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Research Article

Anthropomorphic Factors Influencing Spanish Conservation Policies of Vertebrates

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National and international reports developed for the International Year of Biodiversity concluded that we have failed to meet the 2010 biodiversity target. There is an urgent need to analyze current policies for biodiversity conservation. We examined the anthropomorphic factors underlying the threatened species listings (both red lists and legal lists) and funding allocation for the conservation of vertebrates in Spain at different organizational levels, from the global to subnational level. Our results reveal a strong effect of anthropomorphic factors on conservation policies, mainly legal listings and species priority setting at national scale. Specifically, we found that those vertebrates that are phylogenetically close to humans or physically similar to human neonates tend to receive more conservation attention. Based on results, we suggest recommendations to improve conservation policies in Spain.

1. Introduction

Up to now, 193 countries endorsed through the Convention on Biological Diversity (CBD) a commitment to reduce the rates of biodiversity loss by 2010 [1]. For most nations, the 2010 biodiversity target has been their most important political commitment to conserve biodiversity [2, 3]. Although this target has stimulated considerable international and national interest, it is clear that we have failed to meet the 2010 biodiversity target [4, 5], especially in the case of vertebrates [6, 7]. One of the most important indicators developed for biodiversity is the International Union for Conservation of Nature (IUCN) Red List Index, which shows a net negative trend in the status of species [4]. This indicator uses information from the IUCN Red List (http://www.iucnredlist.org/) to trace trends in the comprehensive extinction risks of various sets of species [8]. The IUCN Red List is widely recognized as the most objective and authoritative listing of species at risk of global extinction (e.g., [9–14]). Approximately half of all countries worldwide have developed national and regional threatened species lists [15], establishing threatened status as the most important indicator for conservation policies worldwide [16] and as an important tool in defining conservation priorities [17, 18].

Currently, there is an extensive debate on the use of the IUCN Red List in decision-making regarding conservation policies. Some authors argue that economic resources should not automatically be allocated to species according to their listing status because spending scarce conservation resources on species at the greatest risk of extinction are not an efficient way to minimize global extinction rates [19, 20], asking for using a broader range of criteria in the species priority setting [21, 22]. These criteria might include the probability of success of avoiding species extinction [20, 22], species' roles in ecosystem functioning [23], and social preferences [24–26]. However, increasingly governmental organizations rely on the IUCN Red List as well as on National Red Lists (NRLs; herein, national red lists and red data books) to influence conservation legislation inform priorities, and guide conservation investments [13, 18].

Some authors have recently identified a taxonomic bias in NRLs [14, 27, 28], which can influence legally threatened

species listings [29–31] and conservation funding [32–35]. This phylogenetic bias indicates that mammals and birds are clearly overrepresented in both conservation legislation and conservation priorities [30, 34, 36].

In addition to taxonomic bias, previous studies have demonstrated that humans have an innate tendency to lavish attention and affection on individuals of nonhuman species with infantile physical features, such as large eyes, large rounded forehead, or short and narrow nose [37, 38]. Lorenz suggested that humans have a natural attraction to these neonates' features, that is, a baby schema or "Kindchenschema," which promotes in the last term a care behavior [39]. In fact, it seems that people feel a more positive affection towards animals which are phylogenetically close to humans or physically similar to human neonates than towards those which are phylogenetically distant or dissimilar to us [24, 39–42].

If anthropomorphic factors (i.e., phylogenetic distance from humans and neonatal morphological characteristics) influence human preferences towards species protection, then the question here is whether anthropomorphism influences vertebrates' conservation priority setting. In this context, we aim to explore the effect of anthropomorphic factors on the decision-making process regarding the conservation listing (both Red lists and legal listing) and conservation priority setting of vertebrates in Spain. We specifically examined the effect of vertebrates' phylogenetic distance from humans (using the taxonomic classification of species) and the effect of species' morphological characteristics on the vertebrates conservation priority setting at different organizational levels, from international to subnational. At the international level, we used the global IUCN Red List and examined European legislation regarding vertebrate conservation and conservation funding allocation. At the national level, we focused on Spain, which is considered a Mediterranean biodiversity hotspot [43]. Finally, on a subnational level, we selected Andalucía, which contains more terrestrial vertebrate species than larger areas such as the United Kingdom or Sweden [44].

2. Methods

2.1. Data Sources. We developed a data matrix of all species of vertebrates (specifically, 679 species) that are present in Spain according to the National Inventory of Biodiversity (http://www.mma.es/portal/secciones/biodiversidad/inventarios/inb/inventario_vertebrados/index.htm), which are distributed among different classes of vertebrates as follows: 48 fishes, 33 amphibians, 73 reptiles, 406 birds, and 119 mammals. In order to analyze the effect of anthropomorphic factors on vertebrates conservation priority setting, we considered three dependent variables (Table 1): (1) the threatened species category in red lists, (2) the threatened species category in conservation legal listings, and (3) funding allocation for the conservation of vertebrates.

The conservation of Spanish vertebrates is regulated by different laws at the international, national, and subnational levels. At the European level, the Habitats Directive (Council Directive 92/43/EEC) and the Birds Directive (Council Directive 79/409/EEC) are the two most important legal tools for protecting Europe's threatened species, and both were transposed into national law. Additionally, the Spanish government has listed threatened vertebrates in the National Catalogue of Threatened Species (NCTS) through the Royal Decree 439/90. The NCTS considers four threatened categories: endangered (EN), sensitive to habitat change (SHC), vulnerable (VU), and of special interest (SI). These categories are similar but not identical to those of the IUCN, which are: extinct (EX), extinct in the wild (EW), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), least concern (LC), and data deficient (DD) (for more details, see [29]). At the subnational level, legislation based on the NCTS categorization system for the conservation of vertebrates has been developed in Andalucía. Here, we searched species listings in each taxonomic group of vertebrates in the global IUCN Red List, NRLs and Red list of Andalucía, as well as conservation legislation in Europe, Spain, and Andalucía, and we recorded the number of Spanish vertebrates for each vertebrate class regarding their threatened status at all organizational levels (Table 2).

