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Using a Systematic Approach to Select Flagship Species for Bird Conservation

DIOGO VERÍSSIMO,*** TATIANA PONGILUPPI,† MARIA CINTIA M. SANTOS,† PEDRO F. DEVELEY,† IAIN FRASER,‡§ ROBERT J. SMITH,*** AND DOUGLAS C. MACMILAN*

*Durrell Institute of Conservation and Ecology, University of Kent, Marlowe Building, University of Kent, Canterbury, Kent CT2 7NR, United Kingdom
†SAVE Brasil, Rua Fernão Dias, 219, cj 2, Pinheiros, São Paulo (SP) 05427–010, Brazil
‡School of Economics, University of Kent, Canterbury, CT2 7NP, United Kingdom
§School of Economics and Finance, La Trobe University, Melbourne, Vic 3083, Australia

Abstract: *Conservation marketing campaigns that focus on flagship species play a vital role in biological diversity conservation because they raise funds and change people's behavior. However, most flagship species are selected without considering the target audience of the campaign, which can hamper the campaign's effectiveness. To address this problem, we used a systematic and stakeholder-driven approach to select flagship species for a conservation campaign in the Serra do Urubu in northeastern Brazil. We based our techniques on environmental economic and marketing methods. We used choice experiments to examine the species attributes that drive preference and latent-class models to segment respondents into groups by preferences and socioeconomic characteristics. We used respondent preferences and information on bird species inhabiting the Serra do Urubu to calculate a flagship species suitability score. We also asked respondents to indicate their favorite species from a set list to enable comparison between methods. The species' traits that drove audience preference were geographic distribution, population size, visibility, attractiveness, and survival in captivity. However, the importance of these factors differed among groups and groups differed in their views on whether species with small populations and the ability to survive in captivity should be prioritized. The popularity rankings of species differed between approaches, a result that was probably related to the different ways in which the 2 methods measured preference. Our new approach is a transparent and evidence-based method that can be used to refine the way stakeholders are engaged in the design of conservation marketing campaigns.*

Keywords: Atlantic Forest, Brazil, choice experiments, latent-class model, marketing, vote

Resumen: *Las campañas de mercadeo de conservación centradas en especies bandera juegan un papel vital en la conservación de la biodiversidad porque reúnen fondos y cambian las actitudes de la gente. Sin embargo, la mayoría de las especies bandera son seleccionadas sin considerar al público objeto de la campaña, lo cual puede obstaculizar la efectividad de la misma. Para abordar este problema, utilizamos un método sistemático y dirigido por actores involucrados para seleccionar especies bandera para una campaña de conservación en la Serra do Urubu en el noreste de Brasil. Basamos nuestras técnicas en métodos de economía y mercadeo ambiental. Utilizamos experimentos de selección para examinar los atributos de las especies que impulsan modelos de preferencia y clase latente para segmentar a entrevistados en grupos por preferencias y características socioeconómicas. Usamos las preferencias de encuestados e información sobre especies de aves en la Serra do Urubu para calcular un valor de aptitud de especies bandera. También solicitamos a los encuestados que indicaran sus especies favoritas en una lista para posibilitar la comparación entre métodos. Las características de las especies que definieron la preferencia fueron distribución geográfica, tamaño poblacional, visibilidad, atractivo y supervivencia en cautiverio. Sin embargo, la importancia de estos factores difirió entre grupos y los grupos difirieron en sus opiniones respecto a sí las especies con poblaciones pequeñas y la capacidad para sobrevivir en cautiverio deberían ser priorizadas. Las clasificaciones de popularidad de las especies difirieron entre los métodos, un resultado relacionado probablemente con las*

***Address correspondence to D. Veríssimo, email verissimodiogo@gmail.com, or R. J. Smith, email R.J.Smith@kent.ac.uk
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diferentes formas en que miden las preferencias los 2 métodos. El nuestro es un método nuevo, transparente y basado en evidencias, que puede ser utilizado para refinar la manera en que los actores están involucrados en el diseño de campañas de mercadeo de conservación.

