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ORIGINAL PAPER

Flagship species on covers of US conservation and nature magazines

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Abstract Some conservation organizations publish magazines that showcase current conservation and research projects, attract new subscribers and maintain membership, often using flagship species to promote these objectives. This study investigates the nature of flagship species featured on the covers of ten representative US conservation and nature magazines, Defenders, National Wildlife, Wildlife Conservation, Zoonooz, Nature Conservancy, Outdoor America, Sierra, Audubon, California Wild and Natural History. Operationally defining flagship species by diet, taxonomic order, body size and IUCN status, we found that magazines tend to use mammal and bird species rather than invertebrate, fish, amphibian, reptile or plant taxa on their covers. Featured birds were mostly omnivorous or piscivorous, large-bodied and of little conservation concern; featured mammals were mainly carnivorous or herbivorous, large-bodied and of considerable conservation concern. These analyses confirm, for the first time, anecdotal observations about conservation organizations focusing their publicity and programmes on large, charismatic species to raise awareness and funds and raise the spectre that the public may be exposed to only a selected sample of conservation problems.

Keywords Body size · Diet · Endangered status · Taxon

Introduction

Flagship species, defined as "popular, charismatic species that serve as symbols and rallying points to stimulate conservation awareness and action" (Heywood 1995) are used in at least three ways in conservation (Caro and O'Doherty 1999; Leader-Williams and Dublin 2000). First, local or national conservation organizations use flagship species to

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increase awareness or to garner political support for a conservation issue. For example, Defenders of Wildlife uses the wolf *Canis lupus* to gain support for wolf reintroductions into the Greater Yellowstone Area and Idaho, USA; the mountain tapir *Tapirus pinchaque* was used to set up Sangay National Park, Ecuador (Downer 1996), and the Asian elephant *Elephas maximus* was used to promote conservation in the Rajaji and Corbett National Parks, India (Johnsingh and Joshua 1994; see also Caro et al. 2004). Similarly, most countries have a national animal or plant for increasing public awareness of that species and conservation in general.

Second, flagship species are used by international and national conservation organizations as emblems and to help raise money. These flagship species tend to be large memorable mammals easily recognized by dint of their shape, colouration, or weaponry: the African Wildlife Foundation uses the African elephant *Loxodonta africana* as its logo, the Worldwide Fund for Nature depicts the giant panda *Ailuropoda melanoleuca*, and the Flora and Fauna Preservation Society uses the Arabian oryx *Oryx leucoryx*. To be distinctive, organizations use different species although there is occasional overlap (e.g., the African Wildlife Foundation and Save the Elephants). Emblems are prominently displayed at fund raising functions, through the World Wide Web and direct mailing, and on small gifts including coffee mugs and T-shirts.

Third, flagship species are used in conservation organizations' magazines that serve to inform members about ongoing projects and maintain donor attention and sympathy. Anecdotally, it has been suggested that conservation publicity targeted at just a few species might bias public perception of conservation but up to now it has never been made explicit as to exactly what kind of flagship species are presented to the public. If, for instance, they are endangered species, they might provide a good representation of the task faced by conservation (Czech et al. 1998).

To classify the type of flagship species utilized by conservation magazines, we had to extract characteristics that could be quantified since flagship species are normally defined using general criteria only (Bowen-Jones and Entwistle 2002). We hypothesized that these species would be homeotherms, or top predators, or large, or endangered species (see Burghardt and Herzog 1980; Kellert 1985; Leader-Williams and Dublin 2000) because the western public is most familiar and therefore most sympathetic to birds and mammals; that they are thrilled by the act of predation and traits that predators possess; that they have seen more large species than small ones, particularly on television programs and in zoos; and they are moved by rarity. We therefore operationally categorized species on magazine covers by taxonomy, diet, body size and IUCN status. We focused on covers of magazines since these reflect the main feature articles inside and, to minimize confounding variables, we used magazine covers of conservation and nature magazines from just one country, the USA.

Methods

We selected ten conservation and nature magazines (Table 1) that were easily available to us and that covered a breadth of conservation activities, including habitat problems, ex situ conservation, scientific research and biodiversity. These were wildlife conservation magazines principally concerned with conserving species for their own sake; nature conservation magazines, primarily concerned with preserving habitats often with an eye to recreation; and semi-academic magazines, centered on scientific research and conservation. We collected data on a total of 759 covers across the 10 magazines with time spans of 10–12 years between 1994 and 2006 (Table 1).

