

The IUCN Criteria Review:

Report of the Marine Workshop

Report of a workshop held at the Asia centre of Japan, Tokyo on January 16-17th 1999, part of the review of the IUCN Criteria for listing threatened species.

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1. Introduction

S. Stuart opened the meeting by welcoming all the participants and explaining logistical arrangements for the meeting. He thanked Yoshio Kaneko for support in organising the meeting. Each participant introduced themselves and explained their own perspectives and experience in this area.

S. Stuart then outlined the context for the meeting. This should be seen as part of the continuing evolution of the IUCN Red List and the aim to devise a better system. In the early 1990s the IUCN undertook a process to develop new criteria that were more objective, systematic and based on the developing understanding of extinction risks. New criteria were adopted by IUCN Council in 1994, and had their first major application in 1996 with the production of the *1996 IUCN Red List of Threatened Animals*. Subsequently the new criteria were used for *The 1998 World List of Threatened Trees*. In these two compilations alone, over 30,000 species were assessed against the new criteria and over 15,000 species were listed as threatened with extinction. This extensive application has clarified a number of issues concerning the application of the criteria and the interpretation of listings. Simultaneously, as a result of a Resolution passed at the Montreal World Conservation Congress (WCC) in 1996, SSC (IUCN Species Survival Commission) was asked to undertake a review of the criteria by the time of the next WCC to be held in 2000. SSC had agreed on a process to review the criteria. This meeting was a part of that process. The first stage was a mailing to all IUCN and SSC members inviting comments on the criteria. These comments were collated and a Scoping Workshop was held in March 1998 to review the comments, identify significant issues and design a process to address them. A number of points were resolved at the Scoping Workshop, but several issues required further work and consultation. The recommendations of the Scoping Workshop were that these should be addressed at three further workshops: (1) on marine issues generally (this meeting), (2) on Criterion A and (3) on problems associated with the range area estimates and on dealing with uncertainty in the assessment of species. There were also a number of problems with applying the criteria to species at regional and national levels that were being addressed by a separate group within SSC. Since the Scoping Workshop efforts had been made to raise funds for these other meetings, and this was now all in place. The sequence of workshops was important. Because of the general nature of many of the problems that were encountered in assessing species in the marine environment, the marine workshop was being held first so that results from the marine workshop could feed into the subsequent workshops.

S. Stuart explained that the participants needed to be aware that at the same time as this technical review was under way, IUCN was seeking to make the process of Red Listing more professional and accountable. The Red List had started in the 1960s as an *ad hoc* subjective process and IUCN intended that it evolve into a systematic and transparent system, appropriate for the uses to which it was now being put. A full-time Red List Officer was now in post and the SSC Executive Committee had approved a system for the appointment of Red List Authorities responsible for the assessment of groups of species, with a clear Terms of Reference. For the next Red List in 2000, these Authorities would be responsible not only for the listing, but also for the provision of supporting documentation for each species. From 2000 all new species on the list would require adequate documentation, and the intention was that for the 2003 List all species would be documented. In addition, a process for challenging IUCN assessments by way of petitions was being implemented.

It is intended that relevant material relating to the criteria review will be published in hard copy and on the IUCN web site.

SSC has a Red List Committee that oversees all these developments. This Committee is also now engaged in developing priorities for taxa assessments for the 2000 and 2003 Red Lists and for the continuing process to develop guidelines for regional application of the criteria.

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The important point here is that IUCN is continuously seeking to improve the professionalism and transparency of the Red List, but this is necessarily a gradual process.

S. Stuart explained that the review of the CITES criteria was a separate process, but that there could be some useful inputs from IUCN to CITES and *vice versa*.

Responses and discussion

G. Webb commented that there were multiple aims for the Red List and that these raised problems at the interface of scientific assessment and policy decisions. This related to whether or not the criteria were measuring extinction risk or drawing attention to species that have management problems. D. Butterworth commented that the discussion should focus only on biological extinction to avoid confusion over extinction versus over-exploitation. S. Stuart said that the Red List was intended to include species that showed symptoms of risk of extinction. D. Butterworth suggested that there needed to be consultation with the regulatory bodies on fisheries, and in particular their scientific committees, when listing species that are assessed regularly using standard fisheries stock assessment methods. S. Stuart agreed but commented that the current process was technical and not political. All participants at this workshop were present in a personal, technical capacity.

J. Paxton asked about the relationship with national bodies. These were often carrying out the same assessments as IUCN, although the situation was more complicated for species that occurred in a number of countries. S. Stuart said that these bodies could become the Red List Authorities in some cases, and in others the global authorities should consult with national bodies.

S. Stuart asked G. Mace to review the background and highlight issues to be addressed during the rest of the meeting. G. Mace started by commenting that the issues to be addressed needed to be considered in the right context. The IUCN Red List is intended to provide information on the global conservation status of species. It is a broad tool to identify those species believed to be most at risk of extinction at the global level. As such it is not sufficient for assessing priorities, determining management actions or the likelihood of economic extinction. There are many problems with the concepts of biological and economic extinction which are not dealt with in this context. The main focus of the list is on species. Sometimes sub-units of species can be included but only if they are distinct.

A. Vincent commented that there were problems in establishing appropriate time frames when using the Red List categories. Some species have undergone historical declines but are now stable. Such depletions may matter greatly to other elements of the ecosystem and are an important indicator of our capacity to conserve and manage biota. It is too narrow an approach to only look at extinction. H. Matsuda agreed that we need to worry about depleted species but thought that this was not relevant for the Red List. S. Stuart stated that the Red List was not the only conservation tool and that SSC had other mechanisms more appropriate for these cases.