Data sources for funding allocation at European and national levels were obtained from 2003 to 2007. On the European level, we looked up the Life Project's database, which is the most important European financial instrument supporting biodiversity conservation (http://ec.europa.eu/environment/life/project/Projects/index.cfm), and at national level we consulted three different sources: (1) the Official Spanish Gazette, (2) annual reports of the activities of seven Spanish national parks, and (3) the projects database of the Biodiversity Foundation, which is a nonprofit making nature foundational organization. At subnational level, we obtained data on conservation expenditures for Doñana Protected Area, which is one of the most important natural areas of the European Union. We consulted annual activity reports for Doñana National and Natural Parks and we carried out personal interviews with environmental managers responsible for endangered species programs (for more details, see [32]). More information about data sources regarding these variables at different organizational levels is presented in Table 1.

As variables (Table 3), we considered (1) those that measured the species phylogenetic distance from humans, recording the vertebrates' class and order of each species, and (2) those that can measure the effect of "Kindchenschema" phenomenon (in the sense of [39]) using morphological traits, such as the length and relative measures of the weight and the eye size of vertebrates, which were calculated employing the quotient between the weight and the length and between the eye size and the length, respectively. We explored the effect of phylogenetic distance from humans on the conservation of vertebrates at two taxonomic levels: (1) class (i.e., if the species is fish, amphibian, reptile, bird, or mammal) and (2) order, incorporating 44 different orders.

There are few caveats regarding our data sources of conservation funding that must be taken into account in the interpretation of our results. The first one is that at the subnational level, we only considered funding allocation in the Doñana Protected Area due to the difficulty of obtaining information regarding funding allocation in other protected

Table 1: Description and data source of the dependent variables.

Variable type	Attributes	Organizational level	Data source
		Red lists[a]	
Ordinal	Vertebrates' threatened category: 7: EX; RE; 6: EW; 5: CR; 4: EN; 3: VU; 2: NT; 1: LC; 0: DD and non	International	IUCN [69] (http://www.iucnredlist.org/)
		National	Atlas and Red Book of fish in Spain [70] Atlas and Red Book of amphibians and reptiles in Spain [71] The breeding bird Atlas in Spain [72] Atlas and Red Book of terrestrial mammals in Spain [73]
		Subnational	Red Book of the Vertebrates Threatened in Andalucía [74]
		Legal listing[b]	
	1: included 0: excluded	International	Habitats Directive (Council Directive 92/43/EEC) Birds Directive (Council Directive 79/409/EEC)
Ordinal	Vertebrates' threatened category: 4: EN; 3: SHC; 2: VU; 1: SI; 0: non	National	National Catalogue of Endangered Species (Law 4/1989) and Royal Decree (439/1990).
		Subnational	*Law 8/2003* of Wild Flora and Fauna of Andalucía
		Conservation budget	
Continuous	Ln (Funding allocation to vertebrates' conservation).	International	Life projects database (2003–2007 years) (http://ec.europa.eu/environment/lif/project/Projects/index.cfm)
		National	Environmental projects published in the Official Spanish Gazette (2003–2007 years) Annual Reports of National Parks Organization for Spanish National Parks (2003–2007 years) The Biodiversity Foundation database (2004–2007 years)

[a](EX) extinct; (RE) at subnational level, regionally extinct; (EW) extinct in the wild; (CR) critically endangered; (EN) endangered; (VU) vulnerable; (NT) near threatened; (LC) least concern; (DD) data deficient; (Non) nonlisted.
[b](EN) endangered; (SHC) sensitive to habitat change; (VU) vulnerable; (SI), special interest; (Non) nonlisted.

areas in Andalucía. We considered our approximation valid because the Doñana Protected Area is a highly emblematic protected area in Spain and receives a great majority of the national conservation budget [45]. The second caveat is that no database of conservation budgets is available at the international level. We thus decided to use LIFE conservation funds.

2.2. Data Analysis. We used nonparametric statistics (i.e., Kruskal-Wallis test) to compare the threatened category of Red lists and legal listing, as well as on funding allocation for vertebrates, among different taxonomic groups. Additionally, we explored the relationship between morphological characteristics (i.e., length, weight, and eye size) and the threatened category of vertebrates (both in red lists and legal listing) as well as their funding allocation, using Spearman and Pearson correlation tests. To avoid problems with heteroscedasticity, we transformed the continuous variables by their natural logs.

3. Results

3.1. Effect of Phylogenetic Distance from Humans on Conservation Policies. Table 4 shows the effect of phylogenetic distance from humans on the vertebrates red lists, legal listing, and funding allocation for their conservation.

While fish was the most threatened vertebrate class in the Red lists at the international, national, and subnational levels ($\chi^2 = 46.76$, df = 4, $P < 0.0001$; $\chi^2 = 126.57$, df = 4, $P < 0.0001$; and $\chi^2 = 35.33$, df = 4, $P < 0.0001$, resp.), reptiles were the most threatened class in legal listing at the national and the subnational levels ($\chi^2 = 17.86$, df = 4, $P < 0.001$; $\chi^2 = 17.63$, df = 4, $P = 0.001$). Phylogeny also had an effect on funding allocation. While amphibians was the most favored vertebrate class at the international level ($\chi^2 = 106.33$, df = 4, $P < 0.0001$), funds at the national level were mainly directed to mammals ($\chi^2 = 66.03$, df = 4, $P < 0.0001$).

Among the different orders of fish the only order with a significantly higher threatened status in the red lists at all

Table 2: Number of Spanish vertebrates for each vertebrate class regarding both, their red list threatened status and their legal listing categories, at international, national, and subnational levels.

