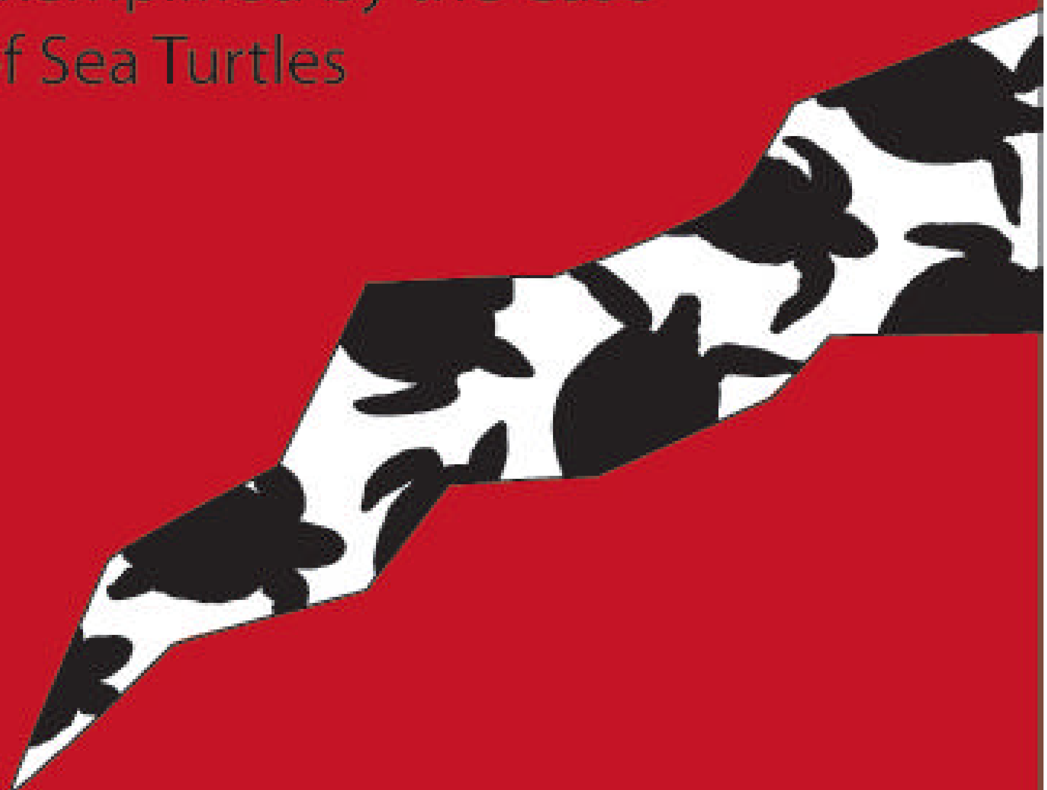
Predicting Extinction: Fundamental Flaws in IUCN's Red List System, Exemplified by the Case of Sea Turtles



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Abbreviations

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CSG	Crocodile Specialist Group of the IUCN/SSC
IUCN	International Union for Conservation of Nature and Natural Resources – World Conservation Union
MTSG	Marine Turtle Specialist Group of the IUCN/SSC
RLA	Red List Authority
S&PS	Standards and Petitions Subcommittee of the IUCN
SSC	Species Survival Commission

Note: The IUCN red listing system comprises three main components: categories of threat (for example, Endangered), criteria for a species qualifying for those categories, and various guidelines for applying the criteria.

Introduction

A previous Director General of IUCN (International Union for Conservation of Nature and Natural Resources - World Conservation Union) has called The Red Lists, formerly the Red Data Books, "IUCN's most famous product" (Holdgate 1999). The categories of threat (Vulnerable, Endangered, etc.) should provide "an assessment of the likelihood that a given species will go extinct within a given period of time (Mace and Lande 1991)." "The classification of categories of threatened species which SSC [Species Survival Commission of the IUCN] has developed is used universally" (Holdgate 1999).

Is the Red List system of categories as authoritative and successful as these insiders would seem to imply? The present article argues that the IUCN system and its application are flawed in multiple ways (inadequate recognition of differences among species, inconsistency in application, insufficient scientific documentation, lack of transparency), and that it should be thoroughly overhauled or replaced by a new system, perhaps operated by a different organization.

A system should not be judged by the easy cases. Species such as the Mediterranean monk seal, the Yangtze river dolphin, the California Condor, Spix's macaw and the Chinese alligator have only in the hundreds or fewer adults remaining in the wild. Inbreeding or some untoward event could easily push them to extinction.

There is no disagreement about the predicament of such species; almost any system would place them in the highest category of threat. Assessment of the Red Lists should depend more on how they deal with problematic cases, species about which little is known, or those that are abundant in one place but not in another, such as is the case with some of the sea turtles. Before turning to those, it may be useful to provide some background about the Red Lists.

History of Changes in Red List Categories and Definitions

The challenges in devising valid objective ways of assessing and describing the risks of extinction are reflected in the repeated changes IUCN has made in the descriptions of its categories of threat. In the earliest Red Data Books, the categories were simply labeled Category 1, Category 2, etc. Category 1 meant:

> Very rare and believed to be decreasing in numbers. (Scott 1965)

By the time of Volume 3 of the Red Data Books (Honegger 1968), the main categories were labeled Endangered, followed by Rare and Depleted. Endangered was defined as follows:

> In immediate danger of extinction: continued survival unlikely without the implementation of special protective measures.

By 1979 this definition was revised (Honegger 1979). It was no longer necessary for the danger of extinction to be immediate. Endangered now meant:

> 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 possibly already extinct.

A footnote added that in practice the Endangered category may temporarily include "taxa whose populations are beginning to recover as a result of remedial action, but whose recovery is insufficient to justify their transfer to another category."

The categories of threat and their descriptions remained essentially the same in 1982 (Groombridge 1982). Without further explanation, the definition of Endangered was not very informative. It encompassed species possibly already extinct, those in immediate danger of extinction, those in danger at some later time, and those beginning to recover. Moreover, in the mid 1970s, the detailed criteria IUCN now has for determining whether a species fits a given category had not been developed. In 1974, "whether the species was endangered or vulnerable was really nothing more than 'expert' opinion, a guess often based on the most fragmentary information…. Beginning in the late 1980s, it was recognized that we needed much more rigorous criteria for assessing conservation status, and that these criteria had to be defensible in the strongest scientific terms" (Mittermeier 2000). This recognition led to a new set of definitions of Endangered, and Vulnerable, etc., and to the addition of a new category, Critically Endangered (IUCN 1994):

> A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the criteria (A to E)….

These criteria included "an observed, estimated, inferred or suspected reduction of at least 80% over the last 10 years or three generations, whichever is the longer." If the decline in this period was only 50%, then the species did not qualify as Critically Endangered but as plain Endangered. If the decline was only 20%, the species would be placed in the Vulnerable category.

Decline in numbers is not the only way of qualifying for these categories. Fragmentation of habitat, very low absolute numbers, extreme fluctuations in numbers, and projected or suspected future declines can qualify a species for particular categories of threat. The details are too extensive to reproduce here but the essential point is that in 1994 not only were categories of threat redefined, but also that criteria for meeting those categories of threat were specified. Thus, for example, the definition of being Critically Endangered, given above, includes "as defined by any of the criteria (A to E)". The addition of this phrase is far from trivial, as will become apparent below.

These new criteria (IUCN 1994) were applied for the 1996 Red Lists, and have since been somewhat further modified (IUCN 2001a). It has been recognized from the start that for some species there are too few data to make a reasonably informed listing. Therefore, various other categories such as Indeterminate, Insufficiently Known, and Data Deficient have been available during different stages in the evolution of the listing system.

Aims Of New Red List System

Before turning to sea turtles, it is only right that any assessment of red listing should take into account the aims of that process. The 1994 revision (IUCN 1994) — essentially reiterated in 2001 (IUCN 2001a) — was explicit and gave four specific aims:

> to provide a system that can be applied consistently by different people;
>
> to improve the objectivity by providing those using the criteria with clear guidance on how to evaluate different factors which affect risk of extinction;
>
> to provide a system which will facilitate comparisons across widely different taxa;
>
> to give people using threatened species lists a better understanding of how individual species were classified.

Another equally important point about red listing is that it is not meant to be a system for determining action. As Mace and Lande (people who have been prominent in recent developments of the red listing system) put it in 1991:

> In the first place it is important to distinguish systems for assessing threats of extinction from systems designed to help set priorities for action. The categories of threat should simply provide an assessment of the likelihood that if current circumstances prevail the species will go extinct within a given period of time. This should be a scientific assessment, which ideally should be completely objective. In contrast, a system for setting priorities for action will include the likelihood of extinction, but will also embrace numerous other factors, such as the likelihood that restorative action will be successful; economic, political, and logistical considerations; and perhaps the taxonomic distinctiveness of the species under review.

These thoughts were taken up in the preamble to the 1994 IUCN categories:

> The category of threat is not necessarily sufficient to determine priorities for conservation action. The category of threat simply provides an assessment of the likelihood of extinction under current circumstances, whereas a system for assessing priorities for action will include numerous other factors concerning conservation action such as costs, logistics, chances of success, and even perhaps the taxonomic distinctiveness of the subject. (IUCN 1994; see also IUCN 2001a)

Regrettably, the admirable intention that the assessment "ideally should be completely objective" (Mace and Lande 1991) is undermined by the guidelines for applying the criteria (IUCN 2001a Annex 1; see also S&PS 2001) which state:

> Assessors should resist an evidentiary attitude and adopt a precautionary but realistic attitude to uncertainty when applying the criteria, for example, by using plausible lower bounds, rather than best estimates, in determining population size….

Immediately objectivity is diminished: being precautionary in the presentation and interpretation of the data introduces bias toward listing in a higher category of threat than warranted by the facts. If the facts are not available, or sufficiently clear, then the objective course would be to say so, that is place the species in the Data Deficient category. "A Data Deficient listing does not imply that a taxon is not threatened" (S&PS 2003). It does not mean that the species is safe (cf Diamond 1988), it does not mean the species merits no attention from conservationists. Quite the reverse, putting a species in the Data Deficient category might lead one to take extra precautions in management decisions or other actions, and to allocate extra funds to collect information. This is when the precautionary principle should come into operation, at the action rather than the assessment stage of Mace and Lande's (1991) two-stage process. But if the system is to be objective, there should be no hesitation in labeling species in a way that immediately tells people when the data are insufficient to place it in any other category besides Data Deficient.

Frequent appeals to the precautionary principle is a theme that runs through the Red List treatments of sea turtles. First, however, we need some background on sea turtles and a brief chronology of the main events.

Sea Turtles: History of Red Listing

There are 7 species of sea turtle. Although some believe that the East Pacific green turtle is a separate and eighth species (*Chelonia agassizii*), analysis of the data on their DNA does not support classification as a separate species (Karl and Bowen 1999). Therefore, in the present discussion, the East Pacific green will be considered along with other green turtles.

Although some of the sea turtle species were included in the earliest Red Data Books (IUCN 1963), the first attempt to provide a world list covering threatened reptiles was Volume 3 of the Red Data Books (Honegger 1968). Table 1 shows how the various turtle species were first placed then, and how this has changed over the years. It should be recalled that the Critically Endangered category was not introduced until 1994. Some points of interest made salient by Table 1 are that the flatback turtle was originally thought to merit listing as Rare, but was dropped from the list in 1982, reinstated in 1996 as Vulnerable, and recently, as a result of a petition, placed in the Data Deficient category. It is not evident that its status has changed greatly over

Table 1. Red Data Book/List Categories for Sea Turtles in Different Years

	Kemp's ridley	**Hawksbill**	**Green**	**Olive ridley**	**Leatherback**	**Loggerhead**	**Flatback**
	Lepidochelys kempi	***Eretmochelys imbricata***	***Chelonia mydas***	***Lepidochelys olivacea***	***Dermochelys coriacea***	***Caretta caretta***	***Natator depressus***[a]
1963		*category 1*			*category 1*		
1970	EN	EN	*depleted*	*rare*	EN[b]	*depleted*	*rare*
1975	EN	EN	EN	EN	EN	VU	*rare*
1982	EN	EN	EN	EN	EN	VU	not listed
1996	CR	CR	EN[c]	EN	EN	EN	VU
2000	CR	CR	EN[c]	EN	CR	EN	VU
2001							DD

CR= Critically Endangered, EN=Endangered, VU=Vulnerable , DD=Data Deficient.
Spelled out in lower case italics: categories formerly but not now in use.
The earlier Red Data Books were in looseleaf books; the dates refer to those of the sheets for turtles; sheets for 1970 may be found in Honegger (1968), those of 1975 may be found in Honegger (1979).
[a] formerly called *Chelonia depressa*
[b] starred as critically endangered although this was not a category then
[c] Mediterranean population listed as CR

these years, at least for the Eastern Australian populations (Limpus et al 2002). Petitions against the 1996 listing of green, hawksbill and olive ridley turtles were not upheld by the Standards and Petitions Subcommittee (S&PS 2001); therefore, these events do not show up on Table 1; they are discussed below. Another point to note is that a separate listing was made for the Mediterranean population of green turtles in 1996, and this was maintained in 2000 (Hilton-Taylor 2000). Some documentation explaining and justifying listings was provided up to 1996, but when the 1996 listings for sea turtles were made, no accompanying documentation was available; some appeared for some species in subsequent years — possibly as a result of complaints about its absence (Mrosovsky 1996; WMI 1997). A closer look at some of the details of these events reveals various inconsistencies and dichotomies in the system.

