Species appeal predicts conservation status

Mattia Brambilla - Marco Gustin - Claudio Celada

M. Brambilla (correspondence)

Fondazione Lombardia per l'Ambiente, Settore Biodiversità e Aree protette, Piazza Diaz 7, I-20123 Milano, Italy. E-mail: brambilla.mattia@gmail.com

M. Brambilla - M. Gustin - C. Celada

Lega Italiana Protezione Uccelli (LIPU/BirdLife Italia), via Trento 49, I-43100, Parma, Italy.

M. Brambilla

Museo delle Scienze, Sezione di Zoologia dei Vertebrati, Via Calepina 14, I-38122 Trento, Italy.

Abstract

Conservation of animal species should start from real needs of protection and intervention shown by species and their habitats, but it is often driven by the perception which humans have of species, as the latter enables fund raising and attracts financial resources for conservation actions. However, this approach dominated by the so-called flagship species has been severely criticised, because of the associated risk of directing resources to charismatic species while neglecting threatened ones. An analysis of conservation status in relation to anthropic value of species outlined how the more "appealing" bird species in Italy have better conservation status. This is likely due to an over-representation of most appealing species in conservation projects and suggests that a more careful and status-based prioritization of conservation efforts should be adopted.

Keywords: assessment; birds; "charismatic" species; flagship species; population; trend

Introduction

Conservation status of animal species is affected by a plethora of different factors. Conservation measures and efforts dedicated to maintaining populations and habitats of a species can have the potential to improve species' status, although their effectiveness depends on a plurality of factors, including, among others, careful planning and the availability of economic resources. Since economic resources for conservation are limited, setting conservation priority is of crucial importance (Wilson et al. 2006). However, in many cases priorities are set according to criteria that are not exclusively scientific, because public awareness - and funding - is biased towards 'charismatic' species - such as eagles, large carnivores, pandas, etc. - which the public at large is more aware of (Caro et al. 2004; Helgen and Groves 2005; Amori et al. 2008; Clucas et al. 2008). There are many examples of species which have received limited conservation attention (despite a high risk of extinction) as a result of their limited appeal (Amori et al. 2008). A focus on "charismatic" species may serve to garner public support for conservation efforts, but it may also potentially divert scarce conservation resources away from taxa that are more urgently threatened (Seddon et al. 2005). Enviromental organizations, governments and other conservation agencies focus their publicity and programmes on large, "charismatic" species to raise awareness and funds, exacerbating the problem. According to a very recent definition, flagship species is "a species used as the focus of a broader conservation marketing campaign based on its possession of one or more traits that appeal to the target audience" (Verissimo et al. 2011), and flagship concept is not a biological or ecological issue (Verissimo et al. 2011). The reliance on particular species also rests on the belief that this approach will be able to secure funding for the preservation of their habitat and by consequence of the biodiversity located therein. This has been promoted to the point that the fate of nature conservation is now inextricably tied to the fate of particular "charismatic" species (Kontoleon and Swanson 2003). However, several studies have shown that the flagship approach has little positive effect on general biodiversity conservation and that the reliance on flagship taxa is

not always an effective path to conservation of less charismatic species in the same areas (Amori et al. 2008; Andelman and Fagan 2000; Prendergast et al. 1993; Williams et al. 2000), although some flagship species are also umbrella or indicator species (Sergio et al. 2006; Sergio et al. 2008). Several cases of declining species in sites where some targeted flagship species are flourishing or stable have been reported (Dowler et al. 2000; Sommer and Hommen 2000). Furthermore flagship species may be absent from many sites holding species of conservation concern. In any case, there is a clear and present risk that non charismatic species receive too little attention and protection; indeed, many uncharismatic taxa belonging to various taxonomic groups await study and conservation (Pillon and Chase 2007).

The appeal of animal species may also be positively influenced by rarity and conservation concerns: rare species close to extinction may be regarded as more "charismatic" than common and widespread ones. Theoretically, rare species may be more desirable by people (tourists or collectors), and so could fall victim to an 'Anthropogenic Allee Effect' (Courchamp et al. 2006), which could worsen their conservation status.

