless, however, this lack of complaint most likely reflects the fact that few countries have used them to date. This may be because many of the national lists were developed before the regional guidelines were published or perhaps because they are not known at all, not well known, or not perceived as important. A number of national assessors were not aware that the guidelines even exist and expressed sincere interest in obtaining more information about them. The importance of using the guidelines when conducting regional assessments of extinction risk must be emphasized; accordingly, we recommend they be much more prominent on the IUCN Red List Web site.

To address national assessors' concerns regarding the IUCN criteria and IUCN Regional Guidelines and improve the process of utilizing the IUCN system at the national level, we divided our recommendations into three general categories: (1) ensuring proper use and understanding of the IUCN criteria; (2) improving the regional guidelines; and (3) improving communication among threatened species assessors (see Miller et al. 2005 for more details).

Proper Use of the IUCN Criteria and Regional Guidelines

Many of the concerns raised in the survey responses have already been addressed in several IUCN publications. It is therefore essential when using the IUCN system that the following documentation be consulted and applied: the IUCN Red List Categories and Criteria (IUCN 2001), the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN 2005) (hereafter called the "User Guidelines"), and the IUCN Regional Guidelines (IUCN 2003). Useful information may also be found on the IUCN Red List Web sites (www.redlist.org, http://www.iucn.org/themes/ssc/redlist.htm).

The data from our surveys and personal experience suggest that the IUCN criteria can be used satisfactorily at the national level provided they are used in conjunction with the regional guidelines, although we do believe some aspects of the guidelines require clarification and support. The most prominent perceptions held regarding national use of the IUCN criteria were that the criteria exaggerate threat status when not used globally, and that in small countries a disproportionately high number of species will be threatened according to the criteria. Although this is often true, it is not due to a fundamental flaw in the criteria but to the fact that a small country will have small populations, and small populations inherently face a higher risk of extinction (Lande 1988, 1993; O'Grady et al. 2004). Provided the regional populations are not isolated, conditions are not deteriorating within or outside the region, and the regional guidelines are followed correctly, the potential for rescue from neighboring countries should result in many species being downlisted from threatened status. The regional guidelines are designed to place the national population into the larger context of its biological population and adjust the threat category accordingly, but this does not imply that all species will automatically become nonthreatened. This is correct in terms of extinction risk. It may not, however, accurately reflect conservation priorities. Indeed, although the national *extinction risk* of species should not be exaggerated when applying the IUCN criteria, the categories may be considered incorrect if interpreted to reflect conservation priority.

This brings to light an important distinction: many national assessors misinterpret the meaning of *extinction risk* by equating a high risk of extinction with high conservation priority. The IUCN system is intended to evaluate extinction risk only, not to prioritize species for conservation (Fig. 1). Although this distinction has been emphasized previously (e.g., Mace & Lande 1991; Gärdenfors et al. 1999; IUCN 2001; Keller & Bollmann 2004), the confusion persists (e.g., Randrianasolo et al. 2002; Mehlman

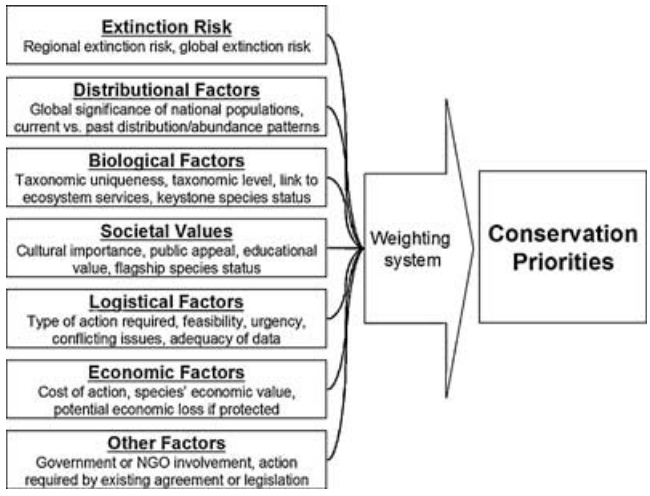

Figure 1. Factors to be considered in the recommended procedure for developing conservation priorities. Extinction risk is one of the many factors to be considered when establishing conservation priorities. The variables considered will depend on the purpose of the priority-setting exercise and the conditions within the region (the factors shown in the figure are illustrative, not exhaustive, because other factors may be included by the assessors). Different factors may be summed, multiplied, or otherwise weighted to achieve an ultimate ranking of conservation priorities.

et al. 2004). Numerous methods that consider extinction risk alongside other factors have been proposed for prioritizing species for conservation action (e.g., Avery et al. 1995; Dunn et al. 1999; Bollmann et al. 2002; Rodríguez et al. 2004, de Grammont & Cuarón 2006; Miller et al. 2006).