Table 1 Nature and conservation magazine covers sampled

Magazine	Organization (Net assets and liabilities in 2005)	Range	Magazines number/year	Total
Wildlife conservation magazines				
Defenders	Defenders of Wildlife ($32,343,702)	1994–2006	4	51
National Wildlife	National Wildlife Federation ($63,881,000)	1995–2006	6	73
Wildlife Conservation	Wildlife Conservation Society ($714,677,000)	1995–2006	6	71
Zoonooz	San Diego Zoological Society ($329,372,000)	1994–2006	12	154
Nature conservation magazines				
Audubon	Audubon Society ($271,859,000)	1995–2005	6	68
Nature Conservancy	The Nature Conservancy ($4,414,726,000)	1995–2005	4	61
Outdoor America	Izaak Walton League of America ($7,643,932)	1994–2006	4	50
Sierra	The Sierra Club ($87,127,024)	1994–2006	6	75
Academic magazines				
California Wild	California Academy of Science ($318,133,896)	1994–2006	4	47
Natural History	American Museum of Natural History ($961,764,729)	1996–2006	10	109
Total				759

We categorized the cover content into ten main 'types': birds, mammals, reptiles, amphibians, fishes, invertebrates, landscapes, humans, and other (such as abstract images or paintings). We further categorized bird and mammal covers by diet, taxonomic order, body size, and IUCN status; small sample sizes for other types precluded statistical analyses.

We counted repeated species of a given homeotherm only once to ensure appropriate comparison with expected values that were specific to species, not covers. However the number of times that species and magazine cover contributed to a given variable was highly correlated (diet, birds and mammals each: $r_s = 1.000$, $P < 0.0001$; taxonomic order, birds and mammals each: $r_s = 1.000$, $P < 0.0001$; body size, birds and mammals each: $r_s = 1.000$, $P < 0.0001$; IUCN status: birds: $r_s = 0.936$, $P = 0.002$; mammals: $r_s = 1.000$, $P < 0.0001$). We transformed expected values (E) to be proportional to our observed data by multiplying each by the ratio of our observed total (OT) number of species over the expected total (ET) number of species (transformed expected = E * (OT/ET)).

We determined principal diet for each species using bird and mammal texts and online databases (MacDonald 2001; Perrins 2003; http://www.ARKive.org). Diet types were: carnivore (meat-eating), piscivore (fish and/or aquatic invertebrate-eating), insectivore (arthropod-eating), omnivore (vegetation, fruit, seed, grain, and/or nectar and animal protein-eating), herbivore (vegetation, fruit, seed, grain and/or nectar-eating) and scavenger (carrion-eating). We obtained expected carnivore, insectivore, omnivore, and herbivore mammal diets from MacDonald (2001) and expected values for carnivore, piscivore, insectivore, omnivore, herbivore and scavenger bird diets from Perrins (2003).

We calculated number of species within different orders from Perrins (2003) and Wilson and Reeder (2005).

We obtained body weights from Dunning (1993), Silva and Downing (1995) and http://www.ARKive.org. We used maximum body weights because this was the only metric available for many species and, as sex and age of cover species were rarely described, maximum body weights seemed appropriate (see Ord and Blumstein 2002). Expected weight distributions were derived from 21 groups with $\log_{10}$ intervals of 0.25 for birds and 0.40 for mammals (Fig. 1 in Blackburn and Gaston 1994 [6,209 bird species] and Fig. 3 in Gardezi and da Silva 1999 [2,602 mammal species]); we log transformed observed weight data and categorized them into the same 21 groups. We determined skew for observed data using these distributions. Subsequently, we collapsed observed and expected $\log_{10}$ body sizes into five groups (see Fig 4a, b) for further analyses.

We used the IUCN Red List of Threatened Species Database Search (http://www.iucnredlist.org/search/search-basic) to determine status of birds and mammals: Extinct in the Wild (EW), Critical (CR), Endangered (EN), Vulnerable (VU), Lower Risk (LR; typically either conservation dependent or near threatened), Data Deficient (DD), and Least Concerned (LC), and how many species fell into each red list.

Magazine covers did not differ statistically in the distributions of diets (Kendall's coefficient of concordance; $k = 10$ in all cases; birds, $n = 6$ dietary categories, $W = 0.737$; mammals, $n = 4$, $W = 0.615$), taxonomic orders (birds, $n = 28$ orders, $W = 0.350$; mammals, $n = 29$, $W = 0.573$), body sizes (birds, $n = 5$ categories, $W = 0.623$; mammals, $n = 5$, $W = 0.871$), and IUCN endangered status (birds, $n = 7$ categories, $W = 0.723$; mammals, $n = 7$, $W = 0.526$). Further, magazine cover types did not vary by year ($n = 10$ years, Kendall $W = 0.698$); therefore, we grouped all magazines together. We then compared the observed number of different bird and mammal species on covers (no repeated species) to expected values for our four categories using chi-square tests.