Palabras Clave: Brasil, experimentos de selección, mata Atlántica, mercadeo, modelo de clase latente, voto

Introduction

Conservation of biological diversity depends on changing the behavior of stakeholders, but this remains a major challenge (Smith et al. 2010). Fortunately, conservation professionals do not have to tackle this problem alone because there are a number of existing approaches based on marketing theory that can help achieve behavioral change (Hastings 2007) and provide an evidence-based framework for engaging and building relationships with stakeholders (e.g., Bateman et al. 2010; Jenks et al. 2010). These approaches are particularly relevant to conservation projects that apply the concept of flagship species. Flagship species are widely applied in conservation (Smith et al. 2010) and act "as the focus of a broader conservation marketing campaign" on the basis of their possession "of one or more traits that appeal to the target audience" (Veríssimo et al. 2011*b*). However, the selection of flagship species is often ad hoc (Simberloff 1998). A recent study in Switzerland found that only 3 of 14 conservation nongovernmental organizations (NGO) used marketing studies when selecting a species for their logo (Home et al. 2009).

This is why there has been a call for better tailoring of campaigns involving flagship species to the characteristics of the target audience (Bowen-Jones & Entwistle 2002; Barua et al. 2011; Veríssimo et al. 2011*a*). In several studies audiences were divided into local and international groups and local and tourists groups (Walpole & Leader-Williams 2002; Caro 2010). However, marketing theory suggests understanding of the target audience could be improved because such broad group categories are often highly heterogeneous in demographic, cultural, and psychographic terms. This is why marketers use a more thorough approach and structure the process of learning about the target audience into the following 4 steps: segmentation, the total population is divided into segments by their relevance to the conservation objective, responsiveness, reachability, and cost to reach them (Kotler & Lee 2008); targeting, audience segments to be targeted by the campaign are selected; positioning, core values of a campaign are defined on the basis of knowledge, attitudes, values, wants, and needs of the different audience segments (Kotler & Lee 2008), and differentiation, campaigns are designed to be more effective than other campaigns that are using competing messages and targeting the same audience segments.

We used this systematic marketing approach to select a flagship species and discuss the benefits such an approach might bring. We focused on a conservation project led by SAVE Brasil, a Brazilian conservation NGO, in the Serra do Urubu. SAVE Brasil set up a pilot environmental education project in 2007 named Zidedeando no Nordeste, which sought to raise awareness about the biological diversity of the Serra do Urubu among high school students, their teachers, and the residents of Lagoa dos Gatos, the largest urban settlement in the region. They chose the Orange-bellied Antwren (*Terenura sicki)* as the project's flagship species because it is endangered (IUCN 2010), has a restricted distribution, and its Portuguese common name can be combined with the Portuguese word for *conserving*, thus creating an opportunity for wordplay in project marketing slogans. The project concluded in 2008 and resulted in increased knowledge and positive attitudes of the target audience. However, the project team had doubts about the suitability of the Orange-bellied Antwren as a flagship species because results showed that, despite the project investment in raising its profile, the bird remained largely unknown to the target audience.

In response SAVE Brasil sought to overcome this limitation by using an evidence-based method to select flagship species for use in future campaigns at this site. We used an audience-driven flagship-selection approach, underpinned by marketing theory, to identify a new flagship bird for the Serra do Urubu. This flagship species will be used in future marketing campaigns to raise conservation awareness. We also compared this approach with a plurality flagship vote (Nurmi 1992), a commonly used approach to flagship selection (e.g., Ward 2004; AMANE 2011; NCHS 2011). This approach requires respondents to choose their single favorite species from a list. The species with the most votes is then selected. The technique has been used recently in northeastern Brazil (AMANE 2011). We compared the marketing- and plurality-flagship vote approaches in terms of theoretical grounding and results.

Methods

Study Site

The Serra do Urubu is a 10-km^2 fragmented patch of Atlantic Forest in northeastern Brazil. It contains 10 threatened bird species, 4 of which have a very restricted range, and several endemic animal and plant species (Bencke et al. 2006). The Serra do Urubu is in one of Brazil's least developed regions, where people living around the forest

affect biological diversity through charcoal making, logging, and hunting (Bencke et al. 2006; Filho & Tabarelli 2006), mostly for domestic consumption.