Other major concerns raised in the surveys were: (1) how to apply the criteria with little available data; (2) difficulties interpreting complex terminology and concepts used in the IUCN criteria; and (3) difficulties classifying certain taxonomic groups (e.g., invertebrates, fungi, nonvascular plants, and some marine and migratory species). Much advice on these topics is already provided in the User Guidelines, and improved communication among assessors will facilitate solution sharing. In our experience these problems can be overcome with a thorough understanding of the criteria and practice in their application. Although conducting assessments can be difficult, especially when relying on inferences and suspicions, creating national red lists often actually generates data and stimulates data collection in the field. Detailed examples of how assessments have been made with limited data should be incorporated into the IUCN Regional Guidelines. It is also important that criteria not be routinely disregarded at the beginning of the assessment process, even if it is unlikely that data for those criteria exist.

Finally, if a country wishes to claim that it uses the IUCN system, the criteria must be used in their original form and the regional guidelines should be followed closely. The criteria are often modified, be it subtly or dramatically, to fit a country's particular needs or traditions. Alternatively, hybrids are created between the IUCN criteria and nationally developed criteria, in which only the elements of the IUCN criteria that appeal to a country are incorporated. Many of these countries then claim to have used the IUCN system to develop their threatened species list, even though the criteria were not followed strictly. This is misleading and can cause confusion because a medley of classification systems are all lumped together under "the IUCN criteria." Naturally, a country should be free to adopt whichever approach it chooses; however, if modifications to the IUCN criteria are made, they should be thoroughly and explicitly documented and no assertions should be made that the IUCN criteria were followed without elaborating on the alterations.

Improvements to the Regional Guidelines

Although the regional guidelines produce reasonable assessments of extinction risk, the subjectivity inherent in the guidelines is a serious concern. Many terms are vague and open to interpretation, and several of the questions posed are difficult to answer, even for countries and taxonomic groups for which large amounts of data exist (Eaton et al. 2005; Keller et al. 2005). This subjectivity reduces the value of having used the quantitative IUCN criteria and diminishes the comparability and compatibility of regional red lists.

Although some degree of subjectivity is inevitable, there are several ways in which it can be reduced. One of the most called for is to formalize criteria for the regional guidelines, which has been tested in Switzerland (Keller et al. 2005). Nevertheless, introducing formalized regional criteria that function equally well for all taxonomic groups and across all national circumstances is a major challenge.

We believe the most practical way to reduce the subjectivity inherent in nonquantitative guidelines is to improve the consistency and transparency with which they are applied across species, taxonomic groups, and over time. This requires clarifying the different steps in the regional assessment process, providing more advice on how to determine which taxa to assess or developing guidelines for different taxa, improving the definition of ambiguous terms, providing more examples (especially of difficult assessments and from regions with little data), and giving advice on where to find the necessary data. It is extremely important that regional assessors fully document *all* decisions made during the assessment process to ensure that the remaining subjectivity is traceable and transparent. The reasoning behind each decision must be thoroughly explained so that the next person to conduct the assessments will be able to repeat the process.