Precautionary v Evidentiary

The 1982 category for green turtles.

In the 1982 Red Data Book, the status of most sea turtles was maintained in their previous categories. For example, leatherbacks and green turtles were kept as Endangered. That might be taken to imply there were no particular problems with these listings. However, the 1982 relisting was far from a smooth process. Drafts of the listing and documentation had green and leatherback turtles categorized as Vulnerable, not as Endangered. But the IUCN Marine Turtle Specialist Group (MTSG) raised numerous concerns: nesting aggregations draw turtles from a wide area and may give an erroneous impression of abundance, each population should be treated separately for purposes of conservation, there are difficulties in estimating numbers of turtles, they may nest less frequently than previously supposed, there are doubts about the capacity of populations to replace themselves because of heavy mortality of hatchlings, and the long time to reach sexual maturity, etc.

In the introduction to this Red Book (Groombridge 1982), one reads that:

> The body of data incorporated in the revised accounts for threatened sea turtles in this volume could, by one interpretation, suggest that the status category formerly given to certain of the species might require modification. However, largely because of

> the factors just outlined above [the points made by the MTSG], the SSC has decided to maintain the previous category designations for all sea turtles, pending a planned discussion of the criteria defining each present category, and related aspects of sea turtle biology and conservation.

This can be decoded as follows. The data given in the documentation indicated a revision of the categorizations was in order. This was the opinion of the compiler of this volume, someone in a good position to make comparisons between different species and provide consistency in listings, but the SSC overruled him or persuaded him otherwise. In other words, the actual data available at the time did not warrant the Endangered listing for some of the species (for further information on sea turtles available at this time, see Bjorndal 1981; Mrosovsky 1983), but bearing in mind the potential unknowns raised by the MTSG, they were kept as Endangered.

So the 1982 listings put a precautionary approach above an evidentiary one. For the green turtle, in the pages that followed the Endangered listing, the reader could learn that there were thought to be about 150 nesting areas of which 10-15 hosted more than 2,000 females a year. Given that individual green turtles seldom nest in consecutive years, that would mean that at least double the average number of females nesting in a given year actually existed out there in the oceans. For 10 major sites that would mean 40,000 females (10 X 2,000 X 2). In Raine Island, Australia, up to 80,000 turtles could nest in a year, though in some years few did. Altogether, from the documentation provided with the 1982 listing, it would have been conservative to think that there were at least 100,000 females of reproductive age in existence in the world at that time — and that was not even counting males or juveniles. Moreover, green turtles were widely distributed; they had not put all their eggs in one national or environmental basket. Yet the green turtle was placed in the same category of threat (Endangered) as the Western swamp turtle in Australia. The total world population of adult swamp turtles at that time was fewer than 100 individuals; these were confined to two small nature reserves, comprising some 220 hectares, less than 1.5% of their former range (Groombridge 1982). A similar example, only at the level of national lists, is the placing of black caiman in their millions alongside monkey species that exist only in hundreds (da Silveira 2001).

So the use of the precautionary principle in 1982 resulted in green turtles being grouped with species in much graver predicaments. Moreover, the situation in itself for green turtles then did not warrant the Endangered label, which in 1982 was for "taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating." But the causal factors for green turtles at that time were not inauspicious; they included a large measure of protection at Tortuguero, Costa Rica, the major nesting area for the species in the Caribbean, as well as in other places, for example, Australia, Suriname, the Galapagos, and Europa Island in the Indian Ocean. There was no good evidence at the time that nesting of these populations was in decline.

Further examples of use of the precautionary principle with sea turtles occur in the categorization of the olive ridley and the hawksbill (see below; S&PS 2001).

Diverse Predicaments, One System

Long-lived species.

To assess and compare declines in numbers of a species, the criteria use periods of 10 years or three generations, whichever is longer. For a slowly maturing long-lived species, this means that one may need to go back a century or more to assess if at the present time the species is down in numbers more than 80%, or more than 50%, etc., from its level three generations ago. This requirement creates several problems.

(a) Often it is hard enough to come up with a figure for present day numbers, let alone one for 100 years ago. The MTSG was tentatively using 47 years as the generation time for the green sea turtle. This is composed of 37.5 years for the time to maturity, based on the midpoint of various estimates, plus 9.5 years for half the reproductive longevity after reaching maturity (Seminoff 2002). Three generations is 141 years and that means we need to know how many there were in the 1860s. In a later draft, to take account of regional variation in growth rates (Boulon and Frazer 1990), a span of 35.5 to 49.5 years, depending on region, was used for generation time. The exact values used are not critical to the point made here, namely that three generations ago for a green turtle have been thought to be a long time, more than a century.

(b) In fact, generation time may often not be something solidly established. There is a recent report of green turtles nesting <20 years after having been released as hatchlings bearing tags (Bell and Parsons 2002); in this case, maturation time is not an estimate based on extrapolation of growth rates but is an actual data point. Maturation in <20 years is faster than generally thought previously. However, these few cases do not establish what the average maturation time is.

(c) Focusing on the past instead of the future diverts attention from trying to come up with a realistic account of whether, given the circumstances prevailing today, the species is likely to go extinct soon. How useful an exercise is it to be trying to come up with an estimate for turtle numbers in the 1860s? In the decade after Darwin published *The Origin of Species* biologists were thinking about other things. The civil war was raging in America. People were not counting turtles. Of course, one may try to overcome this inattention by projecting trends from recently monitored populations back in time. But this runs into numerous problems. Should extrapolations be linear or exponential? What allowance should be made for density-dependent limitations on numbers? How much confidence should be placed in any type of extrapolations made from limited spans of recent monitoring back over gaps of data extending into the mid to late 1800s?

(d) A past decline may not be a strong predictor of current risk of extinction: "The transition from greatly depleted (> 80%) to extinct in the wild for reptiles is often a large step, especially when it involves species that are known to be able to exist at low densities for long periods of time yet retain the ability to recover when given the opportunity…or species that have extensive habitat and are widely distributed. The reasons for population declines in a global population are usually obvious, but not so the reasons likely to result in global extinction" (Webb and Carrillo 2000). And "in the case of long-lived reptiles, it is not clear whether the current criteria are a significant advance over the more subjective, qualitative approach used previously...." (Webb and Carrillo 2000). Others have expressed similar sentiments: "The difficulty of balancing the reality of a decline from previous global abundance, with present low probability of extinction is a problem that the IUCN criteria have not yet solved" (Ross 2000).

A further problem with using declines in the past for qualifying species for being endangered with extinction now is illustrated in Figure 1. Consider a species with a generation time of 25 years which has declined 80% within the last three generations. It should then be considered Critically Endangered today. Let us assume for the sake of simplicity that it meets none of the other criteria such as reduction in range, low absolute numbers, etc., for being Critically Endangered. Then, provided no further declines occur, and the species holds level at its present albeit reduced numbers, it is just a matter of waiting until the time is reached when the decline will have taken place more than three generations ago. The rules for transfer from one category to another (IUCN 1994, 2001a) require a further 5 years before the category can actually be changed. But at some point the time will come when the 80% decline is too far in the past to qualify. The species can then go overnight from Critically Endangered to not endangered at all! Instead of recognizing and designating a gradually improving situation prior to the arbitrary three generations ago date, rigid application of criteria permits an absurdly sudden change in prospects.

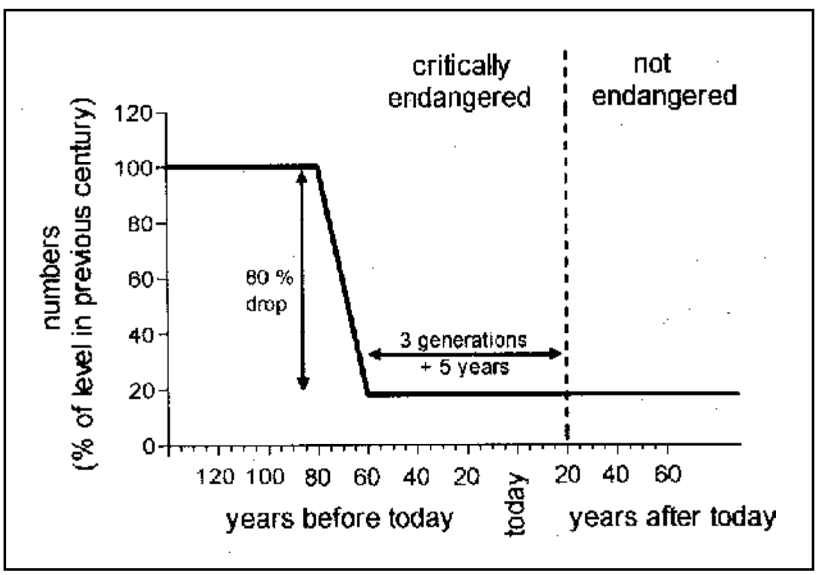

Figure 1. Illustration of the problems with the IUCN Critically Endangered criterion part A when applied to species with long maturation times. In this hypothetical example, the time between generations is 25 years. It is assumed that no factors other than an 80% drop in numbers within three generations of today qualifies the species for any category of threat. For the sake of simplicity, the end of the 80% drop is taken as the starting point for the three generations (+ five years) wait that is needed before the species no longer qualifies as Critically Endangered. The vertical dotted line marks the time when the species changes from being Critically Endangered to not being Endangered at all. This can happen without any change in the numbers of the species, or in trends in those numbers at that time! From Mrosovsky (2000).

Also, a species that has declined more than 80%, but is now actually increasing, will be kept in the Critically Endangered category if the increase is not such as to put it back above the 80% decline. This will follow from application of the criteria, even though there might be good protection in places, some large populations and a wide distribution.

Consider the case of the southern bluefin tuna, listed as Critically Endangered in 1996 on the basis of an 80% population decline in three generations. "The current stock has been controlled by international management efforts and the absolute population size is estimated to be close to 1 million individuals. ...the extinction risk has been estimated and is known to be sufficiently low" (Matsuda 2003).

Consider a species that has a generation each year. An 80% decline in three years would be a bad omen indeed. Then consider a species with a generation time of 30 years or more that has declined 80% over the last 90 years, but has now stabilized and is the recipient of corrective conservation measures. Surely we should be more concerned about the species with the one-year generation time than the species with the 30-year generation time? According to the IUCN (1994) system, which aims to "facilitate comparisons across widely different taxa," both species would be Critically Endangered regardless of other considerations; meeting "any of the criteria" A-E is sufficient. Moreover, the long-lived animal would be stuck in that category for decades even if its numbers remained stable. Such intrinsic species differences in biology make the application of one system problematical. Red listing is meant to warn of extinction risk. A Procrustean approach to species differences is unhelpful.

Widespread species.

As well as species differences in the temporal dimension, in generation time and population dynamics, there are also differences in the spatial dimension, in distribution. Some species survive, or were only ever present, in small areas: others are widespread with different populations in many parts of the world. If some of these populations are robust while others are in serious difficulties, how should the survival prospects be characterized? If the aim is to assess the risk of extinction of the species globally, it is a matter of logic that if the species is secure and flourishing in some parts of its range, then the chances are small that it is about to disappear altogether, even though in parts of its range it may be in dire straits or already locally extinct.