J. Musick argued that productivity may be a more important factor than trends in population size when determining extinction risk, and that because the current criteria do not explicitly account for differences in productivity among species, there was a high probability of erroneous assessments of risk. G. Mace agreed there was always going to be a problem with estimating or predicting extinction for any particular species with high precision under a system such as this. The purpose of the Red List is to be a first filter on the status of species, directing agencies towards those species that needed more attention. There needed to be a clearer explanation of this in accompanying text of the Red List. S. Stuart said that communication issues were important and would be considered in the workshop.

2. Review of issues to be addressed

G. Mace outlined the issues to be considered, based on the briefing papers. With some further discussion in the meeting these were refined as follows. These topics are in no particular order.

1. Using the criteria for harvested and managed species

At present, there is no distinction in the criteria between declines that are a direct result of a managed harvesting programme and those that result from an uncontrolled threatening process. *How should the listing of harvested species be managed? What changes to the criteria or guidelines for application would help to distinguish these different kinds of processes responsible for decline, while still maintaining a precautionary system?*

2. Measuring range sizes and the values for thresholds.

In the criteria, range area measurements for quantitative cut-offs are presented as two-dimensional areas. Many marine species occupy three-dimensional habitats and, unconstrained by land mass boundaries, many marine species have very large, sometimes global, ranges. *How should the threshold values or the guidelines for application be altered to reflect marine ranges? Are the threshold values as applicable to marine species as they are to terrestrial species*

3. Population decline and extinction risk

In criterion A, species can be listed as threatened simply on the basis of a decline in population, range or habitat. These declines are measured over time scales measured in generation lengths, in order to account for variation in life histories among species. However, it may be that criterion A in its current form fails to take account of the variable potential for recovery among species. *Is the current formulation of criterion A leading to biases and inaccuracies in threatened species lists? What other approach might be taken to identifying species in serious decline while also recognising that there is great variation in the potential for recovery?*

4. Defining units for assessment

The current criteria are based around the assessment of biological populations, which are hard to identify in the oceans where direct observation of interbreeding units may be prohibitively difficult. Often only a very small number of populations, or even parts of the range have been identified or studied. *What operational principles can be developed to guide the choice of areas, stocks or other definable units for assessment when applying the criteria to marine species? How should the distinct sub-units or population level data be combined to provide a category of threat for the species as a whole?*

5. Accounting for life history variation in marine species

The criteria attempt to account for significant variation in life histories among species through the assessment of population size being measured by the number of mature individuals. Mature individuals is specifically defined to count only breeding individuals after allowing for variation in the breeding sex ratio. Mature individuals that are unable to breed because of physiological or environmental constraints are excluded. However, it is not clear that this definition adequately incorporates the full range of life histories seen in the marine environment. *What refinements to the definition of mature individuals will incorporate the variability in recruitment, sex changes over the lifespan of individuals, clonal/sessile species and interspecific interdependencies seen in marine species?*

6. Setting time frames for assessment

In the criteria, changes in population size are measured over time intervals of years or generation lengths (always choosing the longer). There are several problems here. For long-lived species with generation lengths of 20+ years the time-scale for assessment may be very long leading to difficulties in assessment and inaccurate measures. The scoping workshop recommended a maximum generation length be set. Criterion A is currently worded so that time windows for assessment are either in the past or the future, but a shifting time window, which includes the present, but starts at any point and finishes after 10 years or three generation lengths (whichever is the longer) may be more appropriate. *Should there be a cap on generation length used in determining time windows for assessment of decline. If so, what length? Should there be a shifting time window in criterion A?*

7. General issues

The scoping workshop had identified a number of general issues needing clarification:

- (a) The manner of use of generation length in the criteria raises some concern.
- (b) The definition of the Lower Risk category of conservation dependent (cd) causes confusion because there is insufficient guidance about what kinds of conservation actions should lead to listing in this sub-category. Also, there should logically be a separate cd category corresponding to each threat category, to indicate how seriously the species would be threatened without continuing conservation actions.
- (c) There are currently no criteria for the near threatened (nt) sub-category, although this category is in wide usage.
- (d) Criterion E (a quantitative analysis such as a PVA) is rarely used at present although some have suggested that this category should have a different status and be allowed to over-rule listings from criteria A to D.
- (e) There are no operational guidelines at present on how to incorporate uncertainty in the assessment process, and this leads to differences in species assessments that are hard to resolve. *Input from the participants was sought on the debate about generation length, conservation dependent, near threatened, Criterion E and uncertainty measures.*

There followed some general discussion on these topics. C. Roberts emphasised that there are many marine species that are not commercially important fisheries species, and that these needed to be given attention. In particular, there are difficulties in assessing the sessile species with pelagic larvae and the clonal organisms. A. Vincent agreed pointing out the importance of dealing with symbioses and other interdependencies.

D. Butterworth raised the issue of inaccuracy of categorisation in the context of economically important species. G. Mace acknowledged this problem but stated that the system is for all species and in principle it is hard to see how to deal with this specifically; but this was an important issue to return to later once the biological issues were dealt with. J. Musick said that the shark specialist group had opted out of certain assessments. C. Roberts asked if there were a mechanism whereby assessments using the criteria could be over-ruled by subsequent more sophisticated analyses. C. Wood said this was an important point for management agencies when their own analyses contradicted the IUCN assessment. G. Webb suggested this could be dealt with by annotations in the list. S. Stuart thought that improved documentation would help here. G. Mace replied that the rules say that the criteria listings stand, although more detailed assessments were welcomed and it is those that should be used to determine policy and management actions. One purpose of the Red List is to encourage these kinds of full analyses of species exhibiting symptoms of extinction risk. The precision of listings was of great concern to IUCN, but it was also recognised that no simple and broad system such as this was ever going to be precise about the fate of a particular species. Rather, the intention was to have more robust categories for groups of taxa exhibiting more or less serious symptoms and encourage specialists and agencies to diagnose more thoroughly before

recommending appropriate management. There is an analogy here with emergency room (casualty department) procedures that categorise patients according to the severity of their symptoms, but leave precise diagnosis and treatment to the appropriate medical specialists. S. Stuart agreed that this issue need better explanation and should be dealt with in a later general discussion on communication.