Several steps must be taken when conducting regional assessments and many different IUCN publications consulted. Nevertheless, nowhere in the IUCN documentation is the entire process outlined. We developed several figures to assist in this process and modified certain figures and tables in the regional guidelines (Fig. 2). In the first step, assessors must determine which taxa and which regional populations to assess (Fig. 3). Differentiating

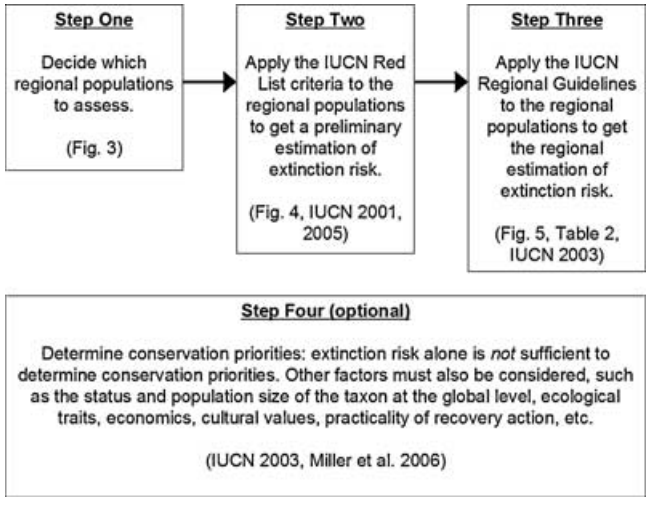

Figure 2. The complete process of assessing the extinction risk of species at the regional level based on the IUCN criteria and the IUCN Regional Guidelines.

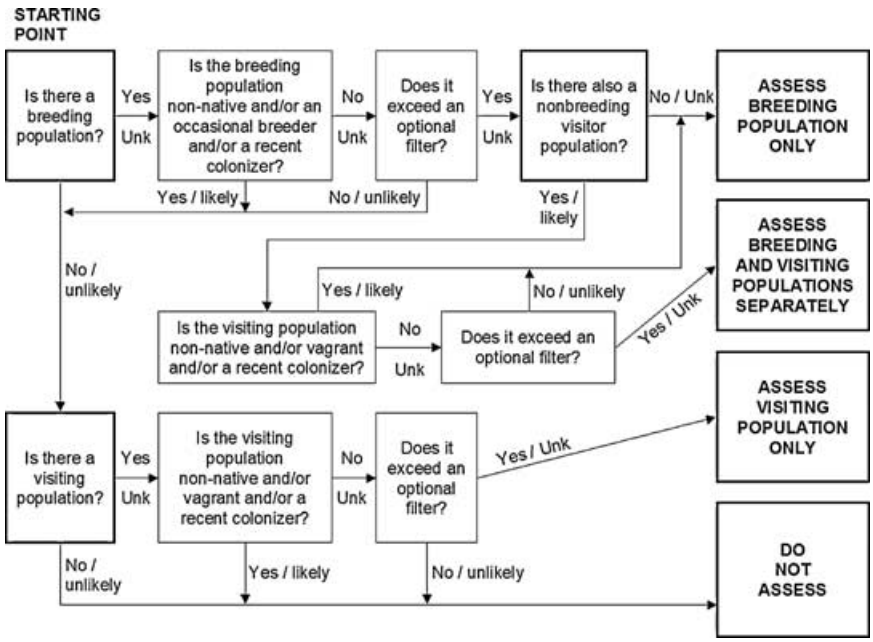

Figure 3. Flowchart to determine which taxa to assess in step one of the regional assessment process. For definitions and explanations of terms, see IUCN (2003) (unk = unknown).

among, for example, visiting taxa, breeding taxa, and occasional breeders can be complicated, especially when several populations of the same species fall into different categories. This step is especially important because the manner in which a species is divided into different populations can substantially affect its final classification.

All species should be assessed for which important part of any stage of their life cycle (e.g., breeding, wintering, migrating) takes place in the region (Fig. 3). Accordingly, assessors should be encouraged to evaluate visiting taxa. If breeding and visiting populations can be distinguished, they should be assessed separately. If they cannot be distinguished, estimates for the visiting population will have to include information from the breeding population and vice versa. Some countries may wish to evaluate units below the species level in circumstances where subpopulations may be geographically, ecologically, genetically, or otherwise distinct (Green 2005).

Prescriptive guidelines for setting a threshold by which to filter out marginal species have been requested (Eaton et al. 2005). Nevertheless, due to the many different geographic contexts in which regional assessments will be conducted, it is difficult to define a specific recommended optional filter level. We recommend the IUCN provide examples within the regional guidelines of how optional filter levels were set in different countries. National assessors should keep in mind that if the threshold above which species are assessed is set too low, many marginal species will be considered highly threatened due to their small population sizes.