But this is not how IUCN views it. IUCN (2001b) has issued guidelines for assessment of trends in widely distributed species. Specifically, referring to Criterion A, (which concerns the % decrease in populations over 10 years or three generations, whichever is greatest), these guidelines mentioned examples of approaches that should *not* be used. These include the situation in which:

> One or more sub-populations is stable or increasing, and so it is assumed that the species is safe, and Criterion A need not be applied.

That is, one should still apply Criterion A. So one might indeed have a situation in which a widespread species was considered secure in one or more parts of the world, but because of declines on a global basis, it met Criterion A and was therefore placed in one of the categories of threat. A species could end up being labeled Endangered, whereas in fact it was thought that there was little chance the species would be lost from the face of the earth.

Perhaps the intent in such cases is to guard against unforeseen events, and dependence on just one or a few populations, in other words, to be precautionary. Perhaps this recommendation results from undue devotion to having every aspect of the listing based on the criteria (see below). Whatever the intent was, this part of the guidelines appears to be somewhat at odds with another part which says that the following approach may be helpful in particular cases:

> A consideration of the relative size and rate of decline of each of the distinct sub-populations may indicate that one (or a few) is sufficiently large, increasing and/or stable that the entire species should be listed at a lower threat category (even in a non-threatened category) than would be indicated by the status of a majority of the populations.

It would seem to depend then on what is meant by “sufficiently large.” But one thing is clear: a global listing for a species that is widespread is not in itself very useful or informative, and may even lead to confusion. A way out of the dilemmas posed by the uneven spreading of threats across different areas inhabited by widely ranging species would be to apply the criteria to different populations and list these separately. A global listing on its own, without supporting documentation and without some indication that some populations would not meet the criteria for a particular category, has the potential to be misleading.

In its more recent guidelines for using the categories and criteria, IUCN (S&PS 2003) has come back to this matter again. It considers the example of taxa, classified as Vulnerable on the basis of global declines, that might nevertheless have populations in a particular region that were stable, and would not even nearly meet the criteria for Vulnerable; such populations but not the species as a whole could be put in the Least Concern category. Commenting on this situation, the guidelines say "although this appears illogical, it is a result of the structure of the criteria." This is a remarkable comment. If it comes to logic, then if there is a population of a species that is Least Concern, and is not liable to become extinct soon, then the species as a whole is not liable to become extinct soon. If one is interested in the likelihood that a species will go extinct, if there are one or a few secure populations, then criteria that demand listing in a threatened category on the basis of problems for the species in other places are not good predictors of loss of that species (cf. Webb and Carrillo 2000). It is the structure of the criteria that is illogical. It comes back to the point that global listing for widespread species is not very useful, or at least not unless accompanied by listing of sub-populations.

Standard System, Diverse Interpretations

As well as the intrinsic difficulties of trying to apply a single system to organisms that are as different as trees and eels, shrews and whales, butterflies and big cats, there are extrinsic reasons why one system does not work. IUCN depends greatly on its specialist groups of which there are more than a hundred. There are specialist groups for hyenas, Asian elephants, tapirs, pelicans, swans, coral reef fish, groupers and wrasses, sharks, iguanas, Japanese plants, bamboos, lichens, and many others, as well as thematic groups such as the Invasive Species Specialist Group, the Veterinary Specialist Group, and the Sustainable Use Specialist Group.

Not surprisingly, these groups have different approaches, and may interpret and apply the increasingly arcane criteria used by IUCN in different ways.

Despite all the guidelines and rules and definitions, a system that has different groups of species assessed by different sets of people — people from different backgrounds, often in different parts of the world, with different agendas, and introducing different doses of precautionary principle — would not seem to be designed to achieve standardization and comparability.

An attempt to have some comparability occurred with the reptile Red Book of 1982. There was a compiler who could compare the input from various sources, and take a broader view than those focusing on particular taxa. However, with the sea turtles such was the influence exerted by MTSG that, as described above, the compiler was overruled.

IUCN now officially designates groups, usually their own specialist groups, as a Red List Authority (RLA). This may make it difficult "to provide a system which will facilitate comparisons across widely different taxa," one of the IUCN's (1994) aims. For there to be comparability and standardization, the central IUCN Red List committees must be able to overrule recommendations from a diverse set of RLAs. How easy will it be for IUCN to overrule an Authority to which it has itself delegated the recommendation? Discussions between the RLAs and the central Red List Program while the documentation is being developed can help in such situations. In the last resort there is a petitions procedure, but this is unlikely to be invoked often. For the most part it will be the different specialist groups that are making the decisions and, with so much latitude for suspected declines and use of the precautionary principle, these decisions are liable to be influenced by the attitudes of particular groups as much as by application of the criteria in a standard and comparable way for widely different taxa. Only glaring problems are likely to be challenged. Some examples of inconsistent listing procedures will now be given.

Hawksbill turtles.

An egregious case of idiosyncratic application of criteria was the MTSG (Meylan and Donnelly 1999) favoring taking the status of the most imperiled population of hawksbills and applying this to the entire species. With this approach, mosquitoes and rats could be called Critically Endangered if some of their populations were reduced to a remnant. And small and unimportant populations living at the limits of a species' range in marginal conditions for physiological function could have disproportionate influence on the category of threat selected. One may give some credit to the petitions committee for rejecting this approach (S&PS 2001). But this was such a glaring misapplication and misuse of the criteria that there was little choice.

Crocodiles.

A different example of a specialist group not following the criteria in a strict way comes from the approach taken by IUCN's Crocodile Specialist Group (CSG) to the listing of the saltwater crocodile. This species was not included in any of the categories of threat in the 1996 Red Lists (Baillie and Groombridge 1996) because the CSG (see Ross 1998) recommended the Lower Risk (Least Concern) designation. This is defined by IUCN (1994) as:

> A taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories: [Conservation Dependent, Near Threatened, and Least Concern].

However, with saltwater crocodiles, according to Webb and Carrillo (2000): "An 80% to 90% decline has probably occurred in most countries: they are extinct in some. They technically meet the IUCN criteria for 'Critically Endangered'...which would imply an extremely high risk of global extinction in the wild in the immediate future, which is neither true nor realistic. The IUCN assessment in this case compromises process to increase accuracy."

Webb and Carrillo (2000) do not actually present a detailed case in their paper for the saltwater crocodile meeting any criteria for Critically Endangered but refer to a CSG Status Survey and Conservation Action Plan (Ross 1998). From this one may learn that this species is the most widely distributed crocodilian and occupies a huge range, extending from India and Sri Lanka throughout the Indo-Malay archipelago, to the Philippines, Sumatra and Irian Jaya, Papua New Guinea, Northern Australia and out to the Solomon Islands and the Caroline Islands. However, density and numbers in most of these areas is much reduced. In India and Sri Lanka, only a few saltwater crocodiles are left, in Myanmar they are found in only a few locales, small numbers are reported for Cambodia, it is rare in Peninsular Malaysia, in Vietnam and the Mekong Delta in the order of hundreds only remain, no large populations are known for the Philippines, and in the Solomon Islands it is greatly depleted. The main areas in which this species is more common are Papua New Guinea, Irian Jaya, Sabah, and especially northern Australia. The situation in much of Indonesia is murky.

Given that inferred and suspected declines are grounds for invoking criteria for decreases, and given the huge areas which formerly were suitable habitat, and presumably supported high densities of saltwater crocodiles, and the smaller areas now in which the species is relatively common or recovering, a plausible case could have been made for considering this species as Critically Endangered.

Thus, had the proscribed IUCN process been followed, the saltwater crocodile should probably have been placed in its highest category of threat. Instead, the CSG weighted their assessment according to what they thought the risks of extinction were, rather than what was happening over the time back to three crocodile generations ago. On the basis of an ability to recover, and actual recovery in some places, and considering present numbers and conservation actions in these places, the CSG recommended the Least Concern category, the lowest of all categories for which there are adequate data. Webb and Carrillo (2000) also give reasons for thinking that the American crocodile is another case in which the 1996 Red List category (Vulnerable) "compromises process by not selecting the CR criteria, but increases the accuracy of the final prediction." Strictly speaking, the CSG has not followed the rules, because "each species should be evaluated against all the criteria, and any criterion met should be listed" (IUCN 1994; see also IUCN 2001a). Meeting any one criteria for a category is meant to lead to listing in that category.

Doves.
Another case in which the criteria have not been strictly followed concerns white-throated ground-doves and Mariana fruit-doves (Collar et al 1994). Both these species have gone extinct on Guam. They remain in reasonable numbers on other islands. But since the area of these other islands is about the same as that of Guam, it is reasonable to infer that a 50% decline has taken place in 20 years; the criterion for Vulnerable is "technically" met. "Nevertheless, as the decline was finite it was felt that both these species would better be placed as Near-threatened for the moment" (Collar et al 1994).

It is not relevant here whether or not one thinks the correct decisions were made for these doves and for the saltwater crocodile. These cases are raised here only to exemplify inconsistency. Maybe the IUCN system "can be applied consistently by different people" — one of the aims of IUCN (1994) — but it is clear that this is not in fact taking place. According to the criteria, the saltwater crocodile should probably have been placed in the highest category of threat (Critically Endangered) or, if not, at least in the second category (Endangered). Instead, it ended up as Least Concern.

Mediterranean green turtles and Pacific leatherbacks.

Further inconsistencies arise with respect to listing of widespread species. Green turtles were listed as Endangered in 1996, but those in the Mediterranean were designated Critically Endangered. Why was only this population given a different listing, with no indication that other populations, such as the large one nesting in Tortuguero, Costa Rica, had almost tripled in number since 1971 (Bjorndal et al, 1999; see also Solow et al 2002). A person looking at the Red List would be led to think that globally the green turtle was considered Endangered, with an especially dire situation in the Mediterranean. They would see no hint — no documentation was provided then — that the Endangered status for some other populations was, at the least, debatable. If the criteria were applied at the population level for green turtles — a reasonable approach with a widespread species — why was this done only for the Mediterranean population? Why give only the bad news?

Another example of the bad news overwhelming the good news for a widespread species occurs in the recent red listings of the leatherback turtle. This species has the widest distribution of any reptile, ranging from tropical beaches for nesting to cold waters far south and north for feeding. The leatherback was moved from Endangered to Critically Endangered in 2000, following increased concern about declines in the Pacific.

The documentation (IUCN 2000) supporting this listing states that analysis of two published estimates of the global population (Pritchard 1982; Spotila et al 1996) suggest a 70% decline in one generation. But this analysis was not actually produced! Presumably because the first estimate was 115,000 females and the second was 34,529, the 70% comes from the difference of 80,471, which is 70.0% of the earlier estimate. There are numerous potential problems about using this approach in this case.

A question that immediately arises is, were these two estimates sufficiently similar in coverage and methodology to be validly compared? Spotila et al's (1996) estimate "includes the same beaches" as Pritchard's (1982) estimate. However, Pritchard adds on 3,000 females to the world population to allow for dilute but widespread nesting in Melanesia. This area does not appear in Spotila et al's list. So it would appear that 3,000 should be taken from Pritchard's estimate to make the areas covered comparable to those in Spotila's estimate. But, on the other hand, something might be added to Pritchard's estimate (or taken from Spotila et al's) because Pritchard (1971, 1982) does not include Gandoca in Costa Rica, The Dominican Republic, or Puerto Rico, all of which are included in Spotila et al (1996).

There may be other cases in which areas surveyed were not comparable, but it is hard to go into this because not infrequently information comes from personal communications (Spotila et al 1996). IUCN now has a policy for red listing that anything cited that is not already in the public domain must be made available (S&PS 2001). This was introduced officially after the 2000 listing of the leatherback as Critically Endangered. For future listings or re-listings, one should expect ready availability of personal communications. That will still leave a nice question for IUCN to decide: what to require in terms of availability when the documentation supporting a listing refers to a publication in the public domain, such as Spotila et al (1996), if that publication itself makes considerable use of personal communications?

Probably a more complicated matter than sorting out whether exactly the same stretches of beach have been compared is arriving at estimates for particular years. Estimating changes in populations over time cannot be done on the basis of publication dates of estimates, certainly not if only 14 years apart. This appears to be another example of what is meant to be a standard system being applied in different ways. To assess if any of the decline thresholds for IUCN's criteria are met, one needs to have estimates for three generations ago and compare those to current estimates, or for when the listing was made. For this one needs some sort of table, with the numbers estimated for each beach, and the dates to which those estimates apply, not when they were published, and then extrapolations back to three generations ago and forward, if necessary, to the present (cf Seminoff 2002) — not a simple task as the years for which data are available often vary among beaches.