B. Taylor suggested that more thought needed to be given to the different levels of uncertainty in the assessments; what level of error is acceptable? R. Akçakaya pointed out that there were different kinds of uncertainty, towards which people might have different attitudes. It was agreed that this was an important general point to return to later.

A. Punt and B. Taylor were concerned that the bigger issues outlined in the briefing documents, especially whether there are fundamental differences between marine and terrestrial species, should be addressed at some point. It was agreed that the general question should be discussed, after the specific points. So it was agreed that apart from the 7 specific points there were the following topics that the group needed to return to:

8. The general questions

a) Marine versus terrestrial species

Most empirical and theoretical work on extinction risk has focused on species in terrestrial environments, and our knowledge and perceptions tend to be influenced by our own familiarity with terrestrial ecosystems. There may be significant differences between marine and terrestrial environments that influence the effective operation of the criteria, and which have so far not been taken into consideration. There is more higher level taxonomic diversity in the oceans than on the land and there are other suggested differences. For example, although extinctions of freshwater fishes have been documented many times, there are no documented extinctions of pelagic marine fish. Also, there is evidence that patterns of long term environmental change may be characteristic of the oceans, operating quite differently from patterns of long term environmental change on land.

Issue: *Are there fundamental differences between marine and terrestrial environments that should be considered for the criteria? Are the apparent differences between terrestrial and marine environments real or a result of relatively poor knowledge of the marine environment? Are the basic principles of extinction theory and life history evolution employed in the criteria applicable to marine as well as terrestrial species?*

b) A new criterion?

There are five criteria in the IUCN system, and meeting any one of these is sufficient for listing. The criteria are based on direct or indirect information about population size and structure and how it is changing over time, areas of distribution and how they are changing over time, and evidence for recent rapid declines. Since many species in the marine environment tend to be poorly known in comparison to terrestrial species, there is often very limited data on which to assess species at all. Frequently the only criterion that can be employed for marine species is the decline criterion which may be applied to only one part of the life cycle, that which is known with any certainty.

Issue: *Are our assessments of marine species biased because many cannot be assessed at all, and others can only be assessed against only one of the five criteria? What techniques and tools can be recommended to marine biologists to assist in assessing more species? Are there other formulations of the criteria that would be more useful for species in the marine environment.*

9. Communication of the purpose and role of the Red List

It was agreed that points 1,7,8, and 9 needed to be discussed in a plenary session. First it was decided to break into working groups to discuss the more specific issues in points 2 to 6.

3. Discussion of issues

1. Issue 2: Measuring range sizes and the values for thresholds

Working group: J. Paxton, C. Roberts, K. Hosoya, T. Yahara, T. Kishida, A. Brautigam

a) 3D ranges

The group did not think this was of concern. The two-dimensional range measures used in the criteria should still be appropriate.

b) Vagrancy

This might need some explanatory wording in the definition of EOO (Extent of Occurrence) indicate that vagrant individuals were not breeding

c) Thresholds for range areas

Because population sizes are so hard to assess in the oceans, range sizes become all important in listing marine species. This is therefore an important topic. The group discussed these thresholds. C. Roberts felt that the thresholds for AOO (Area of occupancy) were too small, but it was recognised that part of the difficulty lay in measuring AOO. Increasing AOO thresholds could lead to listing of many littoral and coastal species. One suggestion was to make different thresholds for marine than terrestrial species, but there was no consensus about what these might be. J. Paxton suggested making marine thresholds 2.5 times the terrestrial ones on the basis that seas occupy 2.5 times the land area. T. Yahara suggested linking range areas to decline in the future. C. Roberts thought this could be addressed through guidelines – making it possible to increase threshold sizes for marine species where relevant.

It was agreed that a particular problematic range area was the ‘typically less than 100 km²’ annotation under criterion D2. This was a very small AOO for marine species and meant that many marine species were excluded from listing as Vulnerable D2, when this was an appropriate category. It was agreed that D2 could be reworded to make this more flexible. It was agreed that this would be helpful.

RECOMMENDATION 1: Alter the definition of Vulnerable D2 by excluding the phrase, ‘typically less than 100 km²’.

2. Issue 4: Defining units for assessment

Working group: R. Froese, S. Molur, J. Meeuwig, B. Taylor, D. Butterworth, G. Webb, H. Ishihara

a) Defining populations

The group had much difficulty with the way that ‘Population’ is defined in the rules for IUCN categories and criteria. Here, ‘population’ is defined as the total unit being categorised, and ‘sub-population’ is used for subsets thereof. In contrast most categorisations are actually of ‘species’, and so ‘sub-populations’ in the IUCN rules equate to what are generally considered biological populations. G. Mace explained that the intention here was to make the criteria

general to the species level or any biological level below. R. Froese and others insisted that this was confusing and that normal biological terms should be used in their usual context. There was consensus on this point.

RECOMMENDATION 2: The terms population and sub-population in the IUCN rules for categories and criteria should be altered to refer to species and populations respectively.

There was further discussion about how sub-units should be recognised. T. Yahara suggested that it is normal to consider genetically distinct units as separate populations, but it was agreed that there would be difficulties in implementing this generally given poor information. A. Vincent thought it important to retain the ability to list threatened populations but D. Butterworth felt that IUCN should only consider global species listings.

b) Accumulating population status up to species status

Two options were presented by the working group:

Option 1: If any two populations (or more) are ‘safe’, then the species cannot be listed in the global Red List. In this case, only regional listings can apply.

Option 2: The decline rate of a species should be the weighted average of the decline rates of all populations for which data are available.

