COST-EFFECTIVE RESOURCE ALLOCATOR: A DECISION SUPPORT TOOL FOR THREATENED SPECIES MANAGEMENT

Appendix S5. Steps for determining the benefit of each candidate strategy.

1. To reduce possible overconfidence in expert's judgments we apply a four-step interval elicitation procedure (Spiers-Bridge *et al.* 2010), requiring the input of values describing:
   a. a best case scenario: i.e. the lowest percentage decline and highest number of mature individuals expected at the end of the planning period with and without management.
   b. a worst case scenario: i.e. the greatest percentage decline and lowest number of mature individuals expected.
   c. a most likely estimate: i.e. the most likely percentage decline and number of mature individuals expected.
   d. the confidence associated with the interval bounded by best case and worst case estimates: i.e. how confident is the user that the interval they created will capture the true value (must be greater than 50 per cent).

When considering the best and worst case scenarios, assessors should be mindful of: the technical and social feasibility of implementing the strategy, the prospects for a run of good (or bad) years, and any unfamiliarity with the potential ecological response.

2. The tool adjusts estimates for projected population decline based on differences in the species generation length, using the following formulae:

$$r_i = -(-d_i + 1)^{\frac{1}{t_0}} + 1 \qquad\qquad \text{Eq. 1.1}$$

$$D_i = 1 - (1 - r_i)^{t_1} \qquad\qquad \text{Eq. 1.2}$$

where r_i is the per annum rate of decline of species i, d_i is the percentage decline of species over the planning period (t_0), D_i is the adjusted projected population decline for species i over the time-frame (t_1), which may be 10 years or three generation lengths (whichever is longer; IUCN Criteria A). Following the IUCN Red List guidelines, we assumed an exponential decline in our extrapolations for lack of precise information on projected changes in threatening processes.

Estimates of number of mature individuals and adjusted population decline are converted into per annum probabilities of extinction based on the associations between IUCN Criteria E, A and D thresholds (Table S1 and S2; below). We did this by first calculating the per annum probability of extinction (p) under each IUCN threat category using the following equation, which assumes a constant per annum rate of extinction:

$$p_i = -(-E_i + 1)^{\frac{1}{t_0}} + 1 \qquad\qquad \text{Eq.1}$$

where p_i is the per annum probability of extinction of species i, E_i is the probability of extinction over the period specified under Criterion E (t_0). Results are summarized in Table S1. Next, we fit two piece-wise linear regressions between per annum probability of extinction and thresholds for Criteria A and D under the same IUCN threat category (described in Table S2) to obtain a continuous relationship between these metrics, and increase the resolution of the IUCN categories (which we found to be a limiting factor in a preliminary elicitation trial). We present these relationships in Figure S1 and S2 (below).

3. Consistent with the IUCN rule set approach to assessment of extinction risk, the tool then selects the higher risk of Criteria A and D judgments, and converts this into expected extant years. We determined 'expected extant years' by taking the reciprocal of the per annum probability of extinction. The lower and upper confidence intervals of each strategy's expected extant years are determined by linear extrapolation of the bounds specified in cell G4 of each species' spreadsheet (which are automatically set to 80 per cent).

Table S1. Converting each IUCN threat category's 'probability of extinction' to 'expected extant years'. The acronyms respectively stand for: Critically endangered, Endangered and Vulnerable threat categories.

	CR	EN	VU
Criterion E. Probability of extinction (E)	50% chance over 10 years	20% chance over 20 years	10% chance over 100 years
Per annum probability of extinction (p)	1/15	1/90	1/950

Table S2. Thresholds for Criteria A and D under each IUCN Red List threat category.

	CR	EN	VU
Criterion A. Decline in population size in the past 10 years, or three generations, whichever is longer.	≥80%	≥50%	≥30%
Criterion D. Population size of mature individuals	<50	<250	<1,000
Per annum probability of extinction (p)	1/15	1/90	1/950
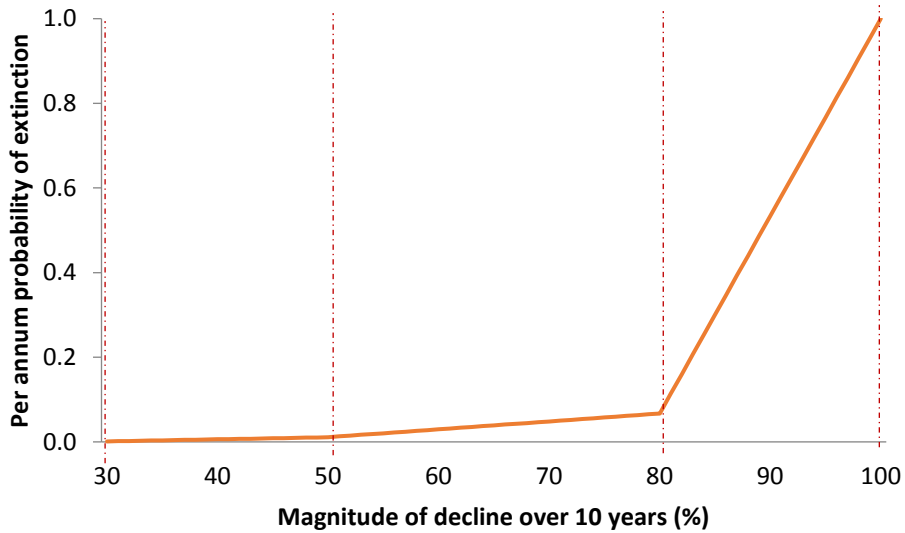
Figure S1. Per annum probability of extinction under increasing magnitude of decline measured over 10 years. Dashed lines indicate the thresholds for IUCN Criteria A, upon which the piece-wise regression is based.
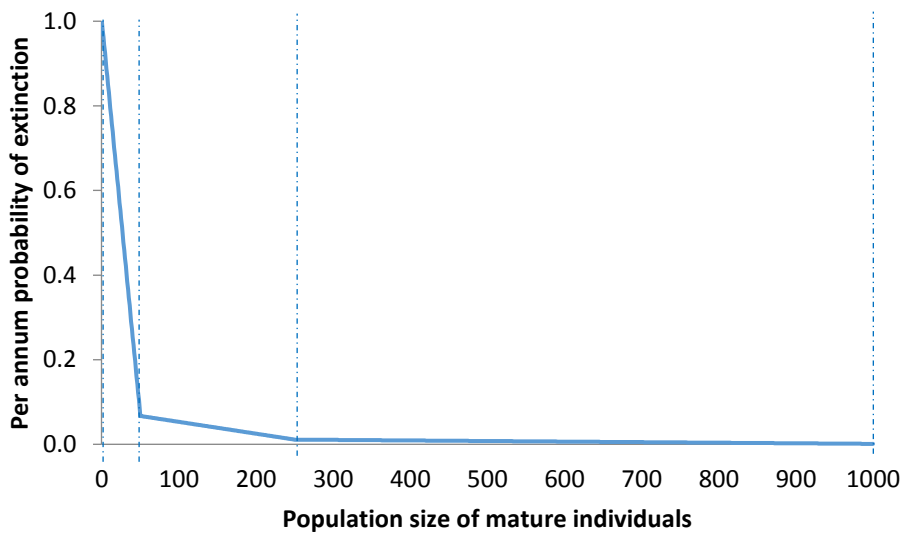
Figure S2. Per annum probability of extinction under increasing numbers of mature individuals. Dashed lines indicate the thresholds for IUCN Criteria D, upon which the piece-wise regression is based.