But the leatherback listing of 2000 does not even make an attempt to provide such information. Essentially, the case for being Critically Endangered rests on the citation of those two published estimates. This is minimal supporting documentation. And it is likely to result in erroneous impressions of the rate of changes in numbers. Although Pritchard's estimate was published in 1982, for parts of the world other than Mexico many of his estimates came from an earlier paper (Pritchard 1971). Taking 1982 as the date may give the impression that the changes in numbers have been more rapid than in fact was the case.

Another problem with a comparison between the 1982 and the 1996 global estimates is that what was known in 1996 may or may not reflect the situation in 2000, the year when the move to Critically Endangered was made. For example, Spotila et al (1996) give the numbers of females for Isla Culebra, part of Puerto Rico, as 12-27; they cite a 1990 annual report as the source of these figures. By the end of the 1990s, however, three to seven times as many leatherbacks were nesting in a year on Culebra, to be specific, 87 for 1999 (Soler 1999).

For Florida, Spotila et al (1996) cite a figure of 35 female nesters, based on a 1995 report. However, leatherback nesting has been going up in Florida in the 1990s (Weishampel et al 2003; Florida Marine Research Institute 2003; Anon 2003) and was almost certainly greater in 2000 than 1995.

Because the Culebra and Florida populations of leatherbacks are small, higher current figures make little difference to the overall estimates, but for other populations failure to use more current values makes more difference. Thus, in the case of Gabon, the 1996 paper (Spotila et al 1996) gives values of 1,276-2,553 females per year (to be consistent with their use of an average of five nests per female, they should have taken only the latter figure). These figures come from a 1988 publication by Fretey and Girardin. Since that time, more information has become available. In the 1999-2000 leatherback season, after extensive field work, 29,686 nests were estimated for Gabon (Billes et al 2000); assuming five nests per turtle, that gives 5,937 females. This makes the Gabon aggregation of leatherbacks arguably the largest for any single country in the world, though because of the variable coverage of beaches in Suriname and French Guiana, and movement of turtles between eroding and newly formed beaches in that region, perhaps there are even more leatherbacks in the Guianas. In 2001, at least 30,000 leatherback nests were estimated to have been laid in Suriname alone (Hilterman and Goverse 2002).

But whether Gabon or the Guianas host more leatherbacks, Gabon is undoubtedly a major breeding area for this species. Yet Gabon was scarcely mentioned in the documentation accompanying the IUCN (2000) listing; it is not even in the list of countries under Distribution. It appears that a preliminary report on the newer work in Gabon appeared in 2000 (Fretey and Billes 2000; see also Fretey 2001). Regardless of what was actually published at the time, those promoting the 2000 leatherback listing failed to consult adequately and obtain information from French biologists. Instead of using an up-to-date value approaching 6,000 females, they went back to the paper of Spotila et al (1996) which itself had used a value from a 1988 paper, a value less than half the number in the 1999-2000 season. At the least, an average of the two numbers should have been used.

These are a few examples of matters the 2000 documentation of the leatherback listing fails to cover. Whether a more thorough analysis would justify the Critically Endangered listing or not, according to IUCN criteria, is not speculated on here. It is up to the designated Red List Authorities to do the work and to come up with better supporting material — if the listing process is to be taken seriously as a scientific exercise.

Another point that should be considered, if this matter were revisited, is how much weight to put on the estimates in Pritchard (1982) for the West coast of Mexico. As he himself has said, “I probably chanced to hit an unusually good nesting year during my 1980 flight along the Mexican Pacific coast, the population estimates derived from which (Pritchard, 1982) have possibly been used as baseline data for subsequent estimates to a greater degree than the quality of the data would justify” (Pritchard 1996). A further irony is that Sarti et al (1996) say that Pritchard’s (1982) population values for leatherbacks in Mexico “appear to be overestimates” when later, as an Assessor for the sea turtle Red List Authority, Sarti used Pritchard’s paper in support of the Critically Endangered listing.

Among other problems in Pritchard’s (1982) estimates are that the number of tracks was not tallied, and even if it had been possible to do this, there was no ground truthing for the flight. The estimate depended greatly on an extrapolation from a figure of 500 leatherbacks per night for a section of beach;

this ballpark figure of 500 was suggested by a biologist who had worked in that area. Building on this uncertain basis, Pritchard thought there might be 1,500 females per night in the combined states of Michoacan, Guerrero, and Oaxaca at the height of the season. Allowing for a 10-day internesting interval, that gives about 15,000 females over a 10-day period. This value was then doubled to reflect individual animals having shorter nesting seasons than for the population as a whole. It is surprising that this doubling — on paper — of the population estimate has not received more scrutiny and discussion. Another large uncertainty is the addition of 12,000 breeding females for East Pacific areas outside those in Mexico surveyed on the 1980 flight (i.e., including nesting on the Pacific coast of Costa Rica).

Pritchard's (1982) report of the high densities of nesting, and the extent of the beaches hosting nests along this coast, was an important contribution. Moreover, the estimates he gave were thoroughly and appropriately qualified with cautions. Unfortunately, these qualifications are often ignored or lost when these estimates are fed into the IUCN procedure, with their threshold values of 80%, 50%, and 20% declines over three generations for determining categories of threat. Is it really meaningful to put so much weight on the numerical values for estimated global declines when the data from which conclusions are drawn are so imprecise?

But the difficulty is not simply that there are problems with Pritchard's (1982) estimate — there are assumptions with most estimates. The difficulty is that the methods used by Pritchard (1982) and Spotila et al (1996) would seem to have differed, thereby weakening comparisons. The latter give values for the totals for the season which are based, at least in some cases, on surveys of nests over much of the season; for converting numbers of nests to numbers of females it is assumed that an individual lays five times in a nesting season. Pritchard's estimates (1971, 1982) are based on taking a figure for number of nests laid on a night during the "peak weeks" (Pritchard 1982) of the season or on "an average night" (Pritchard 1971), and multiplying by 20 to convert it to the number of female leatherbacks in the season. This conversion factor depends not only on an internesting interval of 10 days, for which there is plenty of evidence, but also on the assumption that individual turtles nest at these 10-day intervals for two months out of a total four-month nesting season, which is more problematical. So all that is needed in Pritchard's procedure is to multiply the number nests on a night by 20 (X 10 for different turtles over

Table 2. Conversion factors for estimating the number of female leatherbacks nesting per season from the number of nests on a night at the peak of the season. Data for Suriname from Schulz (1975). Note: if turtles nest 7 or more times per season, conversion factors will be lower.

Year	Total Nests Per Season	Total Nests in May (Peak)	Nests / Night in May	Females Per Season if Each 6 Nests	Conversion Factor
1964	95	35	1.1	15.8	14.0
1967	90	25	0.8	15.0	18.6
1968	200	85	2.7	33.3	12.2
1969	305	105	3.4	50.8	15.0
1970	255	90	2.9	42.5	14.6
1971	285	100	3.2	47.5	14.7
1972	380	125	4 .0	63.3	15.7
1973	900	320	10.3	150.0	14.5
1974	785	280	9.0	130.8	14.5
1975	1,625	625	20.2	270.8	13.4
					14.7 mean

the internesting interval and X 2 for the nesting season of the population being longer than that for an individual turtle).

This is certainly a quick method, quick and — debatable. It is not validated. A 20 conversion factor seems too high, on the basis of analysis of data from Suriname for the actual numbers of nests over almost full seasons of monitoring, as well as a breakdown into monthly totals (Table 2). From such data one can calculate the number per night at the height (peak month) of the season. Assuming that on average an individual nests 6 times per season, to be equivalent of Pritchard's (1971, 1982) nesting every 10 days for 2 months, one can derive the total numbers of individual females (nests/6). One can then calculate the conversion factor that would need to be applied to the number per night at the peak of the season to give the total number in the season. For the Surinam data covering 10 seasons, the values range from 12.2 to 18.6, with a mean of 15 (Table 2).

A conversion factor of 15 is smaller than the 20 used by Pritchard (1971, 1982). When applied to a number of 15,000 per night, Pritchard's (1982) starting point for Michoacan, Guerrero and Oaxaca, whether one uses a 15 or 20 conversion factor, makes a difference of 7,500 turtles per year. This difference is compounded to 18,750 to allow for an individual female nesting approximately only every 2.5 years on average.

Of course, application of a 15 conversion factor derived from Surinam data to a population on the west coast of Mexico may not be justified. These calculations are given only to show that it should be possible in principle to obtain some validation of conversion factors (see also Kerr et al 1999), and that what factors are used can make a major difference to the bottom line.

None of this denies that there are serious problems to be addressed. Loss of leatherbacks incidentally caught in fishing nets, or on long lines, is probably the greatest. Declines at known nesting areas in the Pacific should stimulate efforts to make sure the same does not occur elsewhere. Nevertheless, if the Red Lists are to be instructive, they should reflect the situation, as far as it is known, which for leatherbacks is that they are doing much better in the Atlantic than the Pacific. As well as there being major breeding aggregations in the Guianas and in Gabon, a number of smaller populations in the Atlantic currently appear to be increasing, namely those in Florida (Weishampel et al 2003; Florida Marine Research Institute 2003; Anon 2003), the US Virgin Islands (Boulon R, pers comm 24 Oct 2003), and some beaches in Puerto Rico (Soler 1999). One hears that there is a sizeable leatherback population in Trinidad, with >10,000 nests per year (e.g., Hilterman and Goverse 2003) but I have been unable to obtain confirmation from those working there.

The different situations for Atlantic and Pacific leatherbacks could have been recognized by listing the Pacific population as Critically Endangered, on the basis of the declines there, while leaving the species as a whole as Endangered, or in some lesser category of threat. A split listing of this kind would have been consistent with the way the Mediterranean green turtle was handled. It is not simply that citing differences between two population estimates derived by different methods, covering different areas, and based on data for years other than their publication dates is an inadequate and idiosyncratic procedure for documenting declines over three generations. The problem with the leatherback listing goes deeper. It stems from the fundamental flaw in the IUCN criteria method of making global listings for widespread species. Even if a 80% decline on a global basis for the leatherback were properly supported, the present red listing description — "facing an extremely high risk of extinction in the wild" — would be unconvincing. As Pritchard (1996) put it: "The term 'extinction' is a very absolute one. It should not used casually. The extirpation of leatherbacks throughout extensive parts of their global range does not constitute 'extinction.'"

Supremacy of the Criteria Over Common Sense

Contradictions in the hawksbill listing.

The hawksbill turtle is listed as Critically Endangered. This is the summary label put on this species for the public. Few will have time or interest to go into the fine print underlying this categorization. This fine print is not always simple. Consider some of the present (IUCN 2001a) criteria for Critically Endangered, those concerning decreases in numbers:

> An observed, estimated, inferred or suspected population size reduction of greater than or equal to 90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
> (a) direct observation
> (b) an index of abundance appropriate to the taxon
> (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
> (d) actual or potential levels of exploitation
> (e) the effects of introduced taxa, hybridization, pathogens, pollutants or parasites.

However, where the reduction or its causes may not have ceased, or may not be understood etc., one then goes through the above again, but this time with an 80% cut-off. If one is still in doubt, there are 49 pages of recently available guidelines for using the categories and criteria (S&PS 2003).

Not surprisingly, most of the public will simply accept the Critically Endangered designation as meaning that the species is critically endangered. Few will ask about the criteria for being categorized in this way, fewer will struggle to unravel the meaning of the criteria, and virtually no one will check on the scientific support and documentation for the listing. If they do so for the hawksbill turtle, they will be surprised. The Marine Turtle Specialist Group (MTSG) is the Red List Authority for sea turtles. In the official position of the MTSG on the status of the hawksbill (Meylan and Donnelly 1999) one reads, "The species is not expected to become extinct in the foreseeable future." But at the time this listing was made in 1996, Critically Endangered was for species "facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the following criteria (A-E)" (IUCN 1994). How can a species be facing an extremely high risk of extinction in the immediate future when the official justification for this listing says it is not expected to become extinct in the foreseeable future?