These were discussed. R. Akçakaya considered there were problems with option 1 because the populations might not actually be isolated. Y. Kaneko preferred option 1 because many recent disputes over IUCN listings had resulted where there were agreed to be secure subsets of listed species. There was no consensus and the discussion was continued later (see section 3.5).

3. Issue 5: Dealing with life history variation

Working group: A. Vincent, W. Bond, E. Carrillo, G. Cailliet, J. Reynolds

The discussion in this group had focused on improving some definitions used in the criteria in order to reflect the unusual life histories of some marine species. The group had considered the following issues, and made proposals for amendments to the definitions of ‘mature individuals’ and ‘generation length’ to take account of the following life history characteristics: variation in recruitment, sex changes, clones, sessile species, inter-dependence between species, and generation length.

a) Mature individuals

The essence of this definition should be to reflect the individuals contributing offspring over the generation length of the species. This was complicated in the case of episodically reproducing species. It was agreed that the best operational definition for mature individuals would be twice the number in the rate-limiting sex over a time period of a generation length. There was also a discussion of how to incorporate compensatory effects, but finally agreed this was better dealt with in guidelines about measuring population declines. The definition of mature individuals should also exclude individuals that reproduce but whose offspring will not survive to breed themselves. This could be done by a small change to the definition.

RECOMMENDATION 3: Alter the definition of mature individuals to read, ‘The number of mature individuals is the number of individuals known, estimated or inferred to be capable of *contributing to the next generation*....’

There should also be two extra bullet points as follows: - *Mature individuals that cannot produce new recruits should not be counted (e.g. densities are too low for fertilisation or reproductive conditions are not met), and; – It should be emphasised that the sex that limits the rate of reproduction is not always the rarer sex.*

b) Generation length

It was agreed that the generation length definition in the rules was limited. Many species show variation in reproductive output over their lifetimes, and the generation time can be different under exploitation. T. Yahara noted that generation time is very plastic in many plants and that generation time can therefore be a difficult variable to use. There was much discussion on this issue. Finally, to better reflect the variation in production over a lifetime an alternative definition was proposed, which could be an alternative to the one currently used:

RECOMMENDATION 4: *An alternative definition of generation length is ‘Generation time is greater than the age at first breeding, except in taxa that breed only once. It may be estimated in several ways. For example, (a) the average age of parents in the population, (b) the age at which 50% of total reproductive output is achieved’*

4. Issues 3 and 6: Population decline and extinction risk, and setting time frames for assessment

Working group: A. Punt, H. Matsuda, E. Hudson, J. Musick, C. Wood, R. Akçakaya

Under criterion A, species can be listed as threatened simply on the basis of a past or projected decline in population size that exceeds some critical threshold. The intent here is to be able to list species that are in serious decline without the necessity to have a robust estimate of the total population size. However, in practice a number of very abundant species may have been listed inappropriately using this criterion. The problem is to find a new formulation of criterion A.. This should reflect the fact that rapid decline is a strong indicator of extinction risk, and something that can be measured or estimated even in poorly known species, but the measure needs to provide a more accurate indicator of the actual extinction risk.

The working group reviewed the options for amending criterion A, and had also developed a new alternative. The plenary discussion revolved around a discussion of the various options presented by the working group.

Option 1: No change

It was generally agreed that in its current formulation criterion A often over-estimates extinction risk. Nobody supported the maintenance of the current criterion wording without some amendment.

Option 2: Elimination of criterion A.

Nobody supported this option.

Option 3: Relate the decline rate directly to population size. There are two non-exclusive sub-options:

- a) by expressing the decline as some % of starting population size, carrying capacity (K) or virgin biomass (as is commonly done by many fisheries management agencies).
- b) by linking the decline in criterion A to the thresholds in criteria B, C or D. For example, the criterion might say that species qualifies if it is expected to meet the qualifying levels for criterion B, C or D within some time frame.

Both these options could be expressed as opt-in or opt-out conditions. For example, an opt-in criterion would be where the species qualifies once it has lost a critical (high) % of virgin biomass. An opt-out formulation would use the current criterion A, but the species would be allowed to opt-out of listing if its loss of virgin biomass were shown to be less than some critical (low) % of the original value. This second formulation (the opt-out clause) was favoured by the working group, who had various suggestions for what the opt-out might be. They made both relative and absolute suggestions, including, for example, $N > 10^6$ or an analysis showing that the probability of $N < 10,000$ was less than 0.1 etc.

A. Punt pointed out that (a) could be considered to be an example of how (b) might be defined. T. Yahara supported the general idea of linking declines to population size. J. Meeuwig observed that K was very hard to estimate and varied across time and space for most species. C. Roberts also thought that absolute population size thresholds for opting out could be non-precautionary especially if they did not recognise compensatory mechanisms. J. Reynolds pointed out that depensation should be accounted for in the definition of mature individuals, which would exclude individuals that did not breed at low density, but he acknowledged that this subtlety might be lost. D. Butterworth stated that expressing population size as a fraction of some reference level was sensible and would give the system credibility with fisheries scientists who often use this kind of measure.

B. Taylor noted that the opt-out clause shifts the burden of proof to those seeking to de-list species, and this was probably the right way to do it. They would need to have good data to do this and so the clause might have limited usage. R. Akçakaya cautioned against making it too easy to opt out; he cited the spotted owl example from the NW USA where K will always be 100% but all the time the habitat is declining. There is also a related problem with measuring 'virgin stock' for many species where historical levels are very different to those seen today.

W. Bond commented that criterion A is most commonly used for exploited species, perhaps there should be a different criterion for these. G. Mace disagreed; criterion A is widely used for species facing habitat loss and the effects of introduced species.