Marketing Approach to Selecting Flagship Species

We followed the first 4 steps of the systematic framework developed by Veríssimo et al. (2011*b*) to select a flagship species to represent the biological diversity of the Serra do Urubu. First, we identified the conservation problem to be tackled as the lack of awareness of the uniqueness and importance of the avifauna of the Serra do Urubu, a problem previously identified by SAVE Brazil. Second, we identified the target audience. We selected the communities living around the main forest fragments of the Serra do Urubu because they directly affect the forest biological diversity through subsistence harvesting of natural resources, and the students and teachers of both high schools in Lagoa dos Gatos, the largest town in the region, because SAVE Brasil had worked with these schools on previous projects. Third, we investigated the relation between the selected audience groups and the birds of the Serra do Urubu. We did this by reviewing previous research carried out by SAVE Brasil and through interviews with key informants. Fourth, we focused on identifying the best species for promoting the campaign as one aspect of the campaign's "marketing mix" (Veríssimo et al. 2011*a*). For this, we used discrete-choice experiments because these have a strong grounding in behavioral theory and so reflect real-life choices (Louviere et al. 2010).

Choice experiments provide an understanding of how individuals' value particular attributes of a product or service by presenting respondents with choice questions. Each choice presents 2 or more hypothetical alternative scenarios described by different levels of the same attributes (Mangham et al. 2009). We applied this approach to the choice of flagship species by asking respondents to choose between hypothetical species profiles (Veríssimo et al. 2009). Respondents' choices then allowed us to identify preferred species characteristics.

We selected the species' attributes to be included in the choice experiments and decided how they would vary (hereafter attribute levels). The attributes were species characteristics, and we selected these according to the information gathered through interviews with key informants and a review of the relevant literature (e.g,. Stokes 2007; Veríssimo et al. 2009). We selected direct-use, indirect-use, and nonuse attributes to determine how these aspects contributed to species valuation. We used a limited number of attributes so the survey would not be confusing to participants or lengthy. The 5 attributes were appearance, population size, geographic distribution, visibility, and ability to survive in captivity. These are described below with details on how we set attribute levels (Table 1).

To determine preferences regarding bird appearance, we organized 3 workshops with students. Each student was randomly given 1 of 2 pages with 20 colored bird drawings of similar sizes. The birds were identified only by letters (Veríssimo et al. 2009). Students were asked to rate every drawing on a scale from 0 (not attractive) to 10 (very attractive). We selected the drawings to represent every taxonomic bird order that occurs in the Serra do Urubu to ensure, when possible, that every order had both a species with colorful and drab plumage. We standardized the resulting scores across the respondents score range and compared each species' median score. Given the distribution of the scores across the scale, we decided to divide the appearance attribute into not attractive and attractive categories. We selected the 3 bird drawings with the lowest scores as not attractive species, and each time we used a not attractive species on a choice experiment card we selected one of these 3 species at random. We followed the same process for attractive species on the basis of the 3 bird drawings with the highest scores. Respondents were not informed whether a species had previously been considered attractive or not.

We divided population size into 3 levels, less than 50 individuals, between 250 and 1000 individuals, and between 2500 and 1000 individuals. Given the diminishing marginal value of an extra individual as population increases, we established the levels on the basis of population estimates for species occurring in the region and presented them in the form of nonlinear bounded ranges (IUCN 2010). We did this to convey some of the uncertainty surrounding population estimates in conservation and, because no consecutive population intervals were used, to ensure that levels could be differentiated by respondents.

We divided geographic distribution into 2 levels, species that could be found in the Serra do Urubu and 2 other regions and species that could be found in the Serra do Urubu and 10 other regions. With this design we sought to capture the fact that Serra do Urubu has no endemic bird species, but several species have very restricted ranges that include the area.

We divided visibility into 3 levels, species that are usually not heard or seen, species that are generally heard, and species that are usually heard and seen. This design took into account both the visual and auditory parts of bird watching. We excluded the level that considered seeing but not hearing the bird because this combination was unlikely.

We set survival in captivity as a binary attribute to determine whether respondents were more interested in bird species that could be kept as pets. There is widespread interest in keeping wild-caught birds, especially song birds, and this trade has had substantial negative effects on several bird species in the region (Pereira & Brito 2005).

Table 1. Species attributes and corresponding levels used in choice experiment and socioeconomic data collected (coding in parentheses) in the examination of respondents' preferences for a bird flagship species for the Serra do Urubu, Brazil.