These remarks about the foreseeable future should not just be disregarded as an unthoughtful statement by a harried volunteer team. The draft justification was sent out for review to various other members of the MTSG. Moreover, a number of people who work with hawksbills or know about them agree that it is not about to become extinct — in private at least, though most will not speak out. However, a few opinions on this matter have appeared in print. Pritchard (2000) says that "total extinction is not just around the corner for the hawksbill," though he considers that it does meet the IUCN criteria for Critically Endangered. Ross (2000) writes: "It is difficult to propose or imagine a scenario in which this species will disappear from the world in any current time frame. The species has undoubtedly declined, and probably requires our diligent conservation attention, but it is not going extinct."

What makes this still more important is that IUCN's Red List Standards and Petitions Subcommittee (S&PS 2001) have in effect endorsed the contradiction between the commonsense view and what the application of the criteria permit (allowing for inference, suspicion and the precautionary principle). After their deliberations on the appeals against the Critically Endangered listing, this committee ruled:

> Another basis of the petitions' challenge is the statement in the MTSG's justification that "the species is not expected to become extinct in the foreseeable future". The S&PS concludes that the petitioner's criticism on this point is not valid, because the listing is based on quantitative criteria rather than the qualitative beliefs of the RLA.

So there you have it: the criteria must reign supreme, however much they contradict common sense and the opinion of the turtle experts, the designated RLA. The importance of that little phrase "as defined by any of the following criteria (A-E)" (IUCN 1994) now becomes apparent. It does not matter that it is hard to perceive how the hawksbill is extremely likely to become extinct in the wild in the immediate future. What matters is what the criteria say. Why cannot IUCN consider the obvious alternative that criteria in this case fail to provide a reasonable guide to risk of extinction? (cf Pritchard 2000). Even the MTSG (1995) has noted that there is a risk that "marine turtles may be incorrectly assigned to status categories by IUCN, CITES and other treaties either because the criteria are inappropriate for marine turtles or because we have insufficient data for analysis."

That the criteria lead to contradictory conclusions is evident from other considerations. The hawksbill was listed as Critically Endangered in 1966 not only on the basis of past (Criterion A1) declines of 80% or more over three generations, but also on the basis of projected or suspected further (Criterion A2) declines of 80% over the next three generations. There is some uncertainty about the generation time for this species, with regional differences. Values of 35 and of 25 years have been mentioned (S&PS 2001). Taking the average of these, 30, and multiplying by 3 gives 90 years; let us say approximately 100 years in round figures. Whatever the exact figure, the 1996 hawksbill listing was appealed with respect to both past and projected declines. The Standards and Petitions Subcommittee (S&PS 2001) concluded that a future reduction in the next three generations "does not seem to be well justified." So that means — with the usual cautions about trying to predict anything about the future — that it may be reasonably expected that in 100 years there will at worst still be 20% of the number of hawksbills in existence today. That is not extinction. So how can this species be facing an extremely high risk of extinction in the wild in the immediate future?

What we have here is a clash between two criteria, the inferred past 80% decline (A1) and the poor evidence for a future 80% decline (A2). If the aim of the Red Lists is predicting the risk of extinction, it might be thought that expectations for the future would be weighted more heavily. But the rules say that if any one of the criteria A to E is met, the species goes into the relevant category of threat.

The appeals were made for the 1996 red listings. In 2001 IUCN revised the description of Critically Endangered and its criteria. Presumably, when this occurred, all listings made in 1996, on the basis of the older criteria (IUCN 1994), were reassessed and officially either confirmed or altered by RLAs, on the basis of the new criteria (IUCN 2001a). However, without pressing this point, even if one accepts the IUCN (2001a) revised description of Critically Endangered ("facing an extremely high risk of extinction in the wild"), it still appears inconsistent to say there is an extremely high risk of extinction in the wild while at the same time saying that there seems to be no good justification for expecting declines greater than 80% in the next century. Is IUCN, like a skilled politician, sending different messages to different constituencies? Probably it is just muddled or out of its depth and falling back on the bureaucratic comfort of following rules.

A vivid analogy to the rigid application of rules leading to silly conclusions has been made by the CSG, which considers the use of keys to identify the species of unknown specimens.

> If after following the key you conclude that you are holding a green tree frog, but the organism in hand is brown, warty, and has the definitive characteristics of a toad, it is obviously [*sic*] it is not the organism (category) reached via the key (criteria). This is important information and it happens commonly when developing keys. Either the key is wrong or it has ambiguities in it that need correcting. In any final analysis, you do need a description or illustration of the frog to make sure you reach the right answer, and to ensure the key is steadily improved. We found that thoughtless application of the IUCN criteria, without any consideration of whether the final "risk of extinction" is consistent with some narrative description, can lead to evaluations of extinction that are simply not justifiable. The real goal is to evaluate the risk of extinction, not just to apply the key wherever it may lead. (Messel 1998)

In the case of the hawksbill rulings, IUCN appears to have lost sight of the original question, whether the species is endangered with extinction. It has become fixated on its sublime, incontrovertible, all-encompassing criteria. The criteria dictate the brown toad is a green tree frog, that the hawksbill is Critically Endangered.

Qualitative and subjective aspects.

So surely there needs to be more room for qualitative assessments to participate in the process. Reasons for any such qualitative considerations can and should still be provided in the documentation. But some deviation should be allowed from what rigid adherence to the dictates of the criteria might entail, provided explanation and supporting evidence are given for such deviations. In effect, the IUCN system might be considered more as one of often helpful guidelines for determining categories of threat, and less one of rigid criteria for red listing.

It is not as if there are not already plenty of qualitative aspects in the red listing process. How to follow the IUCN (2001a) recommendation to be "precautionary but realistic" — almost a contradiction in terms — cannot be decided by entering numbers into a computer. Response to uncertainty involves qualitative judgments. How many gaps in the data constitute grounds for placement in the Data Deficient category? What allowance should be made for density-dependent factors? When a nesting beach becomes crowded, turtles sometimes destroy eggs laid by other individuals. There is a need for more research on this and other potential instances of density-dependent effects. Meanwhile, some qualitative decisions may have to be made. And for assessing whether long-lived, widely-distributed species have declined more than certain threshold amounts over three generations, decisions have to be made as to whether to project into the unknown past any present trends of those populations that are currently increasing. Retrospective projections of recently increasing trends will decrease estimates of numbers existing three generations ago and so make it harder to demonstrate declines from that time of 80%, 50% or 20% for the species as a whole. But retrospective projections only for populations that are currently declining biases these exercises toward demonstrating declines from past numbers, and seems to deny the possibility that some populations may be better off today than they were three generations ago. Qualitative decisions are needed to decide how to deal with such matters, and the available knowledge and factors relevant to such decisions may differ for different species. Application of rigid criteria may not be appropriate. It is worth recalling what IUCN (2001a) says about how the quantitative values for the various criteria were derived. They were "developed through wide consultation, and they are set at what are generally judged to be appropriate levels, even if no formal justification for these values exists." Generally judged

— this sounds qualitative and subjective, probably a committee decision. No formal justification! So why should there be overriding adherence to such qualitatively derived numerical values, even in the face of contraindications?

Transparency v Secret Science

The listing of species is meant to be backed up by supporting documentation. The hawksbill turtle was listed as Critically Endangered in 1996. It was not until two to three years later that the justification of the listing became available (Meylan and Donnelly 1999), despite requests for this information, and despite documentation being particularly called for in this case because the listing had made use of inference, there being few reliable data on hawksbill numbers three generations ago.

> The factors responsible for triggering the criteria, especially where inference and projection are used, should at least be logged by the evaluator, even if they cannot be included in published lists. (IUCN 1994; see also IUCN 2001a for detailed requirements and the explicit statement that "all assessments should be documented.")

When the documentation for the hawksbill turtle did finally appear in 1999, some of the references were to personal communications *in litt*. Attempts to obtain these communications were not always successful. Quotation of letters and unpublished communications is a problem with other aspects of IUCN's functioning. For example, at the 1997 meeting of CITES, IUCN distributed analyses of proposals, some of which included sources and statements that could not be verified because the references to *in litt* were not always obtainable. IUCN was criticized for "disseminating statements derived from information that is not publicly available. What should be an analysis based on verifiable data has degenerated into assertion based on secret science" (Mrosovsky 1997).

To its credit, IUCN now requires that analyses of proposals to CITES will not use unobtainable supporting material. They have also indicated that documentation requirements for the Red Lists are being phased in slowly over three years (Hilton-Taylor 2000). One of their Operating Principles is that:

> All status assessments of species should be correctly documented and supported by the best scientific information available. (Hilton-Taylor 2000)

Also, the S&PS (2001) has ruled that:

> ...all data used in a listing must be either referenced to a publication that is available in the public domain, or else be made available.

This is tucked away in a footnote, but is arguably the most important point arising out of the appeals and subsequent rulings on those. There are then at least some attempts — even though belated — to avoid secret science and to be transparent.

The olive ridley listing.

It is ironic then that the membership of S&PS is secret. Their number, expertise, and affiliations are unknown. Also, the basis for some of their decisions are kept secret. The olive ridley turtle was listed as Endangered in 1996 on the basis of a 50% decline within three generations. An appeal against this listing was put in by the present author in 2001, but was rejected by the Standards and Petitions Subcommittee which said "crude calculations based on the data provided by the MTSG indicate that the reduction since the late 1960's has been close to 50%" (S&PS 2001). When asked for these crude calculations, IUCN would not provide them. This hardly fits with one of the stated aims of IUCN (1994), "to give people using threatened species lists a better understanding of how individual species were classified."

It is not as if it were obvious how this 50% decline was derived. Based on estimates for time to maturity of 7-15 years in Kemp's ridley (TEWG 2000), say 11 years as an average, and adding a few years for reproductive longevity, three generations would be approximately 50 years in ridleys. So one might be trying to estimate numbers in the 1940s. Evidence from recent tag returns, that is after the 1996 listing, indicates that olive ridleys can continue to breed for 21 years after first becoming reproductive (Pandav and Kar 2000). If 10 years are added for half the reproductive longevity, three generations ago could be pushed back to the 1930s. There are three main known nesting regions for olive ridleys: the west coast of Costa Rica, Orissa in India, and the west coast of Mexico. These will now be briefly considered.

In Costa Rica, there are two important beaches for the mass nestings (arribadas) of ridleys, Ostional and Nancite. Huge numbers of ridleys nest at Ostional; sometimes in the order of half a million nests per year are laid, though there are large fluctuations from year to year. Although systematic monitoring has not been done, there was no particular evidence in 1996 that this population was in decline then (Ballestero et al 2000; Chaves 2001).

Based on sizes of arribadas, Nancite was a comparably sized rookery (Valverde et al 1998). I can find no evidence that Nancite was larger than Ostional, so even if nesting at Nancite had been totally wiped out at the time of the 1996 listings, that would at worst have left a 50% decline for Costa Rica. But nesting at Nancite was not wiped out by 1996. Although the size of arribadas appears (trend statistics were not given) to have declined from 1980 to 1996, in 1995 there was an arribada of over 80,000, the fifth largest reported in this period (Valverde et al 1998).

Turning to India, at Gahirmatha, Orissa, there is a huge variability from year to year; in some years there are said to be as many as 250,000 nests (review in Shanker et al 2003), although methods of estimating numbers in these mass nestings, and of reporting the results, have been defective (Shanker et al 2003). In other years, no arribadas came ashore there, although this does not mean those turtles have been lost from the population (Mrosovsky 2001). From some admittedly rather meagre reports, there was no evidence of a decline from 1984-85 up to 1995-96 (Patnaik and Kar 2000; Mohanty-Hejmadi 2000). This is consistent in broad outline with accounts by Shanker et al (2003). Although they "interpret the 1990s data as suggestive that the population may be declining or on the verge of a decline," they conclude that, despite the shortcomings of the data, "Gahirmatha has had no drastic decline in the nesting population over the last 25 years, based on a comparison of reliable estimates at the two ends of the spectrum." Besides Gahirmatha, there are other important nesting sites for olive ridleys in India, but reliable data are even scarcer for these. Ignorance about the extent of movements between different arribada sites is another potential complication.