After determining which taxa to assess, regional assessors may have distinct breeding and visiting populations to evaluate. In step two (Fig. 2), a preliminary category is assigned based on the IUCN criteria (Fig. 4). In step three (Fig. 2), the regional guidelines are applied (Fig. 5; see

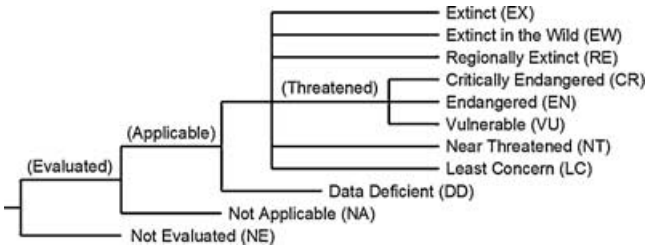

Figure 4. Structure of the IUCN categories at the regional level (adapted from IUCN 2003).

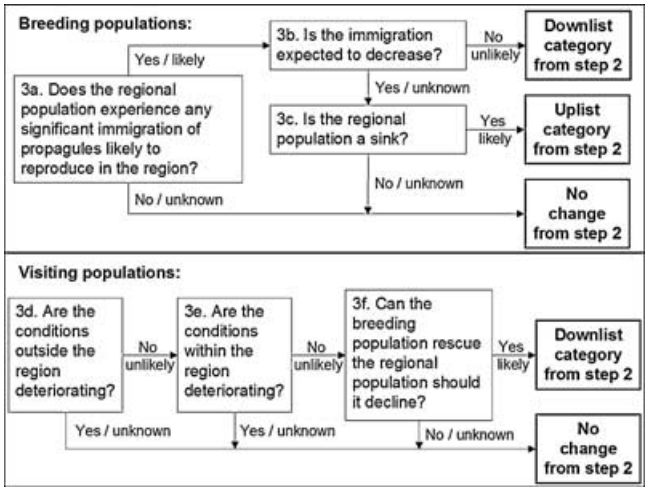

Figure 5. Proposed conceptual scheme for adapting the preliminary IUCN Red List category to the regional level (step three in Fig. 2) (see Table 2 for further assistance in answering the questions).

Table 2. Checklist for judging whether extraregional populations may affect the extinction risk of the regional population.