A. Punt emphasised again the essence of the opt-out option: that there is a 'future-safe' state that would be used for the opt-out. This could be a relative or an absolute measure. J. Musick said that relative measures would generally be problematic.

S. Stuart asked if the group generally supported the principle of the future-safe opt-out. C. Roberts said he was concerned about predicting safe futures from models given the evidence of failures in the past from fisheries models. A. Vincent agreed and stated that dramatic declines should always be cause for concern. She thought that there could be a place for an opt-out but warned against over-reliance on indices (e.g. CPUE) which may be inaccurate measures of status (e.g. with improving technology appearing to reduce effort but effectively increasing it). Opt outs would need very careful analysis.

H. Matsuda thought that linking population size and decline rate could be more important in criterion A2 (future projection). R. Akçakaya emphasised that whatever the safe-future clause was, it should be precautionary.

S. Stuart concluded the discussion by suggesting the consensus was that a safe-future option was definitely worth further thought.

Option 4: Change 'reduction' to 'continuing decline' in criterion A.

This was a suggestion that was developed at the scoping workshop. It has the advantage of simplicity. There is a relationship between this and Option 3, where it might fit as a very weak form of 'future-safe'. To be made more precautionary the threshold decline rates would need altering.

B. Taylor pointed out that this involved shifting the burden of proof away from the assessor – i.e., they only have to suggest that the decline is not continuing and the species may not be listed. The burden is then on others to prove it is continuing to decline, after accounting for natural variations etc. Maybe we need evidence that the population is actually increasing and recovering.

S. Stuart suggested that the discussion of this option should be folded into other 'future-safe' options.

Option 5: Increase the threshold values for decline rates (i.e. increase the 20%, 50% and 80% currently used in criterion A)

S. Stuart commented that there has been much discussion in particular about the 20% decline rate for VU, which is picking up too many species. These values may well need to change whatever else happens.

G. Mace outlined the methods used to derive these values and agreed that they are probably too precautionary, at least at VU.

J. Musick felt that these numbers are ridiculously low for fishes and it was always going to be hard to distinguish these kinds of decline rates from natural fluctuations. He proposed 95% for CR and 80% for EN. A. Punt suggested that the original derivations should be revisited; these values appear to work for some long-lived species, the problem may just be with very productive species although new formulations for estimating generation length may help with this problem.

W. Bond said that 20% loss of habitat was a serious issue for many species, although 20% loss of population might not be. T. Yahara suggested that his proposal to explicitly link A to B and C would help. D. Butterworth also felt the values were absurd for fisheries although he could live with something like this if there were an opt-out clause.

A. Vincent commented that the discussion should not only focus on commercial species. Lots of other marine species are more stable and for these a 20% decline is a serious issue. If these are not identified by the criteria then there is a risk that their numbers will fall so low that it will be too late. One role of the Red List is to provide adequate warning.

C. Wood said that a key problem was how to measure and detect decline in species that show very wide natural fluctuations. Y. Kaneko emphasised the importance of getting this issue sorted out because of the influential nature of the Red List and the implications for CITES.

S. Stuart suggested that a way forward was to review the background to the development of these values originally, and then to consult other groups for feedback and to see how they work. B. Taylor agreed and also suggested looking at the empirical evidence on what kinds of declines actually lead to extinction. G. Mace agreed that this was a good way forward but said that looking at the empirical data was problematic because the information available was strongly weighted towards species that had persisted despite declines. There are few good data sets on species that have gone extinct. A. Punt said that in any case this needed documenting. H. Matsuda made the suggestion that evidence that a decline had ceased should

be taken over 1 generation length, but that evidence that it was increasing should be measured over a longer period, say 2-3 generation lengths.

RECOMMENDATION 5: The formulation of the values for decline rates in A should be reviewed, and these values should be tested against real data sets. Appropriate levels for revised, more exclusive thresholds should be investigated.

Option 6: Allow criterion E to over-rule other criteria.

E. Hudson pointed out that this could be a stand-alone option or could be part of option 3.

R. Akçakaya said that E was not sufficiently precautionary to be allowed to over-rule A. E. Hudson pointed out other problems with this option. Modelling is not objective and biases can come in due to choice of parameter values and model design. This could create a large and difficult task for assessors seeking to arbitrate on alternative assessments. Criterion E could not be used for species where there was limited information. However, this option has the advantage of simplicity.

D. Butterworth stated that this solution would solve the fisheries problem; fisheries managers routinely use stock assessments towards this end, and have developed a range of precautionary approaches to fishing. C. Roberts said that models give the illusion of rigour but cannot deliver confidence, he would not like to see the non-precautionary E over-ruling the precautionary A. T. Yahara said that modelling should be encouraged in conservation biology and that a simple calculation is better than a subjective judgement. J. Meeuwig observed that models should be used for heuristic analysis and for discovering more about the nature of systems affecting species and not for making projections.

J. Musick felt that since more data is needed for E then there must be higher confidence than A; if it is possible to use E then it could over-rule A. A. Punt pointed out that criterion A too is a model, albeit a much simpler one. He felt that the right place for this proposal was as part of an opt-out in option 3. R. Akçakaya said that single species models are much simpler than ecosystem models. In any model output there will be a range of answers, including all the uncertainty measures. The problem is to choose between them. This need not be completely arbitrary if there are standards for models, and this would be important. H. Matsuda said that IUCN should encourage the collection of better data and should not discourage the development of models that make use of these data. G. Mace pointed out that allowing E to over-rule A has other implications. It puts E onto a different status from the other criteria. Subsequently there might be justification for allowing E to also over-rule B, C and D, so that the quantitative analyses allowed in criterion E would need to be done for all species. Given current resources for data collection and species analysis this could be detrimental to the inclusiveness of the Red List.

S. Stuart concluded the discussion by commenting that there was no consensus on this issue.

Option 7: incorporate the intrinsic growth rate explicitly into criterion A.