Attribute	*Description*
Species variables	
Appearance	perception of how visually attractive a species is, presented through drawings of bird species divided into 2 levels: attractive (1) and unattractive (0)
Population size	number of individuals of a given species worldwide divided into 3 levels: <50 (0), 250–1000 (1), and 2500–10,000 (2).
Geographic distribution	number of sites, in addition to the study area, where the species occurs divided into 2 levels: study area plus 2 other sites (0) and study area plus 10 other sites (1)
Visibility	whether the given species would on an average day will not be heard or seen (0), only heard (1), or be both seen and heard (2)
Captivity	whether individuals of a given species would survive as a cage bird (1) or not (0)
Socioeconomic variables	
Gender	female (0) or male (1)
Age	years
Respondent type	whether a respondent was a high school student or teacher (0) or a rural community member (1)

We did not include a cost attribute because it tends to dominate responses in choice studies conducted in developing countries (Hope 2006) and because our aim was not to estimate willingness to pay.

Given the number of attributes types and levels, we sought to limit the potential cognitive burden by presenting each respondent with 4 dichotomous unlabeled choices. Each choice was a comparison of 2 hypothetical species. We then asked respondents which species should have its conservation priority increased, assuming that flagship-species campaigns are most successful when highlighting species the target audience is most concerned about. We did not include an explicit no-choice option because we believed some respondents would be uncomfortable with the survey process and automatically answer no choice if that was the quickest option. Although this differs from standard procedures for use of choice experiments to measure willingness to pay, we thought it would not affect the relevance of our results because we measured respondents' relative preference for different species. Nonetheless, surveyors were instructed not to force respondents to choose and to assign any choices that respondents seemed unwilling or unable to select to an implicit no-choice category. In rural communities the survey was administered orally because of low target audience literacy rates, whereas in schools we explained the survey to the entire class and then asked students to complete it individually. In the absence of a reference demographic data set for the target population, we tried to achieve a representative sample in the rural areas by visiting communities on different weekdays and times of the day and by sampling all available residents in each visit, which was possible given the small size of communities. To ensure representativeness in schools, we sampled one randomly chosen class from each high school year and, given the small group size, all available teachers.

To test the survey, we used PASW Statistics (version 18.0, IBM, Chicago, IL, USA) to design scenarios with attribute combinations so that main effects of attributes on preferences could be estimated from orthogonal independent attribute variables. We then used a shifted or cyclic design to pair these scenarios in which a constant was added to each attribute level of an orthogonal design to produce one or more additional alternatives. The test survey given to one high school class and one rural community, both outside the study area so as to avoid members of the test study affecting the choices of later respondents. We used results of the test survey to produce the Bayesian prior distributions needed for the choice experiment. We used Ngene (version 1.0.1, ChoiceMetrics, Sydney, Australia) to produce a D-efficient Bayesian design for the main survey (Jaeger & Rose 2008). We chose this design type because it maximizes statistical efficiency in estimating preference parameters by minimizing D-error over the prior distribution of the parameters while accounting for uncertainty (Jaeger & Rose 2008). To allow for uncertainty, we used 500 Halton draws from normal distributions for each parameter prior distribution. We then compared the average Bayesian Dp error of over 30,000 Bayesian designs, selecting the one with the lowest error at 0.3303. This design had 8 choice situations, one of which is shown in Figure 1. The design was attribute balanced, meaning each attribute level occurred equally often, which minimizes the variance in parameter estimates (Mangham et al. 2009).

We then used NLogit 4.0 to construct a multinomial logit model to determine aggregate preferences and explore preference heterogeneity among the respondents through latent-class models of flagship suitability, which divided respondents into groups according to their preferences and socioeconomic characteristics (see Supporting Information for further details). Lastly, we used Fishbein's multiattribute attitude model (Chiang et al. 2006)