			Fish	Amphibians	Reptiles	Birds	Mammals
Red lists[a]	IUCN Red List	EX	—	—	—	1	1
		EW	—	—	—	—	—
		CR	5	—	7	3	2
		EN	6	1	7	5	6
		VU	10	4	2	9	7
		NT	2	7	10	21	10
		LC	22	21	39	364	83
		DD and non	3	—	8	3	10
	National	EX		—	—	7	1
		EW		—	—	—	—
		CR	3	1	5	15	2
		EN	11	2	6	30	4
		VU	24	8	11	44	13
		NT	7	7	11	30	14
		LC	—	14	34	—	—
		DD and non	3	1	6	280	85
	Subnational	RE	1	—	—	3	—
		EW	—	—	—	—	—
		CR	3	—	1	14	6
		EN	6	—	6	13	7
		VU	7	2	4	23	19
		NT	2	3	2	18	4
		LC	—	—	—	—	—
		DD and non	29	28	60	335	83
Legal lists[b]	International	Included	19	16	34	171	47
		Excluded	29	17	39	235	72
	National	EN	5	1	5	17	7
		SHC	—	—	3	3	2
		VU	6	1	1	14	23
		SI	1	20	42	252	23
		Non	36	11	21	120	64
	Subnational	EN	5	1	6	19	7
		SHC	—	—	3	3	2
		VU	6	1	1	13	23
		SI	1	22	42	251	24
		Non	12	8	7	120	41

[a](EX) extinct; (RE) at subnational level, regionally extinct; (EW) extinct in the wild; (CR) critically endangered; (EN) endangered; (VU) vulnerable; (NT) near threatened; (LC) least concern; (DD) data deficient; (Non) nonlisted.
[b](EN) endangered; (SHC) sensitive to habitat change; (VU) vulnerable; (SI), special interest; (Non) nonlisted.

organizational levels was Acipenseriformes ($\chi^2 = 147.95$, df = 45, $P < 0.0001$ at the international level; $\chi^2 = 208.43$, df = 45, $P < 0.0001$ at the national level; and $\chi^2 = 118.71$, df = 45, $P < 0.0001$ at the subnational level). Both Acipenseriformes and Cyprinodontiformes had a higher threatened category at the international, national, and subnational levels in legal listings ($\chi^2 = 174.52$, df = 45, $P < 0.0001$; $\chi^2 = 193.04$, df = 45, $P < 0.0001$; and $\chi^2 = 199.46$, df = 45, $P < 0.0001$). In contrast, the orders that received significantly more conservation funding were Procellariiformes, Gaviiformes, and Pelecaniformes at the international level ($\chi^2 = 336.21$, df = 45, $P < 0.0001$), Cetaceaat the national level ($\chi^2 = 360.18$, df = 45, $P < 0.0001$),

Table 3: Description and data source of the explanatory variables used in the study.

Variable type	Variables	Data source
	Phylogeny	
Nominal	Vertebrates' class Vertebrate's order	The Iberian Fauna Project (http://iberfauna.mncn.csic.es/) Species 2000 (http://www.sp2000.org/)
	Morphology	
Continuous	Length Relative weight (quotient between weight and length)	Data source for fish' morphology was obtained from FishBase (http://www.fishbase.org/search.php) and [70]. For amphibians' morphology, we used García-París et al. [75] and Pleguezuelos et al. [71]. For reptiles' morphology we used Salvador [76]. For birds' morphology we used Díaz et al. [77], Martí and del Moral [72], and Tellería et al. [78]. For mammals' morphology, we used, Palomo et al. [73], and Rodríguez [79]. Additionally, we based Cetacea data in Kiefner [80].
	Relative eye size (quotient between eye size and length)	[81–83]

Table 4: Taxonomic groups at class and order levels highly considered as threatened in red and legal listing as well as in conservation priority setting.

		Taxonomic bias	
		Class level	Order level
Red lists	International	Fish	Acipenseriformes, Anguilliformes (fish)
	National	Fish	Acipenseriformes, Accipitriformes (fish)
	Subnational	Fish	Acipenseriformes, Cyprinodontiformes (fish)
Legal lists	International	Amphibians	Cetacea (mammals), Falconiformes (birds)
	National	Reptiles	Acipenseriformes, Cyprinodontiformes (fish)
	Subnational	Reptiles	Acipenseriformes, Cyprinodontiformes (fish)
Funding allocation to vertebrates' conservation	International	Amphibians	Procellariiformes, Gaviiformes, Pelecaniformes (birds)
	National	Mammals	Cetacea (mammals)
	Subnational	Mammals	Lagomorpha (mammals)

and Lagomorpha at the subnational level ($\chi^2 = 101.42$, df = 45, $P < 0.0001$).

3.2. Effect of Morphology on Conservation Policies. At the national level, we found relationships between the relative weight of vertebrates and the threatened status of NRLs ($\rho = 0.14$, $P = 0.060$) and between relative eye size and the threatened status of NRLs ($\rho = 0.15$, $P = 0.038$). Finally, at subnational level, we found significant relationships between the threatened status considered in red list of Andalucía and physical variables, that is, length ($\rho = 0.26$, $P < 0.0001$), relative weight ($\rho = 0.42$, $P < 0.0001$), and relative eye size ($\rho = 0.32$, $P < 0.001$).

In legal listing of threatened species at the international level, we found relationships between threatened status and physical variables, that is, length (Spearman's rho = 0.23, $P < 0.0001$), relative weight ($\rho = 0.49$, $P < 0.0001$), and relative eye size ($\rho = 0.47$, $P < 0.0001$). At the national and subnational levels, there also were a significant correlation between relative eye size and threatened status ($\rho = 0.16$, $P = 0.027$; and $\rho = 0.16$, $P = 0.003$, resp.).

Our analysis yielded significant correlations between funding allocation and relative eye size at the national and subnational levels (national: $r = 0.46$, $P < 0.0001$; subnational: $r = 0.22$, $P = 0.002$). At the national level, there also existed a significant correlation between vertebrates' length and funding allocation ($r = 0.49$, $P < 0.0001$) and relative weight and funding allocation ($r = 0.74$, $P < 0.0001$).