Results

Types

Birds and mammals were used the most on magazine covers (Fig. 1). Landscapes, humans and the category 'other' were used only moderately; plants, reptiles, amphibians, fish and invertebrates appeared rarely (Fig. 1). Across most magazines, birds and/or mammals comprised the top two animal taxa (Table 2). Specifically, wildlife conservation magazines all used mammals or birds the most (Defenders, National Wildlife, Wildlife Conservation, and Zoonooz) whereas most of the nature conservation magazines used landscapes or humans most (Nature Conservancy, Outdoor America, and Sierra); *Audubon* used birds the most (Table 2). The semi-academic magazines both had mammals in their top two types along with invertebrates or "other" types (California Wild and Natural History).

Popular species

Species used more than six times were almost exclusively mammals and mostly large predators (Table 3). The top four species were North American carnivores followed by tigers *Panthera tigris* and pandas (Table 3). Bald eagles *Haliaeetus leucocephalus* were the only bird species on this list.

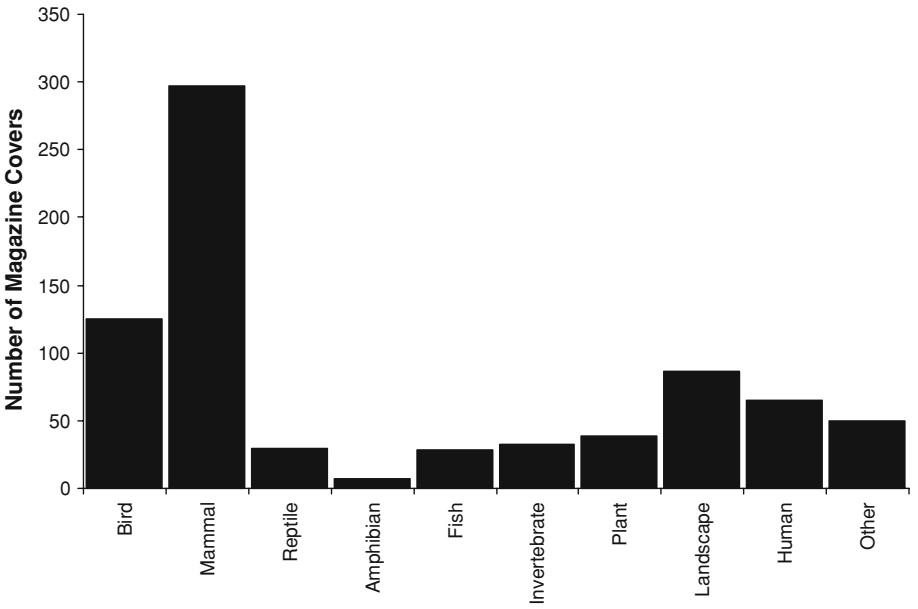


Fig. 1 Number of magazine covers ($N = 759$) categorized by type taxonomic or other affiliation for all magazines combined

Table 2 Proportion of magazine covers by type for each magazine sampled

Type	DW	NW	WC	ZN	AB	NC	OA	SR	CW	NH	All
Bird	**13.7**	**37.0**	**9.9**	**16.9**	**33.8**	9.8	**14.0**	5.3	14.9	10.1	**16.5**
Mammal	**70.6**	**47.9**	**78.9**	**70.1**	11.8	11.5	12.1	12.0	**21.3**	**20.2**	**39.1**
Reptile	2.0	2.7	2.8	7.1	4.4	1.6	0.0	1.3	8.5	3.7	3.8
Amphibian	0.0	0.0	0.0	0.0	1.5	3.3	0.0	1.3	2.1	1.8	0.9
Fish	5.9	2.7	2.8	0.0	4.4	4.9	8.0	1.3	6.4	6.4	3.7
Invertebrate	0.0	4.1	4.2	1.3	2.9	4.9	2.0	1.3	**21.3**	7.3	4.3
Plant	2.0	4.1	0.0	0.6	8.8	8.2	2.0	12.0	6.4	9.2	5.1
Landscape	2.0	0.0	0.0	0.6	**16.2**	**31.1**	16.0	**44.0**	12.8	6.4	11.3
Human	0.0	0.0	1.4	0.0	8.8	**18.0**	**36.0**	**17.3**	0.0	14.8	8.6
Other	3.9	1.4	0.0	3.2	7.4	6.6	10.0	4.0	6.4	**20.2**	6.6
Total	100	100	100	100	100	100	100	100	100	100	100