Finally, there is Mexico. At Escobilla, Oaxaca, there was a spectacular increase in nesting of olive ridleys in 1994 with more than 600,000 nests, more than double (ca 2.2 times) the highest number since 1973 (Márquez et al 1996). The number of arribadas in a year also rose in the 1990s at Escobilla (Peñaflores et al 2000). Ridleys at three other arribada sites in Mexico (Mismaloya, Tlacoyunque and Chacahua) have not fared as well. Márquez et al (1976) give values of 20,000 to 50,000 females for these places for the early 1970s, say 35,000 on average at each site, for a total of 105,000 at these three sites. Let us suppose ridleys at these other sites have been wiped out entirely. That is unlikely to be true because some ridleys were still nesting on these beaches in 1989 (Márquez et al 1990) and there are recent reports of slight increases of nesting at places in Mexico other than Escobilla (Márquez et al 2002). But to simplify the argument, suppose nesting at these other sites had been wiped out. This would still leave Escobilla. A 2.2 times increase from the level of 75,000 for Escobilla in the early 1970s (Márquez et al 1976) would almost compensate for the loss of the colonies at the other three beaches mentioned. The calculations come out to a decrease of only 8.3%. If figures are taken from Márquez (1976) rather than from Márquez et al (1976), then it would seem that there has been an increase from the 1970s. Overall then for Mexico, it is not evident how a 50% decline could be obtained for the 1996 listing. Since that time, numbers at Escobilla have continued to increase with more than 1 million nests in each of two consecutive years in the early 2000s (Márquez et al 2002). It remains to be seen whether this good news will be reflected in subsequent listings.

On a worldwide basis, at the time of the 1996 listing, had this species declined by 50% in three generations? In Mexico, the overall numbers of nests were comparable in 1993 to those in the 1970s, with numbers at Escobilla increasing dramatically. In Orissa, India, what data there were did not demonstrate a decrease. In Costa Rica, nesting was said to be holding up at Ostional and overall in that country numbers were unlikely to have declined by 50%. These figures do not add up to a global decline of 50%.

There are, of course, other places where olive ridleys nest. But these populations are relatively small. For instance, in Suriname fewer than 3,500 olive ridley nests were recorded in 1968 (Reichart 1993). This is two orders of magnitude less than the nesting on Costa Rican or Indian beaches. Even though the nesting in Suriname had declined to about 500 by 1989, this has little impact on the global numbers. Moreover, because the beaches in the Guianas are constantly being eroded and reformed (Schulz 1975), it is not known whether the decrease in nesting in Suriname represents fewer ridley turtles alive, or a movement elsewhere, or both.

The data cited above do not take one back as far as three generations ago. What the situation was for olive ridleys in the 1930s and 1940s is not clear. The survival outlook for the olive ridley is obscured by poor data; a case might well be made for putting it in the Data Deficient category. But the approximate values mentioned above for the more recent years (years for which some numbers are available) are enough to make it reasonable to want to know how the S&PS (2001) thought a >50% decline is plausible. By keeping their "crude calculations" secret, the S&PS withheld guidance about how the application of the criteria works in such a case. An alternative is that they disputed the data presented to them. This seems less likely as it was also stated that "the petitioner's figures largely agree with those of the MTSG, except for a few locations."

Some of the information on olive ridleys cited above was actually published after 1996, but MTSG has members from all of the countries mentioned, and should have been able to find out what the current situation was before making their recommendations for the 1996 Red List. If it did not, it was not doing its job properly and did not merit being designated the Red List Authority for sea turtles. IUCN specialist groups are meant to include experts. If the MTSG was not keeping abreast of what was going on, they were not fulfilling their role as specialists and experts, and the IUCN system was not working.

Certainly, related to what the situation was three generations ago, the evidence for a 50% decline, or indeed for a number of other scenarios, is at best shaky. But since inferred or suspected reductions qualify as support for declines, much is possible with red listing. One thing is clear: the 2001 ruling of the Standards and Petitions Subcommittee of the IUCN depended on a precautionary attitude to uncertainty, and this upheld the 1996 listing of the species as Endangered, that is, "facing a very high risk of extinction in the wild in the near future" — as defined by its criteria, of course. Meanwhile, hundreds of thousands of olive ridleys were nesting, sometimes at such high densities that they were digging up and destroying each others' eggs. Vultures, dogs and crabs were gorging on the spoils (Peñaflores et al 2000), and fishermen in Oaxaca, Mexico, witnessing the dramatic increase in nesting there, could not understand how this species was considered endangered (Márquez et al 1996). Someone really should explain to them the difference between being endangered with extinction and being Endangered as defined by any of the criteria A-E.

Validation

Since there was no formal justification of the values in the criteria, which were set at what were "generally judged to be appropriate levels" (IUCN 2001a), it is fair to inquire if there is any independent support of their legitimacy. It is difficult to check the validity of the IUCN system for predicting extinction probability because of the long times involved. Furthermore, although in some respects the Red List criteria system is objective and precise, with values such as 80%, 50%, and 20% as decline thresholds for categories, and specified numbers of mature individuals needed to meet various other criteria, there is also much that is undefined. It is hard to test the validity of predictions that use terms such as "extremely high risk," "near future," "medium-term future" when these are not explicitly defined.

There is, however, at least one case in which validity can be assessed: 168 avian species were listed as Critically Endangered in 1994 (Collar et al 1994). In this case, it was specified that immediate danger of extinction indicated a 50% chance of going extinct in five years. This is a meaning of the word "immediate" that in this context would probably accord with everyday usage. Although it is hard to obtain recent data on all these 168 species, it is generally accepted that half of these species (84) were not extinct by the end of 1999. Placement in the Critically Endangered category was therefore incorrect for many of these birds, or as Collar et al (1994) put it: "There is a condition which satisfies a criterion for this category which does not truly reflect a 50% chance of extinction in five years."

This was realized even at the time the lists were put out, and was attributed in part to great variation between different users of the system, especially in cases of species for which information was sparse. Whatever the reasons for the poor validity, people reading this list without going through the introductory sections could have been led into thinking that the next few years would be disastrous for many species. Since the time when this list of threatened birds was produced, IUCN (1994) appears to be using a 10-year period as constituting something immediate, and IUCN (2001a) dropped the word “immediate” altogether from its description of Critically Endangered. Nevertheless, the fact remains that the predictions made in Collar et al (1994) were not validated. It is doubtful, even if 10 years were substituted for five, that they would be.

Recapitulation of Problems

The IUCN system of red listing is constantly changing and becoming more complex but is it becoming better? The intent to enable the risk of extinction to be compared between different species is worthy, but is intrinsically constrained and limited by species differences in life histories and population dynamics, in threats faced, and in available information and understanding about their numbers and circumstances. Instead of using these exercises as guidelines, the rigid application of criteria without more allowance for commonsense qualitative judgments is leading to species with greatly different prospects being placed in the same category of threat. The Critically Endangered category has become debased. Along with species that are truly on the brink of extinction, it includes other species that are numerically much more healthy and do not survive only in one part of the world, and have at least a measure of protection in some areas.

Standardization is further diminished by differences extrinsic to the biology of the species: idiosyncratic application of criteria by different groups evaluating different taxa, and wide variation in the amount of documentation and rationale provided to support particular listings. Because the criteria allow for suspected or inferred declines, and also lean toward precautionary over evidentiary attitudes, the listings are not as firmly derived from application of a standard scientific system as might appear at first glance. Validation is obviously difficult, but a limited opportunity to assess this for the Red Lists for birds is not encouraging. In summary, the system is not really standard, it does not ensure sensible answers, and the presentation of scientific evidence is seriously lagging the publication of the lists themselves.

Volunteers and Professionals: The Need for Another Organization

If one criticizes IUCN, a frequent defence is that the members of specialist groups are volunteers, trying to do their best to fit additional work for IUCN into already busy professional lives. Invoking volunteer status as a defence (e.g., Brackett 1997; Meylan 1998) is tantamount to an admission that the job is not being done properly. It is an excuse rather than a refutation of the criticisms (Mrosovsky 1998).

If these volunteers cannot do the job properly, then it should be taken over by others who can, or the system arranged differently. Perhaps the Convention on Biodiversity or some other international organization, or perhaps a respected non-governmental organization such as the Ford Foundation, would be up to the task. It would be important that the amounts of funding from all sources for red lists be made transparent. The IUCN specialist groups could still be one of a number of sources of information, with a professional central group assigning the categories on the basis of cases presented, and after making comparisons to the predicaments of other groups of animals.

Perhaps there should be different types of lists, for instance, one concerned with the risk of the species going extinct, something of great interest and importance to many people, but another covering whether the species is fulfilling its ecological role, and another perhaps directed at economic extinction. It has been suggested that lists should contain species known to be secure rather than those that are threatened, that is, there should be green lists rather than red lists (Imboden 1987). This would shift the burden of proof to those who maintained all is well with a species (Diamond 1988). This could be the ultimate application of the precautionary principle. And it is not certain that the time and effort devoted to making lists of common species would actually help less fortunate ones. Nevertheless, green lists might be one way of highlighting how little we know about the status of so many animals and plants.

Blue lists have also been proposed (Gigon et al 2000). These would aim to assess successful stabilization or restoration of red listed species, and provide psychological uplift to conservationists. Too many lists would be confusing, but some of the features of proposed green and blue lists might be incorporated in other lists. The whole matter of aims and procedures should be rethought. One urgently needed point is obvious already: nations and organizations valuing biodiversity and the environment must decide if such important matters as species extinction should be left to volunteers trying to produce answers on shoestring budgets.

Repeated changes in definitions and criteria could be viewed as an attempt to improve on what is indeed a difficult task. But a system demanding constant attention and adjustment could also be an indication that the attempt to provide universal objective criteria is a failure. Despite recognizing the challenges involved and the hard work by many dedicated people and noting that there have been some improvements, in this author's opinion, time has now run out. The IUCN and SSC leadership have had their chances, they know about these problems, but have been unable or unwilling to address them. Disgraceful deficiencies in documentation in what is meant to be a scientific system have been with us for almost a decade. The problems with the listing of sea turtles have been with IUCN for more than two decades. These matters have been repeatedly brought to their attention. IUCN Red Lists continue to represent these species to the public by labels that fail to reflect their predicament in a fair way.

Why the IUCN Red Listing Status Matters

Because the deficiencies of the IUCN Red Lists are not generally known, the public generally assumes that categorizations are backed by the presentation of data and done in an open scientific way. The IUCN listings still carry weight. Also, at present, there is no other system that is better, and there is a general need for concise summarizing labels. Governments, journalists, scientists and others need a quick dependable way to learn whether particular species are in danger of extinction; they may not have time to undertake research and look into the details.

For sea turtles there are specific reasons why the listing matters, because the matter of conservation actions has been conflated with the assessment of status. Red List status has been used as an argument for stopping commerce in sea turtles. In fact, CITES does not consider that Endangered status automatically means all trade should be prohibited. In 1992 CITES (Conf 8.3) passed a resolution titled "Recognition of the Benefits of Trade in Wildlife."

In some circumstances, giving resources a value and providing incentives to people actually in contact with those resources may promote good stewardship of the environment and its wildlife. This is not the place to go into the clashes between preservationist and sustainable use approaches to conservation of turtles (see Mrosovsky 2000; Pritchard 2000). But it is appropriate to emphasize that if one follows the Mace and Lande (1991) two-stage formulation, then being listed in one of the categories of threat should have no automatic implications for subsequent actions. It should simply provide an assessment of extinction risk.

However, with sea turtles there has been a long-standing attempt to link the two stages in a particular way: an Endangered status has been seen to demand that there be no commerce. For example, a lapel button distributed at the 2000 meeting of the parties to CITES showed a hawksbill turtle with the caption "Critically Endangered" in red, followed by "Vote No" (to a proposal from Cuba for permission to export a quota of hawksbill shells). The same idea found official sanction in The Sea Turtle Conservation Strategy, elaborated at a meeting in Washington DC in 1979: "As long as sea turtles remain endangered, the ending of commercial exploitation of all sea turtle products is a long-range goal or ideal of the conservation strategy" (see Ehrenfeld 1981).

This idea is so strongly embedded in the minds of many of those who want to assist turtles that they will not seriously consider whether a given CITES or other proposal for regulated trade might be beneficial to a species. Given these knee-jerk reactions to Endangered status, it is all the more important that the red listings reflect the actual situation as accurately as possible. Otherwise options for action may become unduly and unimaginatively constrained.