Similar results were obtained for vertebrates classes (Table 5). However, we found that the effect of morphological characteristics was higher in those vertebrate classes phylogenetically close to humans (i.e., birds and mammals).

4. Discussion

4.1. Effect of Phylogenetic Distance from Humans on Conservation Policies. Previous studies have demonstrated that humans prefer species that are phylogenetically close to us;

Table 5: Significant correlations between morphological characteristics and both listing and funding allocations, for each vertebrate class.

Vertebrate class	Physical characteristics	Independent variables	Organizationallevel	Correlation results
Amphibians	Length	Funding allocation	International	$r = 0.472, P = 0.010$
Reptiles	Length	Red lists	Subnational	$\rho = 0.359, P = 0.048$
		Funding allocation	National	$r = 0.417, P = 0.004$
	Relative weight	Legal listing	International	$\rho = 0.535, P = 0.042$
		Funding allocation	National	$r = 0.829, P < 0.0001$
	Relative eye size	Legal listing	International	$\rho = 0.535, P = 0.042$
		Funding allocation	National	$r = 0.737, p = 0.002$
Birds	Length	Red lists	International	$\rho = 0.170, P = 0.002$
			National	$\rho = 0.183, P = 0.001$
		Legal listing	Subnational	$\rho = 0.298, P < 0.0001$
			International	$\rho = 0.308, P < 0.0001$
		Funding allocation	International	$r = 0.264, P < 0.0001$
			National	$r = 0.217, p < 0.0001$
			Subnational	$r = 0.155, P = 0.004$
	Relative weight	Legal listing	International	$\rho = 0.245, P = 0.031$
			National	$\rho = -0.293, P = 0.009$
		Funding allocation	Subnational	$r = 0.229, P = 0.004$
	Relative eye size	Legal listing	International	$\rho = 0.267, P = 0.019$
		Funding allocation	Subnational	$r = 0.401, P < 0.0001$
Mammals	Length	Legal listing	International	$\rho = 0.608, P < 0.0001$
			National	$\rho = 0.556, P < 0.0001$
		Funding allocation	National	$r = 0.674, P < 0.0001$
	Relative weight	Legal listing	International	$\rho = 0.604, P < 0.0001$
			National	$\rho = 0.540, P < 0.0001$
		Funding allocation	National	$r = 0.705, P < 0.0001$
	Relative eye size	Legal listing	International	$\rho = 0.576, P < 0.0001$
			National	$\rho = 0.491, P < 0.0001$
		Funding allocation	National	$r = 0.589, P < 0.0001$

these species tend to evoke a more positive affect than those that are phylogenetically distant from humans or physically dissimilar to human features [24, 25, 41, 42, 46]. Similarly, structural complexity, as an indicator of phylogenetic distance, is positively related to the amount of scientific output on different species, and this relationship underlies the high existence values and societal popularity of complex organisms [33]. In this sense, recent studies have shown that both conservation biology research and public support are skewed significantly towards birds and mammals [32, 35, 46–50]. Both results suggest that phylogenetic distance from humans underlies scientific and social preferences.

Our results also show that funding allocation for vertebrate conservation mostly favors the protection of those species phylogenetically close to humans [30, 32, 51]. As in [25], we found that different groups of vertebrates vary in the amount of political attention they receive. On the one hand, few species of amphibians; bird orders such as *Procellariiformes, Gaviiformes,* and *Pelecaniformes;* and mammalian orders such as *Cetacea* receive relatively high amounts of political attention, as measured by their conservation budget (Table 4). On the other hand, fish, reptiles, and also some orders of small mammals (*Rodentia* and *Chiroptera*) have low political power and receive fewer funds for their conservation, despite the important roles they play in ecosystem function [52]. Similarly, although many other nocturnal creatures are classified as threatened species in the Red lists, they do not receive conservation funds at national and subnational levels. These animals include most of amphibians, which often evoke feelings of disgust [53], and bats, which inspire primal fears related to the vampire myth [54].

This overall taxonomic bias is stronger at national and subnational levels than at international scale. Taxonomic bias in Spanish conservation projects was evident in the overrepresentation of mammals and birds. This bias can occur because Spanish conservation efforts are based on available scientific information, and this information is biased towards species phylogenetically close to humans [29, 32, 55].

4.2. Effect of Morphology on Conservation Policies. Previous studies have demonstrated that humans' preferences for animals are significantly influenced by physical characteristics of the species (e.g., [39, 40, 56–58]). In fact, people are

more inclined to protect species that are large, aesthetically attractive, and regarded as possessing the capacities for feeling, thought, and pain [59].

We found that there is a strong bias in both conservation legal listing and funding allocation towards species that are large, have a large relative eye size, and have a high relative weight (both in relation to their length). Our results agree with Lorenz's "Kindchenschema" phenomenon because both listing and funding are biased towards those vertebrates with relative higher eye size and weight, especially in those vertebrates classes close to humans, that is, mammals and birds.

We also found a stronger correlation for those taxonomic classes phylogenetically close to humans. Thus, we described a correlation between physical characteristics and funding allocation at the national and subnational levels for birds, and mammals. In fact, at lower organizational levels, especially at national level, mammals are the focus of conservation because of their charismatic appeal. They are more likely to receive conservation funds if they are charismatic, well-known, and large bodied [60]. Fortunately, some large charismatic vertebrate predators that are easily recognized, such as carnivores or raptors, can be used as flagship or umbrella species when the area under protection is small sized [61].

5. Conclusions

Understanding which factors motivate species conservation legislation and species priority setting is essential for redefining criteria for future conservation initiatives [62]. In this context, our results suggest that many conservation choices are made on subjective grounds, that is, anthropomorphic factors. Consistent with the conclusions of Metrick and Weitzman [30], we showed that likeability factors or "visceral" characteristics, including physical size, relative weight, and relative eye size, as well as whether the animals were higher life forms, play a more important role in setting priorities for vertebrate conservation. This effect was especially pronounced in legislation and funding allocation for vertebrate conservation at national organizational level. In this sense, according to Bottrill et al. [63], we highlight the need to improve management at the national level with greater connectivity among state and international agencies, having in account both expert opinions and conservation policies assessments.