*Questions**	*Comments*
Breeding populations	
3a. Does the regional population experience any significant immigration of propagules likely to reproduce in the region?	The regional population may likely experience some immigration from neighboring regions, but to determine whether that immigration is "significant," several factors must be considered:
Likelihood of propagule migration: Are there any conspecific populations outside the region within a distance from which propagules could reach the region? Is the regional population part of a larger metapopulation involving extraregional patches? Are there any effective barriers preventing dispersal to and from neighboring populations? Is the taxon capable of long-distance dispersal? Is it known to do so?	If there are no conspecific populations in neighboring regions or if propagules are unable to disperse to the region, the regional population behaves as an endemic and the category should be left unchanged. If immigration does occur, it is important to consider whether the number of individuals arriving in the region is sufficient to rescue the regional population and whether the immigration occurs regularly and over a time period relevant to the threats facing the regional population, such that rescue is feasible.
Evidence for the existence of local adaptations: Are there any known differences reflecting local adaptations between regional and extraregional populations, i.e., is it probable that individuals from extraregional populations are adapted to survive and/or reproduce within the region?	If regional populations express physical, behavioral, genetic, or other adaptations to local conditions that enable them to survive and/or reproduce within the region and that the extraregional populations do not express, it may be unlikely that individuals from extraregional populations would be able to survive and/or reproduce in the region. The extraregional population would therefore be unable to rescue the regional population, and the category should be left unchanged.
Availability of suitable habitat: Are current conditions of habitats and/or other environmental (including climatological) requirements of the taxon in the region such that immigrating propagules are able to establish themselves successfully (i.e., are there habitable areas?), or has the taxon disappeared from the region because conditions were not favorable?	If there is not enough suitable habitat and if current conservation measures are not leading to an improvement in the quality and/or quantity of habitat within the foreseeable future, there will be no site at which immigrating individuals can successfully establish themselves. Thus, immigration from outside the region will not decrease extinction risk and the category should be left unchanged.
3b. Is the immigration expected to decrease?	
Status of extraregional populations How abundant is the taxon in neighboring regions? Are the populations there stable, increasing or decreasing? Is it red listed in any of those regions? Are there any significant threats to those populations? Is it probable that they will produce an appreciable amount of emigrants and continue to do so for the foreseeable future?	If the taxon is relatively common outside the region and there are no signs of population decline, if the taxon is capable of dispersing to and likely to establish in the region, and if there is (or soon will be) available habitat, downgrading the category is appropriate. If the taxon is currently decreasing in neighboring regions, the "rescue effect" is less likely to occur, so downgrading the category may not be appropriate. Information to answer this question can be obtained from a number of sources, including (but not limited to) the IUCN Red List (if information on the status of the taxon in different regions is available from on line documentation); national red lists from neighboring and nearby countries; regional status or conservation publications such as the Species of European Conservation Concern (SPEC), the NatureServe Explorer Web site and the network of Conservation Data Centres/Natural Heritage Information Centres; proxies from which the status of extraregional populations can be inferred, such as habitat status, estimates of annual harvest, and population trends in neighboring regions
3c. Is the regional population a sink?	
Degree of dependence on extraregional populations: Are extant regional populations self-sustaining, showing a positive reproductive rate over the years, or are they dependent on immigration for long-term survival (i.e., are the regional populations sinks)?	If there is evidence that a substantial number of propagules regularly reach the region and the population still has a poor chance of survival, the regional population may be a sink. If so, *and* if there are indications that the immigration will soon cease, upgrading the category may be appropriate. Few populations are known well enough to be considered obvious sinks dependent on a foreign source for individuals. If there is poor local breeding success or survival and there is steady and significant immigration, the population may be a sink. If there is sufficient evidence to impart a strong suspicion that the population is a sink and immigration is expected to decrease, it may be appropriate to increase its risk status. All reasoning must be explained fully in documentation.

continued

Table 2. continued

*Questions**	*Comments*
Visiting populations	
3d. Are the conditions outside the region deteriorating?	
Environmental conditions outside the region: Are the population status, habitat, or other conditions of the taxon deteriorating, or are they projected to do so in the breeding area or in other areas outside the region where the taxon utilizes resources (e.g., are conditions outside the region negatively affecting the number of individuals expected to visit the region)?	If yes/likely, the taxon will experience a reduction or continuing decline, either current or projected, that will affect the classification in step two. Consequently, such conditions should not be accounted for once again in the third step, thus leaving the category unchanged. Information to answer this question can be obtained from a number of sources, including (but not limited to) the IUCN Global Red List (if information on the status of the taxon in different regions is available in the on line documentation); national red lists from neighboring and nearby countries; regional status or conservation publications such as the Species of European Conservation Concern (SPEC), the NatureServe Explorer Web site and the network of Conservation Data Centres/Natural Heritage Information Centres; proxies from which the status of the taxon outside the region can be inferred, such as habitat status, estimates of annual harvest, population trends in neighboring regions, etc.
3e. Are the conditions within the region deteriorating?	
Environmental conditions inside the region: Are the population status, habitat, or other conditions of the taxon deteriorating, or are they projected to do so, within the region?	If yes/likely, the taxon will experience a reduction or continuing decline, either current or projected, that will affect the classification in step two. Consequently, such conditions should not be accounted for once again in the third step, thus leaving the category unchanged.
3f. Can the breeding population rescue the regional population should it decline?	
Plausibility of a rescue effect: Is the taxon globally very sparse (e.g., classified as threatened according to criterion D or as near threatened because it almost meets vulnerable D or globally not evaluated but judged to likely meet criterion D?	If the breeding population is very restricted, it will not be able to rescue the regional population visiting the region, thus leaving the category for the visiting regional population unchanged. If, on the other hand, the breeding population is substantial and conditions are not deteriorating within or outside the region, there is a higher chance that the breeding population will be able to rescue the regional population. The probability of regional extinction is thus less likely than suggested by the criteria in step two; consequently, a decrease in its risk status may be appropriate.