Top two percentages are shown in bold for each magazine and total Magazine Codes: Defenders (DW); National Wildlife (NW); Wildlife Conservation (WC); Zoonooz (ZN); Audubon (AB); Nature Conservancy (NC); Outdoor America (OA); Sierra (SR); California Wild (CW); and Natural History (NH)

Diet

Observed diets of cover species differed from expected (birds: $X_5^2 = 104.923$, $P < 0.0001$; mammals: $X_3^2 = 245.118$, $P < 0.0001$). For birds, magazines used omnivores and piscivores the most, with carnivores and piscivores being over represented (Fig. 2a). For mammals, magazines used carnivores and herbivores the most (Fig. 2b).

Table 3 Most popular cover animals on conservation and nature magazines sampled (out of 759 total covers)

Species	Number of covers	Order	Body weight (kg)	IUCN
Wolf	22	Carnivora	60	LC
Brown (grizzly) bear	19	Carnivora	247	LR
Polar bear	17	Carnivora	660	VU
Cougar[a]	11	Carnivora	100	LR
Tiger	10	Carnivora	320	EN
Giant panda	8	Carnivora	110	EN
Elephant	7	Proboscidea	6,100	VU
Lion	7	Carnivora	225	VU
Bald eagle	6	Falconiformes	6.4	LC
Cheetah	6	Carnivora	65	VU
Gorilla	6	Primates	278	EN
Orangutan	6	Primates	74	EN

[a] Includes Florida panthers and mountain lions

Taxonomic order

Magazines used 19 out of 28 bird orders and 14 out of 29 mammalian orders. Top featured bird orders were Ciconiformes (e.g., egrets, flamingoes, vultures, condors), Passeriformes (e.g., songbirds), Strigiformes (owls), Falconiformes (e.g., falcons, eagles, hawks) and Anseriformes (e.g., waterfowl; Fig. 3a). Top mammalian orders were Carnivora (e.g., wolves, bears, large felids), Primates (apes, monkeys), Artiodactyla (e.g., antelopes, deer) and Perissodactyla (e.g., horses, rhinoceroses; Fig. 3b).

Comparing number of bird and mammal species used by magazines to the total number of species expected within these orders revealed significant discrepancies (birds: $X^2_{27} = 640.343$, $P < 0.0001$; mammals: $X^2_{28} = 675.932$, $P < 0.0001$; see Bradley et al. 1979). For 13 bird orders, the observed values were greater than the expected, most notably in Ciconiformes, Strigiformes, Anseriformes and Falconiformes. In contrast, 15 orders were less than expected, with the greatest difference found in Passeriformes. For mammals, 10 orders had observed values greater than expected; including Carnivora, Artiodactyla, Perissodactyla, Primates and Diprotodontia (e.g., kangaroos, koalas). There were 19 orders where observed coverage was less than expected, principally Rodentia (e.g., mice, squirrels), Chiroptera (bats), and Soricomorpha (e.g., shrews).

Body size

Both bird and mammal covers tended to feature large species (>1,000 g in birds, e.g., mallard ducks *Anas platyrhynchos* Fig. 4a; >100 kg in mammals, e.g., black bears *Ursus americanus*, Fig. 4b) more than expected (birds: $X^2_4 = 343.847$, $P < 0.0001$; mammals: $X^2_4 = 480.531$, $P < 0.0001$). Additionally, body size distributions for bird and mammal species were both left/negatively skewed (birds: skew = −0.493; mammals: skew = −0.131; using the 21 $\log_{10}$ groups, see Methods) contrasting markedly with right/positive expected skews in both taxa.