Although anthropomorphism could be a conservation tool because it has the potential to promote public participation in conservation actions [64], the legal bias towards charismatic species could reduce the probability of achieving the 2020 biodiversity target as policy attention is focused towards few taxonomic groups [25], obscuring those key taxonomic groups essential for maintaining ecological properties as well as a diverse flow of ecosystem services to society [65, 66]. Moreover, funding concentrated on just few charismatic species with neonatal features perpetuates the dearth of social, scientific, and political attention of many less visible species, promoting a sort of pit-fall trap in which few charismatic and cute species, mainly better-known species, tend to receive most of the conservation funds and policy attention [29].

Therefore, it is essential to rethink the vertebrate conservation priority setting process in Spain because most of the social, scientific, and policy attention are allocated towards few charismatic species [7, 67]. Here, we should abandon the automatic allocation of resources to species based on these anthropomorphic factors and take into account a broader range of factors in funding decisions, such as the degree of taxonomic uniqueness of a species, the level of endemicity, the role of biodiversity in maintaining the resilience of ecosystems to disturbance, and the capacity to deliver a set of ecosystem services to society. Decisions could also consider cultural and spiritual values, which must be recognized to involve different groups of stakeholders in conservation decision making. In order to raise awareness of the value of biodiversity, including the value of less attractive species, it is essential to intensify efforts in providing information to the whole society about less cute and charismatic species through adequate environmental education programs. In order to create an environmentally responsible population that contributes to biodiversity conservation, we need to develop programs of environmental education beyond aesthetic appealing that address the ethical and instrumental values of the whole species diversity [68].

Funding concentrated on just a few species with neonatal features perpetuate the dearth of knowledge of many less visible and cute species but essential in the maintenance of ecological functioning and therefore, in the delivery of ecosystem services for human wellbeing.

References

[1] A. Balmford, P. Crane, A. Dobson, R. E. Green, and G. M. Mace, "The 2010 challenge: data availability, information needs and extraterrestrial insights," *Philosophical Transactions of the Royal Society B*, vol. 360, no. 1454, pp. 221–228, 2005.

[2] G. M. Mace, W. Cramer, S. Díaz et al., "Biodiversity targets after 2010," *Current Opinion in Environmental Sustainability*, vol. 2, no. 1-2, pp. 3–8, 2010.

[3] M. R. W. Rands, W. M. Adams, L. Bennun et al., "Biodiversity conservation: challenges beyond 2010," *Science*, vol. 329, no. 5997, pp. 1298–1303, 2010.

[4] S. H. M. Butchart, M. Walpole, B. Collen et al., "Global biodiversity: indicators of recent declines," *Science*, vol. 328, no. 5982, pp. 1164–1168, 2010.

[5] I. J. Gordon, N. Pettorelli, T. Katzner et al., "International year of biodiversity: missed targets and the need for better monitoring, real action and global policy," *Animal Conservation*, vol. 13, no. 2, pp. 113–114, 2010.

[6] M. Hoffmann, C. Hilton-Taylor, A. Angulo et al., "The impact of conservation on the status of the world's vertebrates," *Science*, vol. 330, no. 6010, pp. 1503–1509, 2010.

[7] EME-Evaluación de los Ecosistemas del Milenio de España, "La Evaluación de los Ecosistemas del Milenio de España. Síntesis de resultados. Madrid: fundación Biodiversidad. Ministerio de Medio Ambiente, y Medio Rural y Marino," 2011, http://www.ecomilenio.es/informe-sintesis-eme/2321.

[8] S. H. M. Butchart, H. R. Akçakaya, J. Chanson et al., "Improvements to the red list index," *PLoS One*, vol. 2, no. 1, article e140, 2007.

[9] T. J. Regan, M. A. Burgman, M. McCarthy et al., "The consistency of extinction risk classification protocols," *Conservation Biology*, vol. 19, no. 6, pp. 1969–1977, 2005.

[10] P. C. de Grammont and A. D. Cuarón, "An evaluation of threatened species categorization systems used on the american continent," *Conservation Biology*, vol. 20, no. 1, pp. 14–27, 2006.

[11] G. M. Mace, N. J. Collar, K. J. Gaston et al., "Quantification of extinction risk: IUCN's system for classifying threatened species," *Conservation Biology*, vol. 22, no. 6, pp. 1424–1442, 2008.

[12] R. M. Miller, J. P. Rodríguez, T. Aniskowicz-Fowler et al., "National threatened species listing based on IUCN criteria and regional guidelines: current status and future perspectives," *Conservation Biology*, vol. 21, no. 3, pp. 684–696, 2007.

[13] A. S. L. Rodrigues, J. D. Pilgrim, J. F. Lamoreux, M. Hoffmann, and T. M. Brooks, "The value of the IUCN red list for conservation," *Trends in Ecology and Evolution*, vol. 21, no. 2, pp. 71–76, 2006.

[14] T. J. Zamin, J. E. M. Baillie, R. M. Miller, J. P. Rodríguez, A. Ardid, and B. Collen, "National red listing beyond the 2010 target," *Conservation Biology*, vol. 24, no. 4, pp. 1012–1020, 2010.

[15] J. P. Rodríguez, "National red lists: the largest global market for IUCN red list categories and criteria," *Endangered Species Research*, vol. 6, no. 2, pp. 193–198, 2008.

[16] J. C. Vié, C. Hilton-Taylor, C. M. Pollock et al., "The IUCN red list: a key conservation tool," in *Wildlife in A Changing World—An Analysis of the 2008 IUCN Red List of Threatened Species*, J. C. Vié, C. Hilton-Taylor, and S. N. Stuart, Eds., pp. 1–13, IUCN, Gland, Switzerland, 2009.