We have explored the possible effect of species anthropic value on the conservation status of bird species of the Italian avifauna (Gustin et al. 2009).We tested three alternative possible scenarios that should clarify the nature of relationship between species' perceived value and conservation status. *First scenario*: if conservation efforts have been independent from species' appeal, there should be not association between anthropic value of a species and its conservation status. *Second scenario*: because of a positive association between rarity and appeal (also found in our study, see below), species with a poor conservation status could have high anthropic value (however, this relationship is obviously dependent on the magnitude of the effect of rarity on conservation status, the latter also being affected by a wide variety of other factors). *Third scenario*: if conservation actions have been directed predominantly at "charismatic" species, a correlation between anthropic value and conservation status should be detected (more appealing species should have better conservation status). In this latter scenario, Passeriformes, mainly small-sized birds

usually perceived as “non-charismatic” species, should have a worse average conservation status than non-Passeriformes.

As a second step, we also checked whether the status of range, population and habitat of species (separately assessed) can vary with species appeal, and developed another related prediction: if conservation actions have been directed predominantly at “charismatic” birds, such species should have a better conservation status especially with regard to population, while the status of their habitat and, especially, range, which are likely to be affected by several factors that are largely unaffected by direct conservation efforts, should not be very different from that of other species.

Methods

We analysed a set of species considered “conservation priorities” in Europe over the Birds Directive (2009/147/CE). Bird conservation in the EU is based primarily on the Birds Directive, which includes a list (Annex I) of species considered particularly vulnerable or rare or to require special conservation measures. Member states are bound to improve the conservation status of these species by protecting or enhancing their populations and habitats. Therefore, we worked only with species included in Annex I, thus benefiting from a similar legal protection. Species included in the Annex I actually performed better than non-annex species in a continent-wide analysis of species’ conservation (Donald et al. 2007). Finally, species currently hunted in Italy were excluded from analysis, in order to reduce confounding effects of hunting impact on conservation status.

Assessing conservation status

We developed a practical framework for an assessment of bird species' conservation status at the national/biogeographical level (Gustin et al. 2009), deriving a new method from a modified version of the procedure proposed by Habitat Committee of the European Commission under the auspice of monitoring within the Habitat Directive (92/43/CEE).

The following criteria were adopted to judge the status of the single attributes (range, population and habitat) on the basis of the available literature (c. 2000 among articles, books, chapters, unpublished technical reports).

For range:

(1) favourable: range stable or expanding (since data are available);

(2) inadequate: range decreased of less than 10% of the national or bioregional range; range subjected to marked fluctuations, without general trend perceptible; range not decreasing but entire population concentrated within less than ten sites; range surface very limited;

(3) bad: range contraction higher than 10% of the national or bioregional range, or complete extinction within a bioregion hosting non-marginal populations.

For population:

(1) favourable: population stable or expanding, not lower than respective FRV when available as population figure (Brambilla et al. 2011), and reproductive, mortality and age-structure parameters not differing from standard ones; if data about population and FRV are not available, it is not possible to state that population is in favourable status (for populations up to 2,500 pairs);

(2) inadequate: population declining less than 10% in 10 years, or lower than FRV (when available as population figure) (but higher than 75% of FRV); population not declining but small (likely lower of a hypothetical value of FRV) or sensitive to marked short-term fluctuations without perceptible general trend;

(3) bad: population declining more than 10% in 10 years and lower than FRV (when available as population figure) or lower than 75% of FRV (when available as population figure), or

reproductive, mortality and age-structure parameters strongly differing from standard values (if available); population extremely small;

For habitat:

(1) favourable: habitat extent large enough (and stable or increasing) and habitat quality suitable for long-term sustaining of the species;

(2) inadequate: all other combinations;

(3) bad: habitat extent clearly not enough for long-term survival of the species or population, or habitat quality clearly not sufficient for ensuring long-term survival.

'Unknown' was attributed to species/attributes for which sufficient information were not available. Our method was quantitative to what concerns the population and range components. Due to lack of data, our assessment was qualitative to what concerns the habitat. We supposed that, on the basis of current knowledge about species' status in Italy, our approach could be more reliable and 'conservative' than possible attempts of quantitative evaluation of conservation status based on poor data. However, the framework we used could be easily upgraded in contexts where more data are available, and the results obtained under this procedure could easily be verified through an expert-based critical revision of data (as we actually carried out for Italy).

Conservation status of each species or population was synthesized using the classification proposed by the Habitat Committee:

(1) favourable: all voice favourable, or two favourable and one unknown;

(2) inadequate: one or more inadequate but no bad;

(3) bad: one or more bad;

(4) unknown: three unknown or two unknown and one favourable.