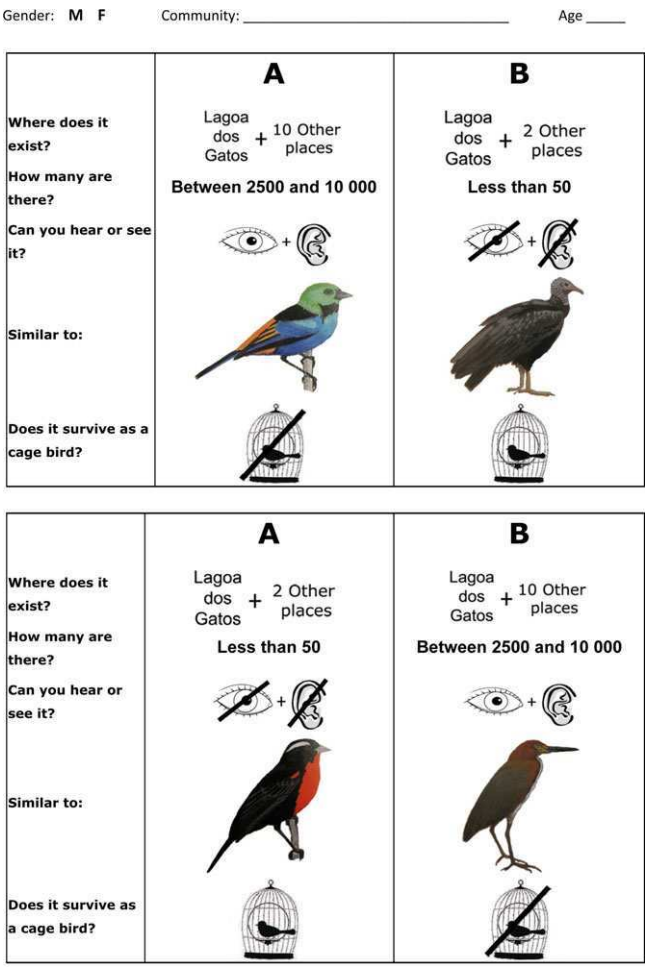

Figure 1. Example of one page, translated from Portuguese, of the choice-experiment survey used to select a bird flagship species for the Serra do Urubu.

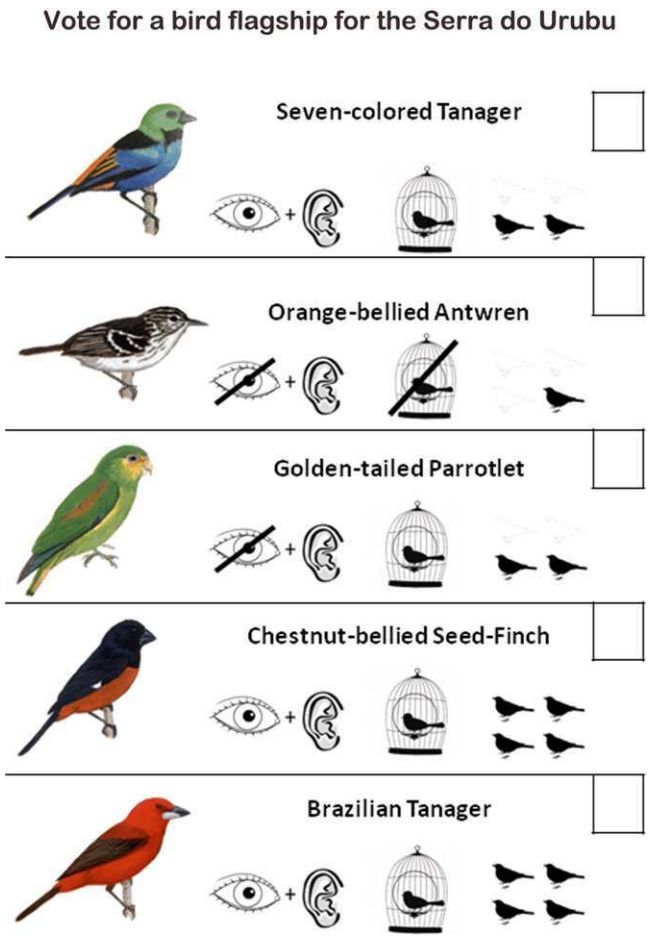

Figure 2. Example of one selection ballot, translated from Portuguese, to select a bird flagship species for the Serra do Urubu.

to combine the preference results from the latent-class model with data on each species to calculate a flagship suitability score for every bird species in the Serra do Urubu.