[17] D. S. Schmeller, B. Gruber, E. Budrys, E. Framsted, S. Lengyel, and K. Henle, "National responsibilities in European species conservation: a methodological review," *Conservation Biology*, vol. 22, no. 3, pp. 593–601, 2008.

[18] M. Hoffmann, T. M. Brooks, G. A. B. da Fonseca et al., "Conservation planning and the IUCN red list," *Endangered Species Research*, vol. 6, no. 2, pp. 113–125, 2008.

[19] H. P. Possingham, S. J. Andelman, M. A. Burgman, R. A. Medellín, L. L. Master, and D. A. Keith, "Limits to the use of threatened species lists," *Trends in Ecology and Evolution*, vol. 17, no. 11, pp. 503–507, 2002.

[20] T. M. Rout, D. Heinze, and M. A. McCarthy, "Optimal allocation of conservation resources to species that may be extinct," *Conservation Biology*, vol. 24, no. 4, pp. 1111–1118, 2010.

[21] D. Farrier, R. Whelan, and C. Mooney, "Threatened species listing as a trigger for conservation action," *Environmental Science and Policy*, vol. 10, no. 3, pp. 219–229, 2007.

[22] L. N. Joseph, R. F. Maloney, and H. P. Possingham, "Optimal allocation of resources among threatened species: a project prioritization protocol," *Conservation Biology*, vol. 23, no. 2, pp. 328–338, 2009.

[23] J. Muñoz, "Biodiversity conservation including uncharismatic species," *Biodiversity and Conservation*, vol. 16, no. 7, pp. 2233–2235, 2007.

[24] S. R. Kellert and J. K. Berry, *Phase III: Knowledge, Affection and Basic Attitudes Toward Animals in American Society*, United States Government Printing Office, Washington, DC, USA, 1980.

[25] B. Czech, P. R. Krausman, and R. Borkhataria, "Social construction, political power, and the allocation of benefits to endangered species," *Conservation Biology*, vol. 12, no. 5, pp. 1103–1112, 1998.

[26] E. Meuser, H. W. Harshaw, and A. Ø. Mooers, "Public preference for endemism over other conservation-related species attributes," *Conservation Biology*, vol. 23, no. 4, pp. 1041–1046, 2009.

[27] P. Hutchings, "Invertebrates and threatened species legislation," in *Threatened Species Legislation—Is It Just An Act?* P. Hutchings, D. Lunney, and C. Dickman, Eds., pp. 88–93, Royal Zoological Society of NSW, Mosman, Australia, 2004.

[28] M. Burgman, "Expert frailties in conservation risk assessment and listing decisions," in *Threatened Species Legislation—Is It Just An Act?* P. Hutchings, D. Lunney, and C. Dickman, Eds., pp. 20–29, Royal Zoological Society of NSW, Mosman, Australia, 2004.

[29] B. Martín-López, J. A. González, and C. Montes, "The pit-fall trap of species conservation priority setting," *Biodiversity and Conservation*, vol. 20, no. 11, pp. 663–682, 2011.

[30] A. Metrick and M. L. Weitzman, "Patterns of behavior in endangered species preservation," *Land Economics*, vol. 72, no. 1, pp. 1–16, 1996.

[31] A. Ø. Mooers, L. R. Prugh, M. Festa-Bianchet, and J. A. Hutchings, "Biases in legal listing under canadian endangered species legislation," *Conservation Biology*, vol. 21, no. 3, pp. 572–575, 2007.

[32] B. Martín-López, C. Montes, L. Ramírez, and J. Benayas, "What drives policy decision-making related to species conservation?" *Biological Conservation*, vol. 142, no. 7, pp. 1370–1380, 2009.

[33] V. M. Proença, H. M. Pereira, and L. Vicente, "Organismal complexity is an indicator of species existence value," *Frontiers in Ecology and the Environment*, vol. 6, no. 6, pp. 298–299, 2008.

[34] M. Restani and J. M. Marzluff, "Funding extinction? Biological needs and political realities in the allocation of resources to endangered species recovery," *Bioscience*, vol. 52, no. 2, pp. 169–177, 2002.

[35] J. R. U. Wilson, S. Proches, B. Braschler, E. S. Dixon, and D. M. Richardson, "The (bio)diversity of science reflects the interests of society," *Frontiers in Ecology and the Environment*, vol. 5, no. 8, pp. 409–414, 2007.

[36] P. J. Seddon, P. S. Soorae, and F. Launay, "Taxonomic bias in reintroduction projects," *Animal Conservation*, vol. 8, no. 1, pp. 51–58, 2005.

[37] T. R. Alley, "Head shape and the perception of cuteness," *Developmental Psychology*, vol. 17, no. 5, pp. 650–654, 1981.

[38] T. R. Alley, "Infantile head shape as an elicitor of adult protection," *Merrill-Palmer Quarterly*, vol. 29, no. 4, pp. 411–427, 1983.

[39] K. Lorenz, *Studies in Animal and Human Behavior*, vol. 2, Harvard University Press, Cambridge, Mass, USA, 1971.

[40] K. Lorenz, *The Foundations of Ethology*, Springer, New York, NY, USA, 1978.

[41] S. Plous, "Psychological mechanisms in the human use of animals," *Journal of Social Issues*, vol. 49, no. 1, pp. 11–52, 1993.

[42] G. M. Burghardt and H. A. Herzog, "Animals, evolution and ethics," in *Perceptions of Animals in American Culture*, R. J. Hoage, Ed., pp. 129–151, Smithsonian Institution Press, Washington, DC, USA, 1989.

[43] N. Myers, R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, and J. Kent, "Biodiversity hotspots for conservation priorities," *Nature*, vol. 403, pp. 853–858, 2000.

[44] A. Estrada, R. Real, and J. M. Vargas, "Assessing coincidence between priority conservation areas for vertebrate groups in a Mediterranean hotspot," *Biological Conservation*, vol. 144, no. 3, pp. 1120–1129, 2011.