Recognizing that the two-stage separation of assessment and action is often not followed and sometimes becomes blurred in automatic calls for more protection is not the same as endorsing this situation. However, if one supports the two-stage process as the ideal, then some interesting questions arise about the balance of effort that should be devoted to these stages. Which is more important: the particular label put on the extinction risk of a species, or whether the appropriate actions are taken? A plausible case could be made that we spend too much time on the finer distinctions among the categories of threat and on red listing in general and not enough on ensuring that a species is soundly managed or receives the help it needs. This viewpoint is attractive but should not be taken to the extreme of doing away altogether with some classification system. That is still needed to assist people in learning which species are priorities for some remedial actions, whatever may be thought the most appropriate ones. Scientific accounts of the predicaments of species, enumeration of their populations and their trends, with supporting references, are still needed. In this broad context, IUCN deserves credit for recognizing these needs and at least trying to fill them.

Is There a Future for IUCN's Red Lists?

IUCN listing matters, yes, but that does not guarantee it will continue to matter if it allows itself to be driven by unscientific elements in its diverse membership and does not improve some of its Red List procedures. To maintain confidence that its red listing is a sound and scientific exercise, IUCN should take immediate and radically effective action on three fronts. First, it must bring some sense into its sea turtle listings; they have become a test case. Second, it must attend to the matter of supporting evidence, demonstrating that lack of documentation is not acceptable. Third, it should reassess again the value of its criteria as predictors of extinction, especially for long-lived and widespread species.

Reconsideration of sea turtle listings.

The tangle IUCN is in over the sea turtles must be unraveled. It would enhance rather than detract from IUCN's reputation to recognize that the present system is not working in this case. But to maintain confidence "requires increased attention to the accuracy of final predictions rather than to the processes involved in making assessments objective. Categories such as critically endangered should be reserved for species that are facing severe and obvious threats. They should not be assigned to species that are abundant and widespread, with no known scenarios that could lead to global extinction, no matter how compelling the case for public sympathy may be" (Webb and Carrillo 2000).

Why was the Critically Endangered category introduced in 1994 in the first place? According to Mittermeier (2000), this was "for those species that are truly on the edge." Using it for species not in this predicament debases this category and in doing so diminishes confidence in the whole system. It is like gradeflation. As more and more students end up with As and first-class degrees, these labels lose their value and meaning. While on the grading analogy, perhaps the pressures in red listing are also toward upgrading. Conservationists tend to talk of upgrading when a species is moved to a category of greater threat, and downgrading when it goes to one of lesser threat (e.g., Collar et al 1994). But upgrading should be a cause of rejoicing and so should be used to describe improved survival prospects of a species.

Using Critically Endangered for a species not in this situation calls other listings in this category into doubt and may distract attention from those in most need (da Silveira 2001). The hawksbill has a pantropical distribution, a large population in Australia, and lesser but increasing nesting in a number of other places; it is not "truly on the edge." IUCN has got itself into a ludicrous situation with its red listing of this species.

In 1994 IUCN said that Critically Endangered means, "facing an extremely high risk of extinction in the wild in the immediate future." In 1996 the hawksbill is listed as Critically Endangered. But in the official justification of that listing the IUCN Marine Turtle Specialist Group says: "The species is not expected to become extinct in the foreseeable future" (Meylan and Donnelly 1999). A secret committee of IUCN then defends and endorses this absurd contradiction on the basis that, with some inference and precautionary principle, one of its criteria could be met. It then compounds the inconsistency by indicating that the evidence is inadequate for meeting another of its criteria for Critically Endangered, a projected 80% decline in the next three generations, ca 100 years (S&PS 2001). How can the hawksbill be extremely likely to go extinct in the immediate future — Critically Endangered — if on the basis of its future prospects the evidence does not put it into that category?

Looking at these problems in a more general way, the IUCN system seems to focus attention and effort on the criteria themselves, almost to the extent of them becoming a distraction. Of course, objectivity is desirable but it does sometimes seem that the emphasis can be more on what happened three generations ago, which in the case of long-lived species is often too murky to be objective, rather than on predicting the risk of extinction in the future.

Undocumented listings and use of the Data Deficient category.
Lack of documentation has not been a problem just with the sea turtle listings. At the time of the 2000 Red List, let alone at the time of the 1996 list, documentation was deficient for a great many species. According to Annex 2 in Hilton-Taylor (2000):

> An analysis of the key documentation fields indicates that approximately 20% of mammals have been documented, 84% of the birds (for the 2000 Red List the bird documentation only includes the rationale for the listing and not the full text on population, range, habitat, etc., which is only available at present in printed format as *Threatened Birds of the World* (BirdLife International 2000), 4% of reptiles are documented, 15% of amphibians, only 1% of fish (mainly the sharks and rays), 2% of invertebrates (mainly molluscs), and 91% of plants….

This is a staggering admission. People assume with all the criteria, and the apparatus of the system, and the phrase "as defined by any of the criteria (A to E)" that the listings have some scientific support. Maybe they do — but support has to be available. The 2000 Red List (Hilton-Taylor 2000) indicates that "the introduction in 1994 of a scientifically rigorous approach to determine the risks of extinction which is applicable to all species and infraspecific taxa, has become a virtual world standard." But how can listing be scientifically rigorous if the rationale is not explained and the references to papers giving the facts are not included? How can one assess how much confidence should be put on a categorization if the supporting material cannot be examined? How is it possible "to give people using threatened species lists a better understanding of how individual species were classified," one of IUCN's (1994) aims? How can anything be verified or challenged?

So, despite all the logos of contributing organizations which appear on the title page of the 2000 Red Lists (Hilton-Taylor 2000), the emperor has no clothes — or many fewer than he should. The recent Red Lists could then be seen as a step back — temporary, it is hoped — from the pre-1996 lists for which there were at least some supporting explanations and references.

If adequate scientific clothing cannot soon be acquired, other measures should be undertaken to rescue a fast sinking credibility which might also reflect on the reputation of contributing organizations. Slow phasing-in of documentation requirements (Hilton-Taylor 2000, Annex 2) sounds unconvincing. IUCN should stop talking about the need for documentation which it was already doing when the new system of criteria was introduced almost a decade ago (IUCN 1994). It should actually do something to demonstrate that assertion without accompanying evidence or rationale is acceptable no longer: all undocumented species should immediately be placed in the Data Deficient or Not Evaluated categories, and be moved out only when adequate supporting material was submitted. Some should probably remain Data Deficient for a while, since the required information to assess categories of threat is often not available, especially in forested areas (Lovari 2001).

Revision of criteria.

Although IUCN (S&PS 2003) has said it does not expect the Red List criteria to be revised in the near future because a stable system is needed to permit comparisons over time, a stable but inadequate system will not be helpful to anyone. In particular, alterations are needed for widespread species, with more emphasis on the state of sub-populations, and for long-lived species, with more weight put on current trends. Allowance should be made for qualitative considerations — which in fact are already being used by some groups — to provide more balance to the dictates of the criteria.

An opportunity for IUCN.

If the IUCN would rise to these challenges and take necessary and firm action over its Red Lists, it would emerge with enhanced credibility. The task of red listing is an opportunity for IUCN to affirm its mission of providing the best objective information and its high regard for science. If it is prepared to take strong, if bitter, corrective action on its Red Lists, then it will become stronger. This will benefit both the species it seeks to save and IUCN itself as an organization promoting conservation. It will be more likely to attract the support, financial and other, that it needs for its great enterprises. Despite many problems, IUCN has catalyzed and has accomplished much: it has been involved in many important developments in conservation (Holdgate 1999). If, as one hopes, it shakes off its bureaucratic arthritis over the Red Lists and becomes flexible enough to alter procedures that are coming up with ridiculous contradictions, it will be more, not less, likely to fulfill its potential and to realize its inspiring dreams for the future.

But if it cannot do better with red listing, then it creates an opportunity for another organization to step in with a better system — a system that respects and insists on the separation of extinction risk assessment from action priority setting, a system that disallows unsupported, undocumented listing, a system that abandons procedures that produce contradictions, and a system that keeps the ever-elastic, precautionary principle out of the presentation of the evidence. Conservation needs emotion and dedication and courage and — in the right place — precaution, but it also needs the best scientific information available.

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References

Anon. 2003. Florida's sea turtle nesting and stranding trends; 2002 a mixed year. Velador 1: 2-3.

Baillie, J., and Groombridge, B. (Compilers and Editors). 1996. 1996 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland and Cambridge, UK.

Ballestero, J., Arauz, R.M., and Rojas, R. 2000. Management, conservation and sustained use of olive ridley sea turtle eggs (*Lepidochelys olivacea*) in the Ostional Wildlife Refuge, Costa Rica: an 11 year review. *In* Proceedings of the 18th International Sea Turtle Symposium. *Compiled by* F.A. Abreu-Grobois, R. Briseño-Dueñas, R. Márquez, and L. Sarti. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SEFSC-436, pp. 4-5.

Bell, C.D.L., and Parsons, J. 2002. Cayman turtle farm head-starting project yields tangible success. Mar. Turtle Newsl. 98: 5-6.

Billes, A., Moundémba, J.-B., and Gontier, S. 2000. Campagne Nyamu 1999-2000, rapport de fin de saison. Protomac/ECOFAC, mimeogr., 77 pp. + Annexes.

Bjorndal, K.A. (ed). 1981. Biology and Conservation of Sea Turtles, Proceedings of the World Conference on Sea Turtle Conservation. Smithsonian Institution Press, Washington, D.C.

Bjorndal, K.A., Wetherall, J.A., Bolten, A.B., and Mortimer, J.A. 1999. Twenty-six years of green turtle nesting at Tortuguero, Costa Rica: an encouraging trend. Conserv. Biol. 13: 126-134.

Boulon, R.H., and Frazer, N.B. 1990. Growth of wild juvenile Caribbean green turtles, *Chelonia mydas*. J. Herpetol. 24: 441-445.

Brackett, D. 1997. No red alert over conservation Red Lists. Nature, 389: 904.

Chaves, G.A. 2001. Nesting activity of sea turtles in Ostional Beach, Costa Rica: 30 years of research. Poster at the 21st Annual Symposium on Sea Turtle Biology and Conservation. 24-28 Feb. 2001. Philadelphia, USA.

Collar, N.J., Crosby, M.J., and Stattersfield, A.J. 1994. Birds to Watch 2: The World List of Threatened Birds. BirdLife International, Cambridge, UK.

da Silveira, R. 2001. Researcher defends managed black caiman exploitation. Crocodile Specialist Group Newsl. 20: 29-30.

Diamond, J.M. 1988. Red books or green lists? Nature, 332: 304-305.

Ehrenfeld, D. 1981. Sea turtle conservation strategy. *In* Biology and Conservation of Sea Turtles, Proceedings of the World Conference on Sea Turtle Conservation. *Edited by* K.A. Bjorndal. Smithsonian Institution Press, Washington, D.C. pp. 567-583.

Florida Marine Research Institute. 2003. Leatherback nesting in Florida. http://floridamarine.org/features/view_article.asp?id=2479. Accessed 6 October 2003.

Fretey, J. 2001. Biogeography and Conservation of Marine Turtles of the Atlantic Coast of Africa. CMS Technical Series Publication No. 6, UNEP/CMS Secretariat, Bonn, Germany, 429 pp.

Fretey, J., and Billes, A. 2000. Les plages du sud Gabon: dernière grande zone de reproduction de la planète pour la tortue-luth? Supplément Ndiva au Canopée 17: i-iv.

Fretey, J., and Girardin, N. 1988. La nidification de la tortue luth, *Dermochelys coriacea* (Vandelli, 1761) (Chelonii, Dermochelyidae) sur les côtes du Gabon. Revue Zool. Afr. - J. Afr. Zool. 102: 125-132.

Gigon, A., Langenauer, R., Meier, C., and Nievergelt, B. 2000. Blue lists of threatened species with stabilized or increasing abundance: a new instrument for conservation. Conserv. Biol. 14: 402-413.

Groombridge, B. (Compiler). 1982. The IUCN Amphibia-Reptilia Red Data Book, Part 1. IUCN, Gland, Switzerland.

Hilterman, M.L., and Goverse, E. 2002. The sea turtles of Suriname 2001 project: aspects of nesting and nest success of the leatherback turtle (*Dermochelys coriacea*) in Suriname, 2001. Biotopic Report to the WWF-Guianas, 33 pp.

Hilterman, M.L., and Goverse, E. 2003. Aspects of nesting and nest success of the leatherback turtle (*Dermochelys coriacea*) in Suriname, 2002. Guianas Forests and Environmental Conservation Project (GFECP). Technical Report, World Wildlife Fund Guianas/Biotopic Foundation, Amsterdam, the Netherlands. 31 pp.