All the results were subjected to evaluation and revision carried out by independent expert scientists, and were finally approved by the panel (Gustin et al. 2009).

We adopted the following scoring system for quantifying overall conservation status: one point for bad conservation status, two points for inadequate status and three points for favourable

143 conservation status. This scoring method was also applied to range, population and habitat status.
144 For overall conservation status, we also calculated the sum of the relative status scores (thus
145 obtaining another evaluation of the general conservation status, with scores ranging from 3 to 9
146 instead of 1-3). For one species (*Sylvia sarda*), lack of knowledge prevented definition of general
147 and population status; for a few other species, some individual scores were not available and thus
148 the overall status scores were not calculated.
149
150 Assessing species' appeal
151
152 Species appeal was estimated as the 'anthropic value index' as defined by Brichetti and Gariboldi
153 (1997). The anthropic value index (devised entirely independently by other authors) is a nearly
154 perfect expression of the human perception of a species (for our study country) that we needed to
155 quantify: anthropic value accounts for the number of both ornithological and popular papers dealing
156 with a given species published in the most widespread Italian journals of ornithology (which are not
157 ISI-ranked and are largely dominated by non-professional contributors) and natural history; and for
158 a given species' ability to breed close to humans, making it relatively well-known to people. (The
159 latter factor is marginal for Annex-I species, which are mainly tied to undisturbed or rural areas,
160 with the only exception of *Ciconia ciconia* and *Falco naumanni*.)
161 The formula used by Brichetti & Gariboldi (1997) defined anthropic value as the sum of
162 recreational value, scientific value, fruition value and antropophily degree. Recreational value
163 expressed the interest which unspecialized people shows for the species, and was calculated on the
164 basis of the number of papers on the species in the two major Italian journals of naturalistic
165 information (Oasis, Airone). Scientific value was defined as the frequency of papers on the species
166 published in ornithological national journals and congresses. Fruition value only interested hunted
167 species, which were excluded from our exercise. Antropophily degree is a measure of species'
168 sensitivity to human presence and of its ability to breed in urbanized areas (according to four

different score categories; likely minor importance in our study system, see above). Anthropic value ranges between 0 and 0.033. In short, anthropic value for our model species assemblage is essentially based on the frequency of 'popular' (both general and ornithological) papers about a species, indicates the perception of the species by the public and consequently probably reflects its perceived importance: species most represented in papers are likely to be the most appealing and 'charismatic' ones.

Anthropic values were not available for two species (*Gypaetus barbatus* and *Marmaronetta angustirostris*), which started to breed in Italy after the anthropic value index was defined by (Brichetti and Gariboldi 1997).

By adopting a value defined over ten years ago and relating it to current conservation status, we should be able to evaluate the relationship between anthropic value of species and respective conservation status, as the effects of the former on the latter are likely to become perceptible over such a timeframe.

Population Estimates

Estimated population sizes were obtained from the Birds in Europe (BirdLife International 2004), apart for the subspecies *Accipiter gentilis arrigonii* and *Alectoris graeca withakeri*, for which we used the most recent estimates.

Statistical Analyses

We first ran a correlation between the following parameters: anthropic value, conservation status, population estimates. Then, we modelled factors affecting conservation status. The dependent variable (conservation status) is an ordinal one, whose value aims at ranking the different categories of conservation status; the distances between different values of the dependent variables do not have

a precise meaning and they are not necessarily constant between different steps on the values scale. Thus, we used ordinal regression, an extension of generalized linear models. Five ordinal regression analyses were carried out in SPSS (Norusis 2007) with overall conservation status, overall conservation status expressed as sum of scores, population status, range status and habitat status as dependent variables, respectively. Anthropic value was the factor tested in all the regression models; in the first three analyses, we also tested the effect of the mean estimated population size, which could affect general conservation status and population status given the possible importance of rarity *per se* as a determinant of conservation status. Population size never affected conservation/population status ($p > 0.19$ for overall conservation status, $p = 0.133$ for population status), and thus models are shown in the Results without this factor.

As we are not dealing with biological traits, we preferred not to include phylogenetic effects in our analyses.

All results remained qualitatively unchanged after removing the species with at least one unknown parameter (see Table S1).

Results

Anthropic value and estimated population size were negatively correlated ($r = -0.27$, $p = 0.016$, $n = 79$): rarest species were more "charismatic" than commonest ones.