This proposal is intended to incorporate explicitly the reproductive potential of species, and their likelihood for being able to recover (bounce back) rapidly from low numbers.

A. Punt said that recovery potential would be incorporated into the new definition of generation length. The age at which maximum production is reached will be younger for a fished species and so the generation length over which declines are measured becomes shorter. The extent of this shift will increase with density dependent responses to fishing. C. Wood felt it would be difficult to estimate the extent of density dependence in natural mortality, and that in practice estimates of r_{MAX} would depend on assumptions about the most appropriate stock recruitment model. D. Butterworth thought that generation length already

accounts for variation in r. H. Matsuda pointed out that generation length and natural mortality vary widely.

B. Taylor felt that this needed more thought. Some species increase their generation times under exploitation.

Option 8: Simple ‘unless the future is safe’ opt out clause.

This was the original new formulation from the working group. The concept was agreed to be a good one but the precise formulation needs more thought and work.

RECOMMENDATION 6: The current formulation of criterion A is generally agreed to be too inclusive and has resulted in the inappropriate listing of many species. The group discussed many options and generally agreed: (1) the threshold decline rates are probably too low (and therefore include too many species); more work needs to be done to set new levels. (2) the most precautionary new formulation of criterion A would be to develop an opt-out clause of the following form:

*a species qualifies if it shows...decline rates of at least x% over y years or z generations (whichever is the longer) ...**unless ...<opt-out condition>** (e.g. population size $N > n$, decline $< p\%$ of K , quantitative analyses showing probability of extinction $< e\%$ in y years).*

This modification depends upon a sufficiently precautionary and widely relevant opt-out clause being devised.

5. Issue 4: Defining units for assessment (revisited)

b) Accumulating population status up to species status (revisited)
The working group presented three options for this task:

- (1) If there are 2 or more ‘safe’ populations, then the species is not listed.
- (2) collect data on as many populations as possible, the species status is the average of these weighted by the size of each assessed population.
- (3) Collect data on as many populations as possible and make a species assessment by the % of populations that are declining. The % decline values in criterion A could be used, e.g. a species is VU if 20% of populations are in decline.

D. Butterworth said that option 1 had to apply if risk of extinction was really being measured. C. Roberts asked how it would be determined that populations were ‘safe’. J. Musick commented that just two safe populations in option 1 was reckless, A. Vincent agreed that option 1 lacked credibility. R. Akçakaya agreed that option 1 was a reckless definition of safety. B. Taylor thought that option 1 was more credible, but that the number of populations regarded as ‘safe’ could be increased to 3, 4 or more. S. Stuart suggested that defining ‘safe’ might benefit from the discussion of the opt-out clause for criterion A.. D. Butterworth and G. Webb both felt that this issue was at the heart of the credibility of the Red List; it was illogical to list a species at risk of extinction if it was represented in known ‘safe’ populations. A. Vincent said that in most cases where a species has lost populations, other populations are also at risk.

R. Akçakaya also disagreed with option (3). He pointed out that fragmentation could increase the number of populations, and also asked what total would be used when calculating the % populations declining. There could be arbitrary consequences; a species that is continually declining would be listed when 12 out of 15 populations

were in decline, but when only 1 out of the remaining three was declining it could be de-listed.

J. Reynolds said that this discussion was only of population size and only referred to criterion A. There needed to be methods for assessing other aspects of populations. C. Roberts agreed; most marine species cannot be assessed by their population size, only their range. T. Yahara commented that the Japanese plant list was compiled using a system like option (2), but because they could not measure population size they weighted using the number of localities to obtain a species value.

An example was presented of a species which had 3 populations meeting CR, 3 meeting EN and 3 meeting VU. Since 66% of populations (>50%) meet at least the EN criterion the species would be EN. R. Akçakaya said this only applied to criterion A. D. Butterworth thought this method could be extended to other criteria as a meta-rule. C. Roberts and J. Meeuwig were both concerned that accumulating up population data according to these formulae would lose a lot of important information about different conditions affecting different populations, and that the units needed to be biological populations and not just locations or assessment units.

It was generally agreed that there is a problem related to listing species where populations face different degrees and kinds of threats, and their assessment as being globally threatened may present difficulties for management agencies.

There followed a general discussion on the options that were presented, with lack of consensus. G. Mace thought this might be a case where it was very hard to generalise and that methods might be best addressed by guidelines to assessors. S. Stuart suggested that there needed to be some specific examples to work on. Participants were encouraged to send relevant examples to G. Mace.

RECOMMENDATION 7: Scaling population data up to the species level can be done in a number of ways. The costs and benefits of alternative proposals should be examined using actual species data.

6. Issue 7: General issues

a) Generation length

G. Mace opened the discussion by outlining three issues: (1) whether generation length was an appropriate scalar for general variation between species in reproductive rate, (2) how to measure generation length in clones, plants and episodic species, (3) whether there should be a maximum generation length in the criteria.

(1)

There had already been some discussion of this topic. It was agreed that the marine fish guidelines had already addressed the problem of declining generation length in exploited species, by suggesting that assessors use the unexploited generation length. G. Cailliet said that there was work on sharks to derive formulae to predict the potential to bounce-back and he would provide references. W. Bond said that this issue was important in other species, especially plants. A. Punt said more work was needed before progress could be made in this area. S. Stuart asked participants to contribute data, and text, on this topic.

(2)

T. Yahara explained the problem of estimating generation times in plants that have vegetative and seed production. The clones (genets) and seeds (ramets) have different generation times. Ramet generation time can be estimated from life tables but genet generation time is hard to

estimate. In addition there are seeds that lie dormant in seed banks whose generation times are long but difficult to measure. He proposed that years or generations (whichever is the longer), as currently used in the criteria, should be changed to years or generations (whichever is appropriate). Because generation time is mostly uncertain in plants, this change, would be more practical for many species.