Hilton-Taylor, C. (Compiler) 2000. 2000 IUCN red list of threatened species. IUCN, Gland, Switzerland and Cambridge, UK, xviii + 61 pp. + CD-ROM.

Holdgate, M. 1999. The green web: a union for world conservation. IUCN The World Conservation Union, Earthscan Publications Ltd., London, UK.

Honegger, R.E. (Compiler) 1968. Red Data Book. Volume 3 - Amphibia and reptilia. IUCN, Survival Service Commission, Switzerland.

Honegger, R.E. (Compiler) 1979. Red Data Book. Volume 3 - Amphibia and reptilia. IUCN, Survival Service Commission, Switzerland.

Imboden, C. 1987. Green lists instead of red books. World Birdwatch 9: 2.

IUCN. 1963. Animals and plants threatened with extinction I. IUCN, Survival Service Commission, Switzerland.

IUCN. 1994. IUCN red list categories. IUCN, Gland, Switzerland. 20 pp.

IUCN. 2000. 2000 IUCN Red List of Threatened Species - *Dermochelys coriacea*. http://redlist.cymbiont.ca/species.asp?id=6494. Accessed 2 February 2001.

IUCN. 2001a. IUCN red list categories and criteria: version 3.1. IUCN Species Survival Commission, Gland, Switzerland. 30 pp.

IUCN. 2001b. Assessing population trends of widely distributed species. IUCN, Gland, Switzerland, 2 pp.

Karl, S.A., and Bowen, B.W. 1999. Evolutionary significant units versus geopolitical taxonomy: molecular systematics of an endangered sea turtle (genus *Chelonia*). Conserv. Biol. 13: 990-999.

Kerr, R., Richardson, J.I., and Richardson, T.H. 1999. Estimating the annual size of hawksbill (*Eretmochelys imbricata*) nesting populations from mark-recapture studies: the use of long-term data to provide statistics for optimizing survey effort. Chelonian Conserv. Biol. 3: 251-256.

Limpus, C.J., Parmenter, J., and Limpus, D.J. 2002. The status of the flatback turtle, *Natator depressus*, in Eastern Australia. *In* Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation. *Compiled by* A. Mosier, A. Foley and B. Brost. NOAA Tech. Memo. NMFS-SEFSC-477, pp. 140-142.

Lovari, S. 2001. The IUCN Red List categories discussed. Biol. Conserv. 97: 405-406.

Mace, G.M., and Lande, R. 1991. Assessing extinction threats: toward a reevaluation of IUCN threatened species categories. Conserv. Biol. 5: 148-157.

Márquez M., R. 1976. Reservas naturales para la conservación de las tortugas marinas de México. Inst. Nal. De Pesca., INP/SI: i83.

Márquez M., R., Carrasco-A., M.A., and del C. Jiménez, M. 2002. The marine turtles of Mexico: an update. *In* Proceedings of the Western Pacific Sea Turtle Cooperative Research and Management Workshop. February 5-8, 2002, Honolulu, Hawaii, USA. Western Pacific Regional Fishery Management Council. pp. 281-285.

Márquez, R., Peñaflores, C., and Vasconcelos, J. 1996. Olive ridley turtles (*Lepidochelys olivacea*) show signs of recovery at La Escobilla, Oaxaca. Mar. Turtle Newsl., 73: 5-7.

Márquez, R., Vasconcelos, J., Peñaflores, C. 1990. XXV años de investigación, conservación y protección de la tortuga marina. Secretaria de Pesca, Instituto Nacional de la Pesca, Mexico. 49 pp.

Márquez M., R., Villanueva O., A., and Peñaflores S., C. 1976. Sinopsis de datos biológicos sobre la tortuga golfina, *Lepidochelys olivacea* (Eschscholtz, 1829) en México. INP. Sinop. Pesca 2: 61 pp.

Matsuda, H. 2003. Challenges posed by the precautionary principle and accountability in ecological risk assessment. Environmetrics, 14: 245-254.

Messel, H. 1998. Letter. IUCN Crocodile Specialist Group Newsletter, 17: 15-16.

Meylan, A. 1998. Hawksbill turtles still endangered. Nature, 391: 117.

Meylan, A.B., and Donnelly, M. 1999. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata*) as Critically Endangered on the 1996 *IUCN Red List of Threatened Animals.* Chelonian Conserv. Biol. 3: 200-224.

Mittermeier, R.A. 2000. A challenge to the global community. *In* Hilton-Taylor, C. (Compiler) 2000. 2000 IUCN red list of threatened species. IUCN, Gland, Switzerland and Cambridge, UK xviii + 61 pp.

MTSG. 1995. A global strategy for the conservation of marine turtles. IUCN/SSC Marine Turtle Specialist Group. 24 pp.

Mohanty-Hejmadi, P. 2000. Agonies and ecstacies of 25 years of sea turtle research and conservation in India. *In* Proceedings of the 19th Annual Symposium on Sea Turtle Biology and Conservation. *Compiled by* H.J. Kalb, and T. Wibbles. U.S. Dept. Commerce. NOAA Tech. Memo. NMFS-SEFSC-443, 83-85.

Mrosovsky, N. 1983. Conserving Sea Turtles. British Herpetological Society, London, UK.

Mrosovsky, N. 1996. Need for clarity on species at risk. The Times, London, 12 November, 19.

Mrosovsky, N. 1997. IUCN's credibility critically endangered. Nature, 389: 436.

Mrosovsky, N. 1998. Plight of hawksbill turtles. Nature, 392: 646.

Mrosovsky, N. 2000. Sustainable Use of Hawksbill Turtles: Contemporary Issues in Conservation. Key Centre for Tropical Wildlife Management. Northern Territory University, Darwin, Australia.

Mrosovsky, N. 2001. When arribadas fail to arrive. Kachhapa, 5: 17.

Pandav, B., and Kar, C.S. 2000. Reproductive span of olive ridley turtles at Gahirmatha rookery, Orissa, India. Mar. Turtle Newsl. 87: 8-9.

Patnaik, S.K., and Kar, C.S. 2000. Status and conservation of sea turtles in Orissa, India. *In* Sea Turtles of the Indo-Pacific: Research, Management and Conservation. Proceedings of the 2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation. ASEAN Academic Press, London, U.K. 13-24.

Peñaflores, C., Vasconcelos, J., Albavera, E., and Márquez, R. 2000. Twenty five years nesting of olive ridley sea turtle *Lepidochelys olivacea* in Escobilla beach, Oaxaca, Mexico. *In* Proceedings of the 18th International Sea Turtle Symposium. *Compiled by* F.A. Abreu-Grobois, R. Briseño-Dueñas, R. Márquez, and L. Sarti. U.S. Dept. Commerce NOAA Tech. Memo. NMFS-SEFSC-436, 27-29.

Pritchard, P.C.H. (Compiler) 1971. The leatherback or leathery turtle *Dermochelys coriacea*. IUCN Monograph No. 1. IUCN, Morges, Switzerland. 39 pp.

Pritchard, P.C.H. 1982. Nesting of the leatherback turtle, *Dermochelys coriacea* in Pacific Mexico, with a new estimate of the world population status. Copeia, 4: 741-747.

Pritchard, P.C.H. 1996. Are leatherbacks really threatened with extinction? Chelonian Conserv. Biol. 2: 303-305.

Pritchard, P.C.H. 2000. A response to Nicholas Mrosovsky's *Sustainable Use of Hawksbill Turtles: Contemporary Issues in Conservation*. Chelonian Conserv. Biol. 3: 761-767.

Reichart, H.A. 1993. Synopsis of biological data on the olive ridley sea turtle *Lepidochelys olivacea* (Eschscholtz 1829) in the western Atlantic. NOAA Tech. Memo. NMFS-SEFSC-336, 78 pp.

Ross, J.P. (Ed.) 1998. Crocodiles, status survey and conservation action plan, 2nd edition. IUCN/SSC Crocodile Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK viii + 96 pp.

Ross, J.P. 2000. Book reviews. Mar. Turtle Newsl. 88: 28-29.

S&PS. 2001. Red List petitions results. Species, Newsletter of the Species Survival Commission IUCN, 36: 31-34.

S&PS. 2003. Guidelines for using the IUCN Red List categories and criteria. http://www.iucn.org/themes/ssc/redlists/Redlistguidelines2003.pdf

Sarti, L., Eckert, S.A., Garcia, N., and Barragan, A.R. 1996. Decline of the world's largest nesting assemblage of leatherback turtles. Mar. Turtle Newsl. 74: 2-5.

Schulz, J.P. 1975. Sea turtles nesting in Surinam. Stichting Natuurbehoud Suriname (STINASU), Verhandeling Nr. 3.

Scott, P. (Editor). 1965. The Launching of a New Ark. First report of the president and trustees of the World Wildlife Fund. Collins, London, UK.

Seminoff, J.A. 2002. Draft green turtle assessment for MTSG-wide review. http://www.iucn-mtsg.org/Red_List/cm/cm_assessm2002.shtml

Shanker, K., Pandav, B., and Choudhury, B.C. 2003. An assessment of the olive ridley turtle (*Lepidochelys olivacea*) nesting population in Orissa, India. Biol. Conserv. 115: 149-160.

Soler, R. 1999. Leatherback turtle (*Dermochelys coriacea*) nesting on Brava, Resaca Flamenco, Zoni and Tortola beaches on Culebra, Puerto Rico in 1999. USFWS, Caribbean Field Office, Boqueron, Puerto Rico. 13 pp. plus appendix.

Solow, A.R., Bjorndal, K.A., and Bolten, A.B. 2002. Annual variation in nesting numbers of marine turtles: the effect of sea surface temperature on re-migration intervals. Ecol. Lett. 5: 742-746.

Spotila, J.R., Dunham, A.E., Leslie, A.J., Steyermark, A.C., Plotkin, P.T., and Paladino, F.V. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? Chelonian Conserv. Biol. 2: 209-222.

Turtle Expert Working Group. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-444. 115 pp.

Valverde, R.A., Cornelius, S.E., and Mo, C.L. 1998. Decline of the olive ridley sea turtle (*Lepidochelys olivacea*) nesting assemblage at Nancite Beach, Santa Rosa National Park, Costa Rica. Chelonian Conserv. Biol. 3: 58-63.

Webb, G.J.W., and Carrillo C., E. 2000. Risk of extinction and categories of endangerment: perspectives from long-lived reptiles. Popul. Ecol. 42: 11-17.

Weishampel, J.F., Bagley, D.A., Ehrhart, L.M., and Rodenbeck, B.L. 2003. Spatiotemporal patterns of annual sea turtle nesting behaviors along an east central Florida beach. Biol. Conserv. 110: 295-303.

Wildlife Management International. 1997. Review of the IUCN/TRAFFIC assessment of the Cuban proposal to CITES COP 10 concerning hawksbill turtles (*Eretmochelys imbricata*). (IUCN/TRAFFIC Ref.: Doc 10.89 No.10.60). Distributed to the Parties to CITES COPIO, 14 pp.

Summary

- IUCN's Red Lists (formerly Red Data Books) classify animals and plants into categories according to their risk of extinction.

- The designation of these categories has changed repeatedly in the four decades since the Red Data Books were started. Criteria that must be met to qualify for particular categories of threat have now been elaborated. Unfortunately, standardization, objectivity, and transparency have been undermined by inadequate provision of supporting data and inconsistency in the application of the criteria.

- The Red Lists are meant to assess extinction risk, not prescribe particular actions. However, too often, excessive intrusion of the precautionary principle into the presentation of the evidence has detracted from objectivity. Data Deficient is often the most scientifically appropriate category.

- The application of the present universal criteria to long-lived and to widespread species is especially liable to encounter difficulties.

- Labels such as Critically Endangered, when used in isolation, are potentially misleading; there is a divergence between what the category Critically Endangered means in the Red List system, and what the public generally understands by the words "critically endangered."

- The higher echelons of IUCN need to take decisive action to correct inconsistencies and flaws in the system. The task of red listing appears to be too challenging for an inadequately funded and largely volunteer organization. Alternatives should be considered.

- These problems are illustrated by the history of the red listing of sea turtles. Some of these listings involve contradictions and are illogical. Information on green, hawksbill, olive ridley and leatherback turtles is presented in some detail. The survival prospects for these species are better than is generally thought.