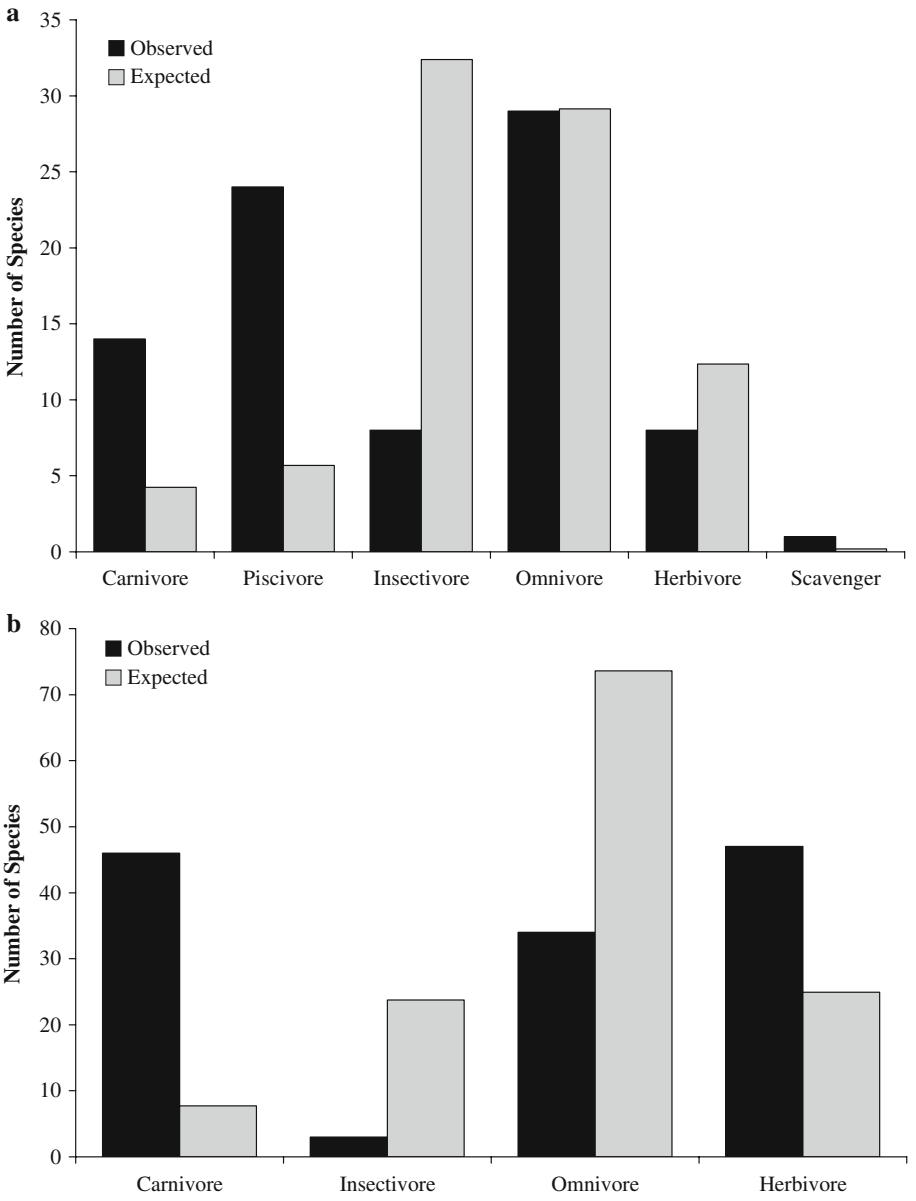
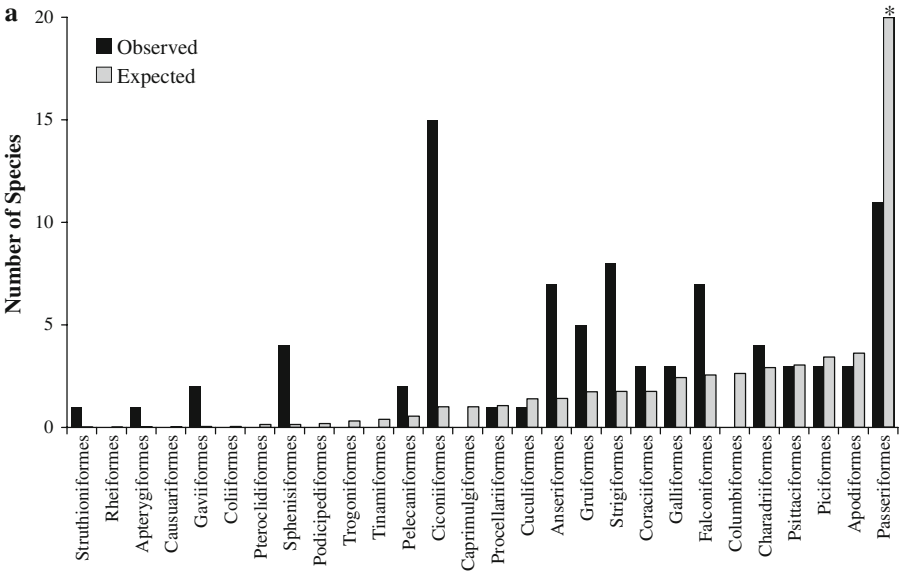


Fig. 2 Number of (**a**) bird and (**b**) mammal species on covers categorized by different diet categories

IUCN endangered status

Bird species on covers mostly fell in the category of Least Concern and did not differ from expected ($X_6^2 = 1.987$, $P = 0.920$; Fig. 5a). Mammals were principally Lower Risk, Endangered, Critical and Extinct in the Wild species and covers differed from expected ($X_6^2 = 287.067$, $P < 0.0001$; Fig. 5b).