J. Reynolds agreed that a general definition of a clone is that it is that which regenerates when it is cut off. He thought that generation length could be calculated by weighting both kinds of reproduction and that adding in seed bank storage was also fine. He also suggested that an appropriate definition for generation length in these cases was the time from seed release to subsequent seed release in the genet.

G. Cailliet said that different people used different measures of generation time, and that it was important also to look at the invertebrate literature. S. Stuart encouraged people to send relevant data and text to G. Mace.

(3)

G. Mace explained there were two reasons for considering a cap on generation length. First, that three generation lengths could be hundreds of years in long-lived species and assessors were unhappy about using such long time scales. For estimates of decline in the past, these periods of time may simply not be relevant – the species could have stabilised long ago but at a lower level (depleted species), or the cause of threat could have changed. For future projections it was often impossible to estimate the status of a species hundreds of years ahead on the basis of current threats. Second, there is an internal contradiction in the criteria affecting species with long generation times that are being assessed under criterion E. If species have a generation length longer than 20 years, and criterion E shows that they have a probability of extinction greater than 20% in 5 generations, then they can qualify for EN, but not VU. This is because there is no generation time measure in VU. A cap on generation length of 20 years would be required to sort out this conflict.

G. Webb agreed that 3 generations was too long a time period for assessment of crocodiles. J. Musick said the past declines were not now relevant and W. Bond agreed that capping made sense in terms of human time scales.

A. Vincent thought that the past declines were important even if they were long ago. She said that capping the past was a problem because information about past status could rapidly be lost. She further warned about shifting baselines, such that we began to consider recent (already depleted) numbers to reflect the original or depleted numbers. J. Meeuwig agreed that this could mean the assessment period was too short for picking up non-recovery. G. Cailliet was concerned that species showing long-term fluctuations would be qualifying incorrectly if the time period was short. E. Hudson pointed out that generation time was important in the criteria as a scalar and that capping it would limit its usefulness. B. Taylor agreed that this related to the issue of recovery potential and that this proposal might act against the listing of the most vulnerable species. She thought 60 years (3 x 20 years) was too short a time to assess the status of long-lived species.

There was a general discussion about the effect that the cap would have in terms of species dropping off the list. G. Mace said that it was important to know the implications and asked for examples from participants. R. Akçakaya suggested that the second reason for capping generation length (internal consistency) could be avoided by adding a generation length alternative to the definition of VU (i.e. ...in 100 years, or 5 generations, whichever is longer)

S. Stuart concluded that there was no general consensus here, although nobody objected to capping future projections. Many people felt that 20 years was too short for the maximum

generation length for use in past, but most agreed that there should be some cap on the past. There was a more fundamental issue raised by A. Vincent about the importance of listing depleted species since population declines are important for population viability and ecosystem function, whether or not they pre-sage extinction.

RECOMMENDATION 8: Generation times used for future projections should be capped. The decision about capping generation times used for measuring historical declines should be considered further, especially by looking at the kinds of species that would come off the list as a result of different maximum lengths. 20 years is too short, so another solution should be sought to establishing internal consistency in criterion E, e.g. adding a generation time alternative to VU.

b) Conservation dependent (cd)

GM outlined the structural problem related to cd. In theory CR, EN and VU should all have a cd equivalent. S. Molur gave the example of how misleading cd could be to decision makers. The gharial and the tiger are both cd in India, but the tiger should be EN(cd) and the gharial nt(cd). H. Matsuda also gave the example of the blue whale which is kept out of CR and in EN by management, but cd can only be used for species that are in LR through effective management.

G. Webb and A. Vincent felt it was important to have a label for species that are under management; G. Webb thought the term misleading – it implied this was the most needy species.

G. Mace said this issue was a trade off between complexity and accuracy. S. Stuart said that revising cd could be a big task, and he asked whether anyone thought it of very high priority. He suggested that this issue was better addressed by clearer guidelines and documentation, and there was general agreement with this.

c) Near threatened (nt)

G. Mace said that there were some calls for criteria for nt. This category had been used much more extensively than had been expected, and without much consistency among assessors. However, developing explicit criteria would effectively make it another category of threat.

J. Musick said the shark group used nt where there was not enough information to place a species in a threatened category. C. Roberts thought it played a useful role in assessing biodiversity status, even in its present form. B. Taylor pointed out that the level of risk in VU is actually quite a serious issue and that therefore nt was important.

W. Bond was concerned that the relationship between the Lower Risk categories was often misunderstood, and that nt and cd were very different from lc, which was actually ‘safe’. There was agreement that the cladogram in IUCN rules needs clarification and that there needed to be better explanation of the roles of the sub-categories of LR.

S. Stuart suggested that more guidelines were needed but that this was not a very important issue to deal with immediately.

RECOMMENDATION 9: Better explanation of the role of the sub-categories of LR is needed and a re-drafted figure. The development of criteria for nt and the expansion of cd are not a high priority.

d) Criterion E

It was agreed that this had been considered in full under issues 3 and 6.

e) Uncertainty

R. Akçakaya gave a presentation on the nature and treatment of uncertainty. There are several different kinds of uncertainty, but uncertain values can be combined, using fuzzy variables, to give overall measures in the criteria. The answer will depend upon how the assessor sets parameters that deal with ‘dispute tolerance’ – whether a range of plausible values will be included or whether he seeks to reach a consensus value, and ‘risk tolerance’ – how precautionary the assessor is. Further details of the method can be obtained from R. Akçakaya.

There was general agreement that this was a helpful approach, especially for providing explicit information about how each assessor was dealing with risk and uncertainty. This topic would be explored more at a later workshop. This method could also provide a clear role for nt.