Plurality Flagship Vote

To investigate how the more traditional flagship-selection approach differed from the choice-experiment approach (Fig. 2), we conducted a separate survey in which we asked respondents to choose 1 of 5 candidate species, thus simulating a plurality vote. The candidate species were chosen so as to present distinct combinations of attributes (Fig. 2). All respondents received similar lists from which to select a species (hereafter ballots). The order of the different species on the page was randomized. We provided information on the same species attributes used in the initial survey, although we excluded geographic distribution because survey analyses showed this attribute was unimportant when the population was considered as a whole (Table 2). We also asked respondents which of the 5 species they already knew so we could test whether awareness was an important indicator of preference. We used the same delivery method and target audience as the choice-experiment survey to allow for comparison between this method and the flagship-suitability model. We obtained 286 valid ballots, 187 from high school students and 99 from rural communities. Given this unbalance in the sample size between the 2 respondent types, we used bootstrapping to extract 10,000 samples of 99 ballots out of the 187 obtained from high school students and then used the average proportion of votes obtained by each species in each target group to rank the species.

Results

Flagship Species Suitability Model

We surveyed 242 respondents from 12 rural communities, 142 respondents from all high school years (one

Table 2. Estimation coefficient for species' attribute preferences for the multinomial logit (MNL) and latent-class flagship species suitability model with 3 groups of respondents.[a]

Utility function variable	*MNL*	*Group 1 (40%) (SE)*	*Group 2 (17%) (SE)*	*Group 3 (43%) (SE)*
Appearance	0.41 (0.05)***	0.18 (0.08)*	0.3 (0.19)	0.91 (0.13)***
Population Size	−0.26 (0.04)***	−0.78 (0.06)***	0.72 (0.19)***	−0.11 (0.09)
Geographic distribution	−0.06 (0.05)	−041 (0.08)***	0.14 (0.17)	0.22 (0.11)
Visibility	0.1 (0.04)***	−0.07 (0.05)	0.23 (0.15)	0.4 (0.09)***
Survival in captivity	−0.22 (0.05)***	−0.29 (0.08)***	−2.83 (0.35)***	0.48 (0.15)**
ASC[b]	−3.84 (0.23)***	−3.73 (0.15)***	$-31.6\ (7 \times 10^6)$	$-31.5\ (1.6 \times 10^6)$
Segment variable				
Respondent type			2 (0.58)***	0.65 (0.32)*

[a] *Probability of a respondent belonging to any given group of the flagship-suitability model is indicated below the group number. Significance levels: *P < 0.05, **P < 0.01, ***P < 0.001.*
[b] *Alternative specific constant, unobservable effects beyond the attributes present in the choice sets.*

Table 3. Statistical criteria for determining the number of groups in the latent-class model of preferences for bird flagship species.

Model	*No. of parameters*	*Log likelihood*	*AIC*	*BIC*	*AIC3*
MNL	6	−1195.3	1.412	1.433	1.424
LCM2	14	−1165.3	1.386	1.431	1.417
LCM3	22	−1138.4	1.364	1.434	1.414
LCM4	30	−1119.2	1.350	1.446	1.419

Abbreviations: AIC, Akaike's information criterion; BIC, Bayesian information criterion; AIC3, modified Akaike's information criterion with 3 as penalty factor; MNL, multinomial logit; LCM, latent-class model.

Table 4. Comparison of species rankings obtained by plurality flagship-species vote and by the flagship-suitability model (adjusted to exclude the attribute geographic distribution, which was not in the plurality flagship-species vote).

Species	*Election votes*	*Model probability*	*Election rank*	*Model rank[a]*
Orange-bellied Antwren	58	0.482	1	2°
Seven-colored Tanager	49	0.439	2	4°
Chestnut-bellied Seed-Finch	47	0.429	3	5°
Brazilian Tanager	22	0.475	4	3°
Golden-tailed Parrotlet	17	0.521	5	1°

[a] *Relative rank for the 4 species used in the selection.*

class per school year), 36 high school students in the last 2 years of their primary teacher qualification course, and 18 high school teachers. The sample from rural communities was 52% male and 48% female, and a median age was 32 years. The respondent sample from high school students and teachers was 63% and 71% female, respectively. This imbalance reflects a wider trend in the education system of the state and country (INEP 2009). For students the median age was 17 years while for teachers it was 29 years.