[45] M. Múgica, C. Martínez, J. Gómez-Limón, J. Puertas, J. A. Atauri, and J. V. de Lucio, *Anuario EUROPARC-España del estado de los espacios naturales protegidos 2009*, FUNGOBE, Madrid, Spain, 2010.

[46] B. Martín-López, C. Montes, and J. Benayas, "The non-economic motives behind the willingness to pay for biodiversity conservation," *Biological Conservation*, vol. 139, no. 1-2, pp. 67–82, 2007.

[47] I. Fazey, J. Fischer, and D. B. Lindenmayer, "What do conservation biologists publish?" *Biological Conservation*, vol. 124, no. 1, pp. 63–73, 2005.

[48] B. Bajomi, A. S. Pullin, G. B. Stewart, and A. Takács-Sánta, "Bias and dispersal in the animal reintroduction literature," *Oryx*, vol. 44, no. 3, pp. 358–365, 2010.

[49] J. A. Clark and R. M. May, "Taxonomic bias in conservation research," *Science*, vol. 297, no. 5579, pp. 191–192, 2002.

[50] J. Schlegel and R. Rupf, "Attitudes towards potential animal flagship species in nature conservation: a survey among students of different educational institutions," *Journal for Nature Conservation*, vol. 18, no. 4, pp. 278–290, 2010.

[51] T. D. Male and M. J. Bean, "Measuring progress in US endangered species conservation," *Ecology Letters*, vol. 8, no. 9, pp. 986–992, 2005.

[52] B. Clucas, K. McHugh, and T. Caro, "Flagship species on covers of US conservation and nature magazines," *Biodiversity and Conservation*, vol. 17, no. 6, pp. 1517–1528, 2008.

[53] P. Muris, B. Mayer, J. Huijding, and T. Konings, "A dirty animal is a scary animal! Effects of disgust-related information on fear beliefs in children," *Behaviour Research and Therapy*, vol. 46, no. 1, pp. 137–144, 2008.

[54] P. Prokop, J. Fančovičová, and M. Kubiatko, "Vampires are still alive: Slovakian students' attitudes toward bats," *Anthrozoos*, vol. 22, no. 1, pp. 19–30, 2009.

[55] L. M. Bautista and J. C. Pantoja, "What animal species should we study next?" *Bulletin of the British Ecological Society*, vol. 36, pp. 27–28, 2005.

[56] S. Bitgood, D. Patterson, and A. Benefield, "Exhibit design and visitor behavior: empirical relationships," *Environment and Behavior*, vol. 20, no. 4, pp. 474–491, 1988.

[57] A. Gunnthorsdottir, "Physical attractiveness of an animal species as a decision factor for its preservation," *Anthrozoös*, vol. 14, no. 4, pp. 204–215, 2001.

[58] B. Martín-López, C. Montes, and J. Benayas, "Economic valuation of biodiversity conservation: the meaning of numbers," *Conservation Biology*, vol. 22, no. 3, pp. 624–635, 2008.

[59] S. R. Kellert, "Attitudes toward animals: age-related development among children," *Journal of Environmental Education*, vol. 16, no. 3, pp. 29–39, 1985.

[60] N. Sitas, J. E. M. Baillie, and N. J. B. Isaac, "What are we saving? Developing a standardized approach for conservation action," *Animal Conservation*, vol. 12, no. 3, pp. 231–237, 2009.

[61] R. Home, C. Keller, P. Nagel, N. Bauer, and M. Hunziker, "Selection criteria for flagship species by conservation organizations," *Environmental Conservation*, vol. 36, no. 2, pp. 139–148, 2009.

[62] K. H. Redford, P. Coppolillo, E. W. Sanderson et al., "Mapping the conservation landscape," *Conservation Biology*, vol. 17, no. 1, pp. 116–131, 2003.

[63] M. C. Bottrill, J. C. Walsh, J. E. M. Watson, L. N. Joseph, A. Ortega-Argueta, and H. P. Possingham, "Does recovery planning improve the status of threatened species?" *Biological Conservation*, vol. 144, no. 5, pp. 1595–1601, 2011.

[64] A. Chan, "Anthropomorphism as a conservation tool," *Biodiversity and Conservation*, vol. 21, no. 7, pp. 1889–1892, 2012.

[65] B. J. Cardinale, J. E. Duffy, A. Gonzalez et al., "Biodiversity loss and its impact on humanity," *Nature*, vol. 486, pp. 59–67, 2012.

[66] C. Kremen, "Managing ecosystem services: what do we need to know about their ecology?" *Ecology Letters*, vol. 8, no. 5, pp. 468–479, 2005.

[67] B. Martín-López, I. Martín-Forés, J. A. González, and C. Montes, "La conservación de biodiversidad en España: atención científica, construcción social e interés político," *Ecosistemas*, vol. 20, pp. 104–113, 2011.

[68] M. Kassas, "Environmental education: biodiversity," *The Environmentalist*, vol. 22, no. 4, pp. 345–351, 2002.

[69] IUCN, *IUCN Red List of Threatened Species*, IUCN, Cambridge, UK, 2010, http://www.iucnredlist.org.

[70] I. Doadrio, *Atlas y Libro Rojo de los Peces Continentales de España*, National Museum of Natural Science, General Direction of Nature Conservation, Madrid, Spain, 2001.

[71] J. M. Pleguezuelos, R. Márquez, and M. Lizana, Eds., *Atlas y Libro rojo de Anfibios y reptiles de España*, The Spanish Ministry of the Environment, Autonomous Organism of Nature Reserves, Madrid, Spain, 2004.

[72] R. Martí and J. C. del Moral, *Atlas de las Aves Reproductoras de España*, The Spanish Ministry of the Environment (Autonomous Organism of Nature Reserves) and Spanish Ortnithologist Society, Madrid, Spain, 2003.

[73] J. L. Palomo, J. Gisbert, and J. C. Blanco, *Atlas y Libro Rojo de los mamíferos terrestres de España*, The Spanish Ministry of the Environment, Autonomous Organism of Nature Reserves, Madrid, Spain, 2007.

