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Essay

A Necessary Adjustment of the Extinction Risk associated with the Red List Criteria?

Un ajustement du risque d'extinction associé aux critères de la Liste rouge rendu nécessaire?

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Key Words: *avian extinction; threatened birds; IUCN Red List*

The IUCN Red List Categories and Criteria are used to assign species to classes of projected extinction risk (least concern, near threatened, vulnerable, endangered, critically endangered, extinct in the wild, extinct). Formerly, the classification into categories was based on expert opinion. Since 1994, the process has become more rigorous, underpinned by quantitative criteria with specified numerical thresholds (IUCN 1994, 2001). Although most of the criteria are based on attributes associated with extinction risk, such as small population size, rapidly declining population, or small and declining range size, only criterion E has thresholds for extinction probability within a specified time-frame as determined by stochastic quantitative models (Lande 1993), such as those used in population viability analyses (IUCN 2001). For example, a species facing a probability of extinction of at least 50% within 10 years or 3 generations (whichever is longer) qualifies as critically endangered under criterion E, and 50% of critically endangered species are anticipated to be extinct 10 years from the year of classification.

Some conservationists would assert that species considered threatened because they meet criteria other than E should not be considered to be at risk of extinction within any particular time frame. Rather, the value of the Red List is to rank species in terms of relative extinction risk. This is undoubtedly a valuable exercise that, inter alia, aids the allocation of limited conservation resources. Commonly those resources are preferentially directed towards species considered critically endangered.

Nevertheless there is a widespread assumption, by scientists (e.g. Mace 1994, Collar et al. 1994, Crosby et al. 1994, Sekercioglu et al. 2004, Thomas et al. 2004, Redding and Mooers 2006) and by the wider public, that extinction probabilities applicable to criterion E also apply to species qualifying for these particular categories under other criteria. This assumption underpins a number of recent high-profile studies. For example, in a widely quoted and influential study, Thomas et al. (2004) concluded that up to 37% of species may be committed to extinction by 2050 as a consequence of climate change, an estimate that partly assumes that "each category [carries] a specified probability of extinction." Redding and Mooers (2006) combined information on evolutionary history and threat status to rank species' conservation priority and "used the criterion E value to assign p_e [extinction probability] values to each species." Sekercioglu et al. (2004) investigated the ecosystem implications of biodiversity loss and predicted, on the basis of "the extinction probabilities for threatened species

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used by IUCN," that by 2100, 6-14% of all bird species will be extinct and 7-25% will be functionally extinct.

Such studies rest on the assumption of, at the very least, a rough equality of the extinction probabilities of species qualifying under different criteria. The assumption is acknowledged in a recent review of the Red List by Mace et al. (2008): '...in the absence of conservation interventions, a larger proportion of species listed in higher threat categories will go extinct over shorter periods. We anticipate these proportions and periods correspond roughly with the values given for each category in criterion E, but this cannot be proven'. Indeed I would argue that the utility of the Red List approach would be seriously undermined if this were not the case and there was a significant mismatch between the extinction risk of organisms listed under different criteria in the same category.

To test the above assumption, colleagues and I (Brooke et al. 2008) recently developed a novel way of using criterion E to predict rates of transition of species between the threat categories of vulnerable, endangered and critically endangered. Criterion E of course gives a direct prediction of the rate at which critically endangered species will become extinct. We then tested our predictions against Australian and global avian datasets over various timescales. We were able to ignore the issue of generation length since the median generation length of threatened and near-threatened bird species is 3.3 years (Brooke et al. 2008).

The results, of which a representative part is given in Table 1, indicated a fair match between predicted and observed rates for the transition from vulnerable to endangered. Thus the rate modelled from criterion E was close to the rate at which species, classified under the other criteria A-D, moved between categories. The match was poorer for the transition rate endangered to critically endangered: fewer species made the transition than predicted. The match was worst for critically endangered species: considerably fewer species went extinct than predicted. This remained true even when the undoubted success of some projects in pulling certain critically endangered species back from the brink of extinction was taken into account (Butchart et al. 2006). At the most, one quarter of the species classified as critically endangered 10 years ago might have gone extinct in the past decade, as compared to the half anticipated from criterion E.