7. Issue 1: Using the criteria for harvested and managed species

The issue here is whether special mechanisms are desirable to deal with harvested, exploited and managed species in the Red List. B. Taylor said that finding a way of defining ‘managed’ species would be very difficult. There was general agreement on this. A. Punt suggested that most issues specific to marine species under harvest raised between this meeting and the marine meeting in had been discussed. This was agreed.

8. The general questions

a) Marine versus terrestrial species

A. Vincent said that the main differences between marine and terrestrial systems were due to scale, interconnectedness and dispersal. C. Roberts suspected that, in the context of the Red List, the differences are not so important, and R. Akçakaya agreed, stating that there were no fundamental differences and the range within both marine and terrestrial species was very broad.

J. Paxton, C. Wood and others considered that the main difference was poor detectability and difficulties with obtaining measures in the oceans. A. Vincent also thought there was massive potential for habitat degradation from the effects of pollutants etc. C. Wood thought there might be longer auto-correlation in environmental variables affecting recruitment in the oceans.

In general, the differences were thought to be of scale only.

b) A new criterion?

S. Stuart thought that there might be a difference in the way that species respond to reduced density. In terrestrial systems, populations at low density tend to aggregate in pockets of habitat, whereas in the open oceans they might simply be at lower density and therefore be more prone to compensatory effects. J. Reynolds pointed out that the definition of mature individuals should pick this up, but wondered if there were examples, illustrating how this effect might lead to such rapid declines that there was no time to pick it up. J. Musick suggested the white abalone of California and C. Roberts suggested the giant clam. A. Vincent thought that groupers were another example, and J. Reynolds cited some experimental work on sea urchins. There was discussion about whether a new criterion F could be used to pick up this effect.

R. Akçakaya said that criterion E could be used although there might need to be higher extinction thresholds to make it more precautionary. J. Reynolds said that it should be dealt with under criterion A and there was no uniqueness in this effect for marine species. S. Stuart thought that addax, oryx and desert tortoises might be terrestrial examples. W. Bond thought there were plant examples, but he did not think that this was worth a new criterion.

J. Musick thought that people were over-emphasising the probability of depensatory effects. C. Roberts said that sessile marine invertebrates might suffer more serious depensation.

S. Stuart concluded by saying that this might justify more thought, but at present there seemed to be no basis for a whole new criterion.

9. Communication

G. Mace commented that the scoping workshop had already highlighted a number of deficiencies in the information about the purpose and uses of the Red List. This had led to misinterpretations and misunderstandings and it was important to identify key areas to be aware of before the release of the 2000 Red List. S. Stuart said that expert advice on effective communication was needed.

R. Froese reiterated that it was very important to redesign the figure in the red booklet describing the nature of the categories, especially to distinguish least concern more clearly from other LR categories. He also stressed the importance of clarifying the terminology used for populations and subpopulations (see section 3.2a).

Given the wide application of IUCN categories, A. Vincent was worried about the consequences of species being de-listed. S. Stuart said that a number of high profile species had been de-listed last time with little impact, e.g. wolf, tiger, white rhino.

There was also some discussion about improving the effectiveness of the nt category. C. Wood suggested that if the opt-put clause were adopted for criterion A, then nt could be used to flag concerns about declining trends in opted-out species.

There needs to be more detail and clarity in the red book; S. Stuart agreed this was a high priority.

4. Summary of recommendations

RECOMMENDATION 1: Alter the definition of Vulnerable D2 by excluding the phrase, ‘typically less than 100 km²’.

RECOMMENDATION 2: The terms population and sub-population in the IUCN rules for categories and criteria should be altered to refer to species and populations respectively.

RECOMMENDATION 3: Alter the definition of mature individuals to read, ‘The number of mature individuals is the number of individuals known, estimated or inferred to be capable of contributing to the next generation....’

There should also be two extra bullet points as follows: - *Mature individuals that cannot produce new recruits should not be counted (e.g. densities are too low for fertilisation or reproductive conditions are not met)*, and – *It should be emphasised that the sex that limits the rate of reproduction is not always the rarer sex.*

RECOMMENDATION 4: An alternative definition of generation length is '*Generation time is greater than the age at first breeding, except in taxa that breed only once. It may be estimated in several ways. For example, (a) the average age of parents in the population, (b) the age at which 50% of total reproductive output is achieved*'

RECOMMENDATION 5: The formulation of the values for decline rates in A should be reviewed, and these values should be tested against real data sets. Appropriate levels for revised, more exclusive thresholds should be investigated.

RECOMMENDATION 6: The current formulation of criterion A is generally agreed to be too inclusive and has resulted in the listing of too many inappropriate species. The group discussed many options and generally agreed: (1) the threshold decline rates are probably too low (and therefore include too many species); more work needs to be done to set new levels. (2) the most precautionary new formulation of criterion A would be to develop an opt-out clause of the following form:

a species qualifies if it shows...decline rates of at least x% over y years or z generations (whichever is the longer) ...unless ...opt-out condition (e.g. population size $N > n$, decline $< p\%$ of K, PVA showing probability of extinction $< e\%$ in y years).

(3) This modification depends upon a sufficiently precautionary and widely relevant opt-out clause being devised.

RECOMMENDATION 7: Scaling population data up to the species level can be done in a number of ways. The costs and benefits of alternative proposals should be examined using actual species data.

RECOMMENDATION 8: Generation times used for future projections should be capped. The decision about capping generation times used for measuring historical declines should be considered further, especially by looking at the kinds of species that would come off the list as a result of different maximum lengths. 20 years is too short, so another solution should be sought to establishing internal consistency in criterion E, e.g. adding a generation time alternative to VU.

RECOMMENDATION 9: Better explanation of the role of the sub-categories of LR is needed and a re-drafted figure. The development of criteria for nt and the expansion of cd are not a high priority.

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