*Passeriformes expected value of 50.33 not shown in its entirety

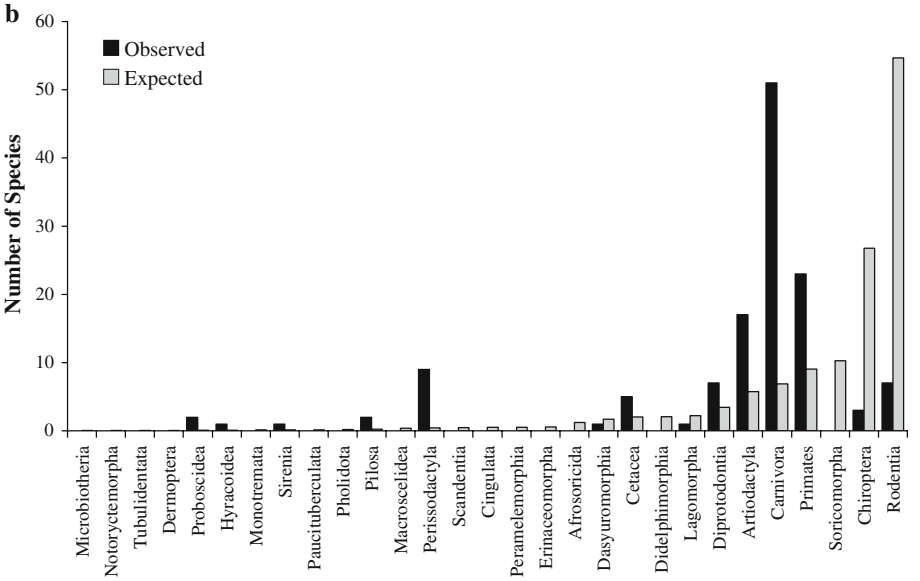


Fig. 3 Number of (**a**) bird and (**b**) mammal species on covers separated by order

Discussion

Covers of magazines published by conservation and nature organizations in the USA over the 12 years were broadly centered on flagship species as operationally defined here. All wildlife conservation magazines principally featured homeotherms on their covers, while