The fact that there is a progression from fair match for vulnerable species via weak match for endangered species to downright poor match for critically endangered species hints - I would put it no stronger - that the population models underlying the criteria are weakest when populations and range sizes are very small.

If, as seems to be true of birds, the Red List criteria over-estimate extinction risk, notably of critically endangered bird species, there is an immediate need to assess whether the same applies to other taxa. If that proves to be the case, how should the conservation community react? One response might be to acknowledge the exaggeration, but to point out that extinction carries such awful finality that it is wiser to adopt a precautionary approach. While possibly over-estimating the average risk of extinction of species in the most threatened categories, the criteria would capture the risk faced by the most threatened species in a category.

In the public arena, this business as usual attitude raises the possibility that the conservation community might be accused of exaggerating species' extinction risk, of crying wolf (Lomborg 2001). I believe this to be a serious possibility which cannot be brushed aside. Whatever the reason for their position, opponents of a conservation ethic will not shrink from using a perceived shortfall in recent extinctions to undermine the overall case for conservation. Better that we should put our own house in order.

A second option is that the criteria should remain as they are, but this be accompanied by shifting a proportion of species to a lower threat category, the process known as downlisting, to reflect their lower risk of actual extinction. Such a shift would involve a significant number of species moving Red List category at a stroke. It would violate one of the cardinal requirements of the Red List process, that it aspire to stability. It is a recipe for confusion. Better to avoid such a rocking of the boat.

Among birds, 669 species are currently listed as vulnerable, 363 as endangered and 190 as critically endangered (www.birdlife.org - accessed 3 July 2008). Although these totals arise from scrupulous application of the present criteria, they are, conveniently, totals which allow ornithologists to maintain a watching brief or more active conservation action on the majority of critically endangered species. If the number of such species

Table 1. Observed, calculated, and predicted transition rates through Red List categories (in percentage of species per decade). Positive values indicate net deterioration (i.e., more species moving into higher threat categories than lower threat categories), whereas negative values indicate net improvement. Upper rows simplified from Brooke et al. (2008). Bottom row based on revised criterion E values suggested in the text.

		Threat category				
		Least Concern	Near Threatened	Vulnerable	Endangered	Critically Endangered
All bird species 1988-2004	Observed	0.63	3.74	4.54	4.09	-2.39
	Observed adjusted to exclude the impact of conservation action	0.63	3.82	5.08	4.89	3.98
Critically Endangered species 1994-2004	Observed	–	–	–	–	1.70
	Observed adjusted to exclude the impact of conservation action	–	–	–	–	10.8
	Predicted using current criterion E	–	–	8.30	40.0	50.0
	Predicted using suggested revision of criterion E	–	–	4.24	15.7	25.0

diminished as some were downlisted, so it might become difficult for conservationists to maintain the necessary focus on the newly-downlisted but most threatened endangered species.

The third option seems most sensible, an adjustment of the explicit extinction risks associated with criterion E so that they more accurately reflect the risks faced by species in today's circumstances. There would be no need to adjust other criteria, under which the overwhelming majority of species are actually classified, and therefore very few species would change category.

Any revised set of extinction risks should obviously retain the ranking vulnerable, endangered, critically endangered. I would also suggest they should, in conformity to the current criteria, predict slower transition rates from the broader category of vulnerable to endangered than from endangered to critically endangered, and from critically endangered to extinct. With this basis, I tentatively suggest:-

Vulnerable 5% extinction risk in 200 years (c.f. current 10% risk in 100 years)
Endangered 10% extinction risk in 40 years (c.f. current 20% risk in 20 years)
Critically Endangered 25% extinction risk in 10 years (c.f. current 50% risk in 10 years).

These revised values of criterion E would retain the riders based on generation length that form part of the present criterion E (IUCN 2001).