The anthropic value and conservation status were positively correlated ($r_s = 0.25$, $p = 0.030$, $n = 78$), while estimated population size and conservation status were not ($r_s = 0.06$, $p = 0.608$, $n = 80$). An ordinal regression with conservation status as dependent variable showed a significant effect of anthropic value on determining general conservation status (estimate: 76.90 ± 28.94 SE, $p = 0.008$). Results remained qualitatively unchanged when the sum of scores was used instead of the

three-score conservation status. In both cases, the estimated number of breeding pairs did not significantly affect (all $p > 0.19$) the species' conservation status.

A positive association between the anthropic value of a species and its conservation status was found, suggesting that conservation efforts have not been independent from species appeal. Between the mutually alternative scenarios, the third one (conservation actions predominantly directed at appealing species, which have better conservation status) seems to be most plausible. In addition, Passeriformes have a poorer conservation status than other birds: the mean conservation status was equal to 1.69 ± 0.08 (median = 2) for non-Passeriformes (n = 68 species) and to 1.08 ± 0.08 (median = 1) for Passeriformes (n = 12 species), the difference being highly significant (U = 198.50, Z = -3.14, p = 0.002; for sum of scores, U = 39.50, Z = -4.65, $p < 0.001$).

Ordinal regression analyses showed significant effect of anthropic value on population status (estimate: 87.80 ± 29.20, p = 0.003), but not on habitat (p = 0.177) and range status (p = 0.215). The additional prediction was also met: population status is strongly affected by species appeal, while the status of habitat and range is not significantly correlated to it.

Discussion

Conservation actions are often biased towards 'charismatic' species because of easier fund availability for such species (Caro et al. 2004; Helgen and Groves 2005; Amori et al. 2008; Clucas et al. 2008), and many non-charismatic species have received poor attention (Amori et al. 2008), to the point that uncharismatic taxa belonging to various taxonomic groups still await study and conservation (Pillon and Chase 2007).

However, until now virtually no study has reported evidence of the possible consequences of those disproportional efforts for species' conservation on their conservation status at a large scale.

Our results on Italian breeding birds suggested that species with more appeal might have received more conservation attention in past years, thus leading to a better conservation status, especially with regards to population status. In addition to the disproportional and charisma-driven attention given to bird species, most of the reintroduction projects carried out in Italy involved avian orders including large and 'charismatic' species (Brichetti and Gariboldi 1997). A similar pattern with overrepresentation of vertebrates over other animals, and of some orders of birds over others, has been reported in a worldwide assessment (Seddon et al. 2005). This could have contributed to the better population conservation status enjoyed in current years by more "charismatic" species, despite the link between rarity and appeal (Courchamp et al. 2006), which also seems to affect our study system. Conservation status depends also on population trends and viability, on changes in habitat and range, and the effect of rarity *per se* is not particularly relevant in our study system.

In conclusion, national and regional governments, conservation organizations, protected areas and all the actors involved in the conservation arena should try to focus more on real needs for protection and intervention, rather than on people interest appeal in species. Given that species-specific conservation efforts are in some cases irreplaceable, despite the widely recognised importance of broader (e.g. ecosystem) approaches (Franklin 1993; Clark 1999; Roemer and Wayne 2003), it is at least desirable that further conservation efforts targeted at single species will not be driven by species' attractiveness, but by prioritization of conservation status and optimal resource allocation (Wilson et al. 2006). If the tendency of directing conservation efforts toward "charismatic" and appealing species will not be reduced, the risk is that other species will disappear before they ever get a chance to become 'charismatic' thanks to their increasing rarity.

Acknowledgments

We are very grateful to N. Baccetti, B. Barov, V. Bergero, E. Bianchi, G. Boano, G. Bogliani, P. Brichetti, I. Burfield, F. Casale, R. Falco, O. Janni, P. Pedrini, F. Piccarolo, M. Ravasini, D. Rubolini, F. Spina for kind help and comments.

Supplementary material for online publication

The list of bird species treated under the current analysis and the relative conservation status (Table S1) are available online.