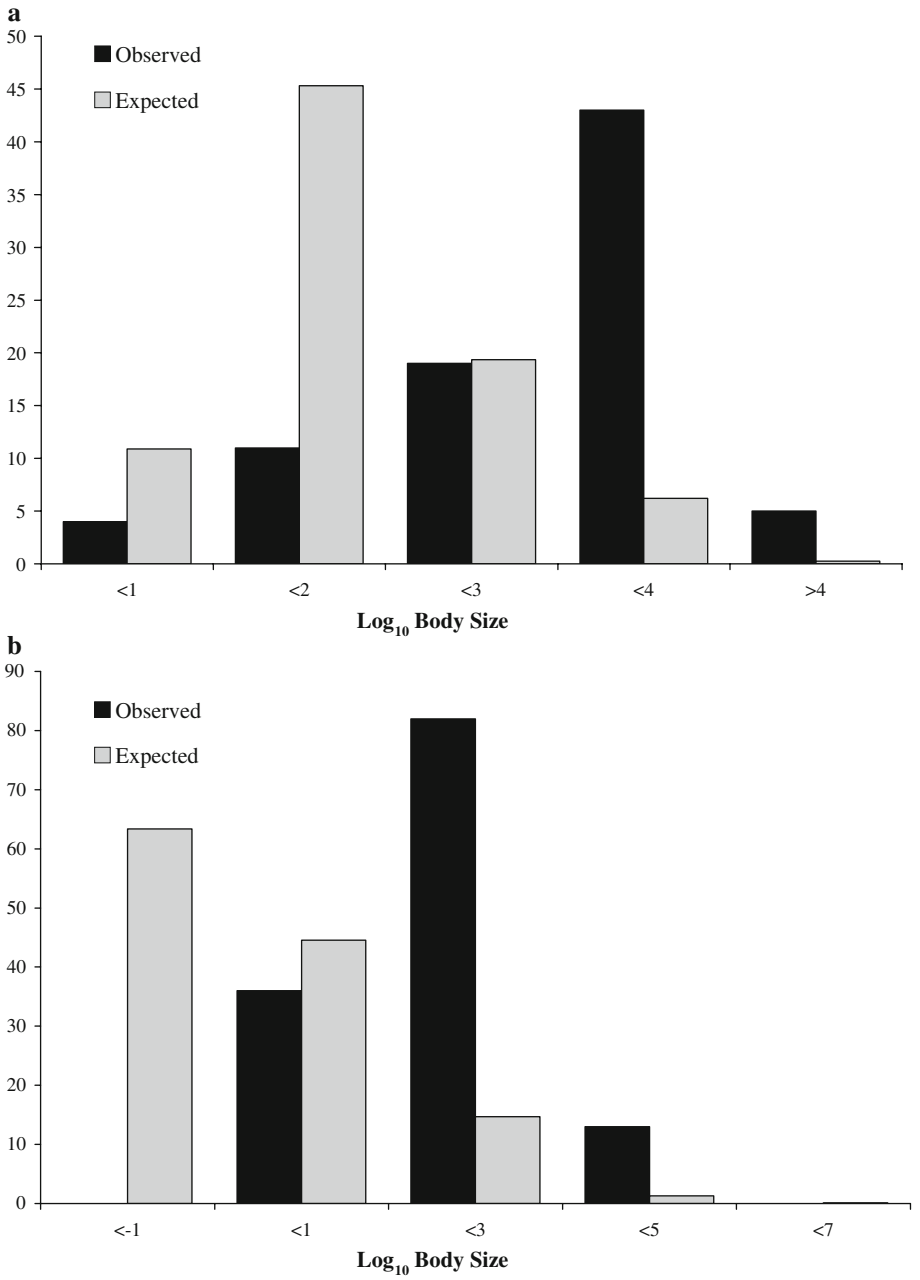


Fig. 4 Number of (**a**) bird (in gms) and (**b**) mammal (in kgs) species on covers categorized by body size

nature conservation magazines concentrated on birds, landscapes or humans. More semi-academically oriented magazines equally used mammals and invertebrates or the 'other' category the most.