[74] A. Franco and M. Rodríguez de los Santos, *Libro Rojo de los vertebrados amenazados de Andalucía*, Regional Environment Ministry of Andalusian Board, Sevilla, Spain, 2001.

[75] M. García-París, A. Montori, and P. Herrero, *Fauna Ibérica: Amphibia: Lissamphibia*, vol. 24, National Museum of Natural Science, CSIC, Madrid, Spain, 2004.

[76] A. Salvador, *Fauna Ibérica: Reptiles*, vol. 10, National Museum of Natural Science, CSIC, Madrid, Spain, 1998.

[77] M. Díaz, B. Asensio, and J. L. Tellería, *Aves Ibéricas I. No Paseriformes*, J. M. Reyero, Madrid, Spain, 1996.

[78] J. L. Tellería, B. Asensio, and M. Díaz, *Aves Ibéricas II. Paseriformes*, J. M. Reyero, Madrid, Spain, 1999.

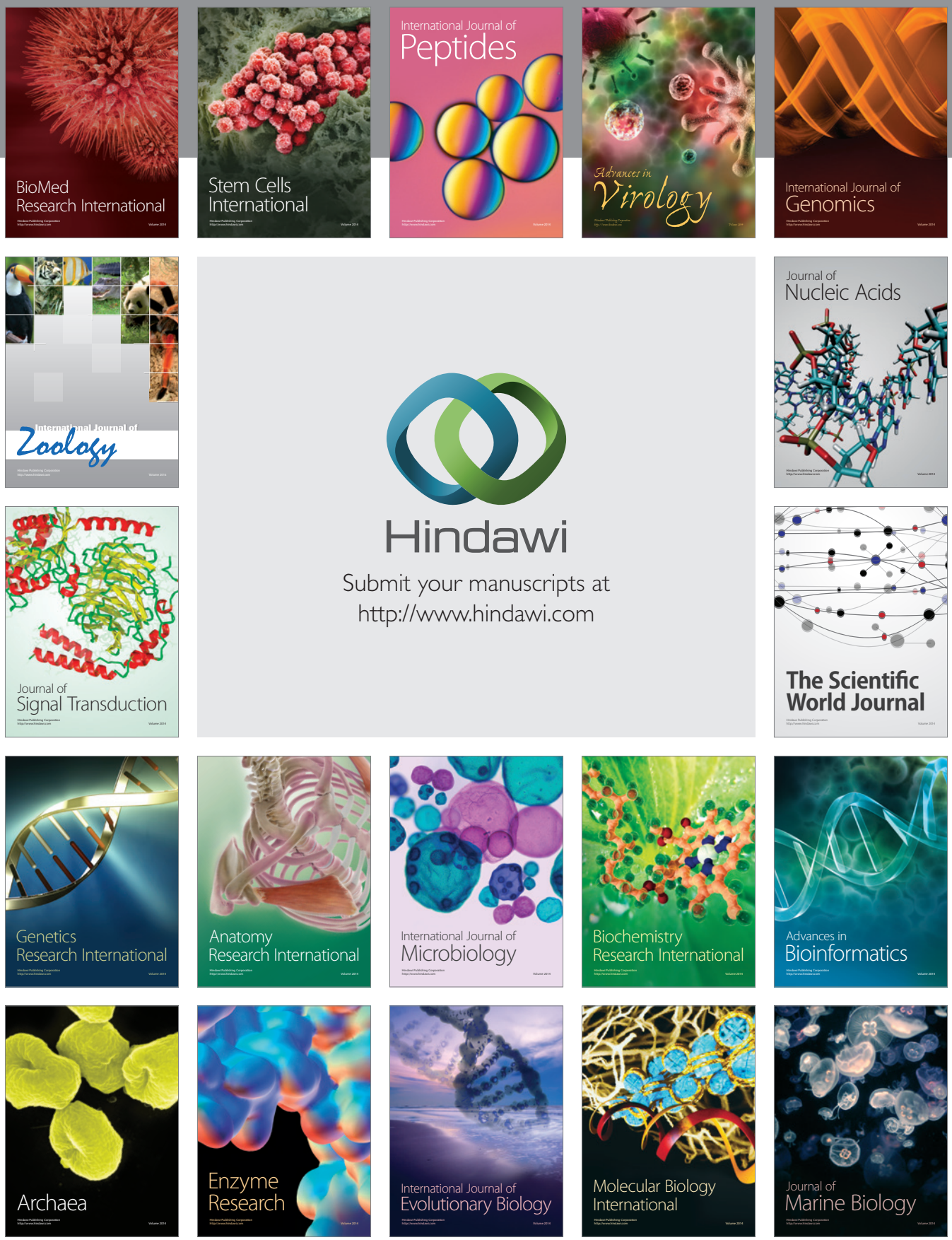
[79] J. L. Rodríguez, *Guía de Mamíferos Ibéricos*, Natural Content, Ávila, Spain, 1999.

[80] R. Kiefner, *Guía de los cetáceos del Mundo: Océano Pacífico, Océano Índico, Mar Rojo, Océano Atlántico, Caribe, Océano Ártico, Océano Antártico*, Editorial Group M&G Difusión, D. L., Elche, Spain, 2002.

[81] M. D. L. Brooke, S. Hanley, and S. B. Laughlin, "The scaling of eye size with body mass in birds," *Proceedings of the Royal Society B*, vol. 266, no. 1417, pp. 405–412, 1999.

[82] H. C. Howland, S. Merola, and J. R. Basarab, "The allometry and scaling of the size of vertebrate eyes," *Vision Research*, vol. 44, no. 17, pp. 2043–2065, 2004.

[83] R. J. Thomas, T. Székely, I. C. Cuthill et al., "Eye size in birds and the timing of song at dawn," *Proceedings of the Royal Society B*, vol. 269, no. 1493, pp. 831–837, 2002.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