**Question numbers refer to the boxes in Fig. 5 (modified from IUCN 2003).*

IUCN [2003] for complete process). Because the regional portion of the assessment process differs for breeding and visiting populations, we recommend treating them differently. For an exploration of the issues to consider when answering the questions in Fig. 5, refer to Table 2.

An especially difficult question to answer is: When is rescue by extraregional populations *likely* rather than just *feasible* (Eaton et al. 2005)? The ability to answer this question is largely limited by the amount of knowledge available on the ecological interactions between different populations of a species. In many cases (if not most), solid data to answer the questions posed in the regional guidelines are unavailable, so the questions cannot confidently be answered yes or no. Nevertheless, there is often enough general information to lead an assessor to believe the answer is "probably" or "most likely." Nonetheless, when lacking certainty, most assessors will act conservatively and select "no/do not know," thus potentially ignoring important information. Methods have been proposed for dealing with uncertainty when conducting IUCN classifications (Akçakaya et al. 2000). These techniques should also be useful when using the regional guidelines. When assessors are confronted with making a decision that cannot be based on solid data, it may be beneficial to determine whether the answer is "likely" or "unlikely" and then choose yes or no accordingly. This approach will reduce the tendency to choose no/do not know even when the available general information indicates the answer is most likely yes. All decisions of this nature must be documented fully.

Successful application of the regional guidelines requires careful consideration of the dynamics of interactions between populations within and outside the region being evaluated (Fig. 5). The IUCN should assist this process by providing a clear set of examples from a range of different regions and taxonomic groups that illustrate in detail how available information can be used to reach an assessment. The decisions made and the information available at all stages in the process should be presented so assessors can identify where the information came from and how it was used to inform the decisions. The reasoning behind each of the decisions should be thoroughly

explained to illustrate descriptively how to conduct assessments in different contexts and provide potential solutions to the issues that come up in the assessment process.

Improving Communication among Threatened Species Assessors

Applying the IUCN criteria is not a straightforward process, and it is not simple to understand at a glance. Many of the problems national assessors face relate to difficulties in interpretation of the criteria, especially when assessing poorly known taxonomic groups. Problems in obtaining information from neighboring countries and submitting assessments to the IUCN Red List Programme also exist. Moreover, there is no direct method by which national assessors can contact the IUCN or other national assessors to pose questions and discuss concerns related to national red listing or the use of the IUCN criteria. There is clearly a need for improved communication and information exchange between the IUCN and national red list compilers and among national compilers from different countries.

The most efficient method for improving communication is to establish an on line database of national red-listing information, which would facilitate access to information regarding the status of species in other countries and serve as a communication center (Rodríguez et al. 2000). The Web site would include the threat status of species from different national lists, frequently asked questions regarding the IUCN criteria or national red listing in general, a mechanism for on line submittal of national assessments to the IUCN Red List Programme (to facilitate incorporation of national assessments, especially those of endemic species, to the global IUCN Red List), contact information for national assessors in different countries, and a link to an on line discussion group dedicated to national red listing. Discussing difficult cases and problematic concepts with other national assessors can be extremely useful, as is examining the different ways in which other assessors dealt with similar problems.

Additionally, articles in which assessors from different countries relate their experiences in threatened species listing could be published in the IUCN journal *Species*, not only to provide an opportunity for national assessors to express their concerns and their problems and make novel contributions, but also to improve exposure among countries to other countries' red-listing efforts.

The problems we discussed highlight the importance of adequate training and experience in applying the criteria. A comprehensive training package has already been developed by the IUCN Red List Programme and should be distributed to national and regional assessors. Training workshops led by IUCN Red List staff and other certified trainers should also be made available and were requested widely in the surveys. These workshops could be conducted on a regional basis by inviting several countries to the same workshop, which would also increase the contact and communication between national assessors in neighboring countries. These mechanisms for improving communication among threatened species assessors should greatly improve the support network for national users of the criteria.

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Supplementary Material

Selected results of our survey on use of the IUCN Red List Criteria in national threatened species listing is available in conjunction with the online version of this article from http://www.blackwell-synergy.com/doi/abs/10.1111/j.1523-1739.2007.00656.x (Appendix S1).

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