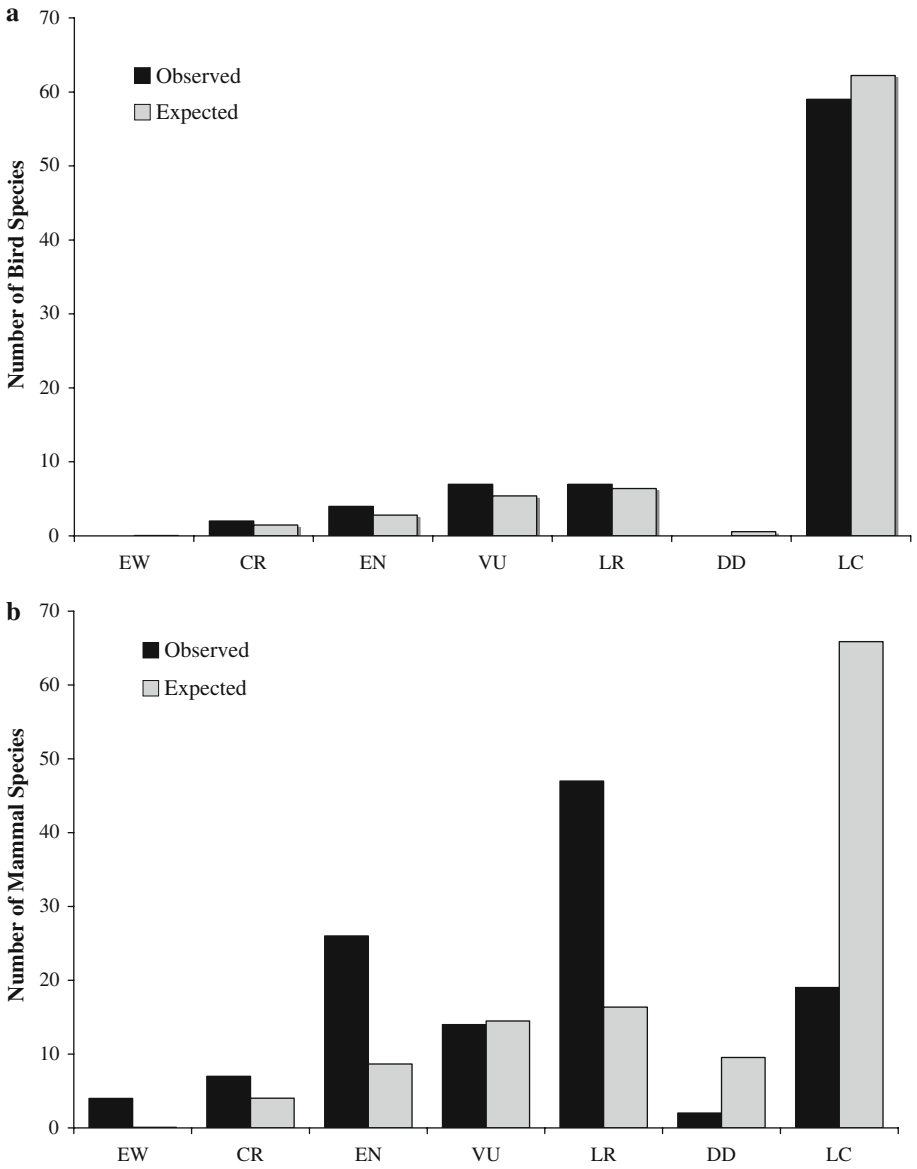


Fig. 5 Number of (**a**) bird and (**b**) mammal species on covers categorized by IUCN status. EW, extinct in the wild; CR, critically endangered; EN, endangered; VU, vulnerable; LR, lower risk; DD, data deficient; LC, least concerned

Biases were evident regarding bird and mammal cover species. First, cover mammals were typically carnivores or herbivores (both more than expected) whereas omnivory is the most expected diet. Cover birds were mostly omnivores or piscivores whereas insectivory is the most expected diet. Second, mammals were mainly Carnivora, Artiodactyla, Primates and Perissodactyla and birds were principally Ciconiformes, Passeriformes, Strigiformes, Falconiformes and Anseriformes. These are well-known orders that contain species perceived to

be charismatic. Third, cover mammals and birds were disproportionately large for their taxon. Last, mammals were biased towards species of conservation concern. In contrast, birds were no different from their expected conservation status across the class. In it worth noting that large, carnivorous mammalian species—wolves, bears and large felids—were used repeatedly by magazines. This may be because conservation organizations are trying to tap urban financial resources and these species are revered by people in cities (Kellert et al. 1996) as they do not suffer the economic impact of living in proximity to them (see Bowen-Jones and Entwistle 2002; Kaltenborn et al. 2006). In summary, US conservation and nature magazine covers featured large, meat eating, endangered mammals and large, fish eating or omnivorous birds of little conservation concern.

What are the implications of these findings? The magazines that we examined contained information on some of the most prominent conservation and biodiversity projects supported by major NGOs in the USA. Given that lead stories are usually showcased on covers, there is a bias towards flagship mammals and birds featured in conservation magazines and by extension in contemporary conservation programs, particularly those advocating wildlife conservation. For example, although the Conservation and Research for Endangered Species (CRES) Program at the San Diego Zoo that publishes Zoonooz divides its habitat conservation program into flagship species, science-based approaches, telemetry, native biodiversity, and genetics categories, seven out of their 12 projects are on charismatic mammal populations, and another on the Komodo dragon *Varanus komodensis* (Walpole and Leader-Williams 2002). Similarly, almost 50% of the 81 research projects reported on the Wildlife Conservation Society website between winter 2003 and September 2006 were on charismatic species. The American Museum of Natural History and California Academy of Sciences are less biased on their covers, although the missions of these organizations are not solely conservation related.

Whether a focus on flagship species detracts conservation attention from other projects is open to (difficult) empirical investigation but conservation funding is arguably a zero-sum game. While some would suggest that flagship species have conservation merit because such species are large, or are predators requiring a sufficient prey base (Sergio et al. 2005), and may thus act as umbrellas for sympatric species, there is no consensus on these points, and evidence speaks against flagships serving as umbrellas (Andelman and Fagan 2000; Caro et al. 2004; see also Munoz 2007). Some flagship species might play a keystone role in ecosystems (Estes et al. 1998) but this is case specific.

Finally, conservation and nature magazines may need to attract donors and have used flagship species to accomplish this, but there may be merit in diversifying their focus to further educate their donors about additional conservation issues. They could achieve this by featuring covers (and articles) that increase the public's knowledge of less charismatic species and that better represent the earth's biodiversity. Indeed, Bowen and Entwistle (2002) state 'the appeal of novelty and interest in less traditionally charismatic species should not be over looked' especially since there is the possibility of 'flagship fatigue' (decreased effectiveness due to over-exposure). Instead, magazines could publish more cover articles that include, but are not limited to: the importance of biodiversity in ecosystem function; laboratory based methods of pinpointing areas of high biodiversity; the critical need to involve local stakeholders in conservation solutions; the import of working with industry to reduce greenhouse gas emissions; and engaging children's interest in the natural world. While we acknowledge that the ten organizations that we sampled do indeed address some of these issues, our findings (especially for mammal and bird cover species) suggest that these concepts are overshadowed by the widespread use of flagship species in conservation and nature magazines.

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