Following the methodology of Brooke et al. (2008), I generate the decadal transition probabilities shown in Table 1 for the revised values of criterion E. The predicted transition probabilities for vulnerable to endangered and for endangered to critically endangered match observation quite well, both for the worldwide dataset in Table 1 and for the Australian dataset discussed by Brooke et al. (2008). However the predicted rate of extinction of critically endangered species remains above what is observed. A precautionary element within the criteria might be considered desirable.

To conclude, it seems possible that, where current Red List criteria specify the time frame of extinction, they may over-estimate a species' actual risk. It may be that this is due to imperfections in the stochastic models on which the criteria are based (Melbourne and Hastings 2008), in which case there is an opportunity for population modellers to re-visit those models, now that their output can be tested against the fate of threatened species in the past decade. Illustrative of possible problems in the models is the remarkable ability of species to persist in the face of extensive habitat loss (Brooks and Balmford 1996). Or the persistence of species may arise from some other reason altogether. Whatever the reason, small adjustments, of the scale suggested here, would bring criterion E into line with what has been observed among birds in recent times, and so help forestall the charge that conservationists are prone to exaggeration.

Responses to this article can be read online at:
http://www.ace-eco.org/vol4/iss1/art1/responses/

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LITERATURE CITED

Brooke, M. de L., S. H. M. Butchart, S. T. Garnett, G. M. Crowley, N. B. Mantilla-Beniers, and A. J. Stattersfield. 2008. How fast are threatened bird species moving towards extinction? *Conservation Biology* **22**:417-427.

Brooks, T. M., and A. Balmford. 1996. Atlantic forest extinctions. *Nature* **380**:115.

Butchart, S. H. M., A. J. Stattersfield, and N. J. Collar. 2006. How many bird extinctions have we prevented? O*ryx* **40**:266-278.

Collar, N. J., M. J. Crosby, and A. J. Stattersfield. 1994. *Birds to watch 2: the world list of threatened birds.* BirdLife conservation series 4. BirdLife International, Cambridge, United Kingdom.

Crosby, M. J., A. J. Stattersfield, N. J. Collar, and C. J. Bibby. 1994. Predicting avian extinction rates. *Biodiversity Letters* **2**:182-185.

IUCN (World Conservation Union). 1994. *IUCN red list categories.* IUCN, Gland, Switzerland.

IUCN (World Conservation Union). 2001. *IUCN Red List Categories and Criteria*: version 3.1. IUCN SSC, Gland, Switzerland and Cambridge, United Kingdom.

Lande, R. 1993. Risks of population extinction from demographic and environmental stochasticity and random catastrophes. *American Naturalist* **142**:911-927.

Lomborg, B. 2001. *The Skeptical Environmentalist.* Cambridge University Press, Cambridge, UK.

Mace, G. M. 1994. Classifying threatened species: means and ends. *Philosophical Transactions of the Royal Society* B **344**:91-97.

Mace, G. M., N. J. Collar, K. J. Gaston, C. Hilton-Taylor, H. R. Akçakaya, N. J. Leader-Williams, E. J. Milner-Gulland, and S. N. Stuart. 2008. Quantification of extinction risk: IUCN's system for classifying threatened species. *Conservation Biology* **22**:1424-1442.

Melbourne, B. A., and A. Hastings. 2008. Extinction risk depends strongly on factors contributing to stochasticity. *Nature* **454**:100-103.

Redding, D. W., and A. O. Mooers. 2006. Incorporating evolutionary measures into conservation prioritisation. *Conservation Biology* **20**:1670-1678.

Sekercioglu, Ç. H., G. C. Daily, and P. R. Ehrlich. 2004. Ecosystem consequences of bird declines. *Proceedings of the National Academy of Sciences, USA* **101**:18042-18047.

Thomas, C. D., A. Cameron, R. E. Green, M. Bakkenes, L. J. Beaumont, Y. C. Collingham, B. F. N. Erasmus, M. F. D. Siqueira, A. Grainger, L. Hannah, L. Hughes, B. Huntley, A. S. V. Jaarsveld, G. F. Midgley, L. Miles, M. A. Ortega-Huerta, A. T. Peterson, O. L. Phillips, S. E. Williams. 2004. Extinction risk from climate change. *Nature* **427**:145-148.