References

Amori G, Gippoliti S, Helgen KM (2008) Diversity, distribution, and conservation of endemic island rodents. Quaternary International 182:6-15

Andelman SJ, Fagan WF (2000) Umbrellas and flagships: efficient conservation surrogates or expensive mistakes? Proc Natl Acad Sci USA 97:5954-5959

BirdLife International (2004) Birds in Europe. BirdLife Conservation Series, vol 12. BirdLife International, Cambridge

Brambilla M, Gustin M, Celada C (2011) Defining Favourable Reference Value for bird populations in Italy: setting long-term conservation target for priority species. Bird Conservation International 21:107-118

Brichetti P, Gariboldi A (1997) Manuale pratico di ornitologia. Edagricole, Bologna

Caro T, Engilis AJ, Fitzherbert E, Gardner T (2004) Preliminary assessment of the flagship species concept at a small scale. Anim Conserv 7:63-70

Clark JR (1999) Diversity: the ecosystem approach from a practical point of view. Conserv Biol 13:679-681

Clucas B, McHugh T, Caro T (2008) Flagship species on covers of US conservation and nature magazines. Biodivers Conserv 17:1517-1528

Courchamp F, Angulo E, Rivalan P, Hall RJ, Signoret L (2006) Rarity value and species extinction: the anthropogenic Allee effect. PLoS Biol 4:e415

Donald PF, Sanderson FJ, Burfield IJ, Bierman SM, Gregory RD, Waliczki Z (2007) International conservation policy delivers benefits for birds in Europe. Science 317:810-813

Dowler RC, Carroll DS, Edwards CJ (2000) Rediscovery of rodents (Genus *Nesoryzomys*) considered extinct in the Galápagos Islands. Oryx 34:109-118

Franklin JF (1993) Preserving biodiversity: species, ecosystems, or landscapes? Ecol Appl 3:202-205

Gustin M, Brambilla M, Celada C (2009) Valutazione dello stato di conservazione dell'avifauna italiana. Ministero dell'Ambiente, della Tutela del Territorio e del Mare & LIPU/BirdLife Italia,

Gustin M, Brambilla M, Celada C (2010) Stato di conservazione dell'avifauna italiana- le specie nidificanti e svernanti in Italia non inserite nell'Allegato I della Direttiva Uccelli. Ministero dell'Ambiente e della Tutela del Territorio e del Mare e LIPU/BirdLife Italia

Helgen KM, Groves CP (2005) Biodiversity in Sri Lanka and the Western Ghats. Science 308:199

Kontoleon A, Swanson T (2003) The willingness to pay for property rights for the Giant Panda: can a charismatic species be an instrument for nature conservation? Land Economics 79:483-499

Norusis MJ (2007) SPSS 15.0 Advanced Statistical Procedures Companion. Prentice-Hall, Upper Saddle River

Pillon Y, Chase MW (2007) Taxonomic exaggeration and its effects on orchid conservation. Conserv Biol 21:263-265

Prendergast JR, Quinn RM, Lawton JH, Eversham BC, Gibbons DW (1993) Rare species, the coincidence of diversity hotspots and conservation strategies. Nature 365:335-337

Roemer GW, Wayne RK (2003) Conservation in conflict: the tale of two endangered species. Conserv Biol 17:1251-1260

Seddon PJ, Soorae PS, Launay F (2005) Taxonomic bias in reintroduction projects. Anim Conserv 8:51-58

Sergio F, Caro T, Brown D, Clucas B, Hunter J, Ketchum J, McHugh K, Hiraldo F (2008) Top predators as conservation tools: ecological rationale, assumptions, and efficacy. Annual review of Ecology and Systematics 39:1-19

Sergio F, Newton I, Marchesi L, Pedrini P (2006) Ecologically justified charisma: preservation of top predators delivers biodiversity conservation. J Appl Ecol 43:1049-1055

Sommer S, Hommen U (2000) Modelling the effects of life-history traits and changing ecological conditions on the population dynamics and persistence of the endangered Malagasy giant jumping rat (*Hypogeomys antimena*). Anim Conserv 4:333-343

Verissimo D, MacMillan DC, Smith RJ (2011) Toward a systematic approach for identifying conservation flagship. Conservation Letters 4:1-8

Williams PH, Burgess ND, Rahbek C (2000) Flagship species, ecological complementarity and conserving the diversity of mammals and birds in sub-Saharan Africa. Anim Conserv 3:249-260

Wilson KA, McBride MF, Bode M, Possingham HP (2006) Prioritizing global conservation efforts. Nature 440:337-340

Fig. 1. Mean anthropic value of species with different population status showing how species with worst status are also the less charismatic ones, and vice versa.