The multinomial logit analysis, which considered the respondents as a single group, showed that all attributes were statistically significant except geographic distribution (Table 2). The latent-class model, which we used to develop the flagship-suitability model, showed the respondents were best split into 3 groups on the basis of statistical fit and group membership (Scarpa & Thiene 2005) (Table 3).

Group 1, which made up 40% of respondents and was most likely to include high school students, preferred species with appealing aesthetics, small population size, and small geographic distribution that could not survive in captivity. Group 2, which made up 17% of respondents and was most likely to include respondents from rural communities, preferred species with large population sizes that could not survive in captivity. Group 3, which made up 43% of respondents and was most likely to include people from rural communities, preferred species with appealing aesthetics and high visibility that could survive in captivity. A group of 11 species shared the highest overall flagship suitability score. These species included the Squirrel Cuckoo (*Piaya cayana*), Flavescent Warbler (*Basileuterus flaveolus*), and the Rufous-tailed Jacamar (*Galbula ruficauda*). The Orange-bellied Antwren, the previous flagship species, ranked number 142.

Plurality Flagship Vote

In the plurality flagship vote respondents preferred the Orange-bellied Antwren (30%), followed closely by the Seven-colored Tanager (29%). Percent selection of other species was much lower (Table 4). Awareness was not related to preference because the 2 species selected the most were among the 3 least recognized by respondents.

Discussion

Flagship species are key components of campaigns to fund-raise or change behavior for conservation. Nonetheless, many conservation organizations still use ad hoc processes to select flagships, which may result in less

effective marketing campaigns. Our case study from the Serra do Urubu in Brazil is the first to follow an evidence-based and audience-driven framework to select a flagship species. Through our evidence-based and audience-driven methods to select a flagship species it was possible to determine, on the basis of preferences of the target audience, which of the 221 bird species of the Serra do Urubu had the greatest potential to be a successful flagship. Moreover, because we went beyond use of aggregate models, we provided information on audience heterogeneity. Such information will allow the development of better flagship suitability models.

Flagship-Suitability Model

The flagship-suitability model uncovered a range of preferences across the different target audience groups. Aesthetics was important for groups 1 and 3, which made up the large majority of the respondents (Table 2). This result is consistent with results of previous studies on flagship-species selection (Smith et al. 2012) and on human preferences for different bird species (e.g., Stokes 2007; Veríssimo et al. 2009), although these studies focused on audiences from developed countries. Population size was an important attribute for the majority of respondents, namely groups 1 and 2, although these groups showed opposite preferences (Table 2). Group 1 preferred species with small population sizes, consistent with results of previous studies in other locations (Bandara & Tisdell 2005; Home et al. 2009), whereas group 2 preferred species with larger populations. This difference in preference between groups could be related to loss aversion and a consequent "regret minimization strategy," whereby respondents try to minimize losses and therefore prefer to avoid losing a currently abundant species (Tversky & Kahneman 1991).

Geographic distribution was relevant only for group 1 (40% of respondents) (Table 2). Respondents in this group preferred species with smaller distributions, a finding consistent with results of previous studies (Meuser et al. 2009; Veríssimo et al. 2009). The visibility of a species was relevant for group 3 (50% of respondents) (Table 2). This result mirrors previous results showing the importance of this trait for tourism flagship species (Kruger 2005; Veríssimo et al. 2009). The importance of survival in captivity, the only attribute considered relevant by all 3 groups, was expected because keeping birds in a cage (i.e., cage birds) is culturally important in this part of Brazil. However, preferences for this attribute also showed opposing results. Groups 1 and 2 preferred species that could not survive in captivity, perhaps because they perceived these species as more fragile and thus more of a conservation priority, whereas group 3 preferred species that could be kept in captivity. Respondents in group 1 were significantly more likely to opt out of the choices posed in our survey, which could be because this group most likely consisted of high school students who did not have one-on-one supervision while responding to the survey, unless they requested it. This was not ideal because surveyors were unable to follow each respondent and individually document difficulties in making choices. Nonetheless, all respondents were told to discuss any difficulties in answering the survey with the surveyors, and none of them raised the issue.

This detailed information on the preferences of different groups within the target audience illustrates the advantages of using a latent-class model because it highlights differences and conflicts in preferences, something that can be critical for the development of a conservation marketing campaign. It also allows relative assessment of preferences for each attribute in every group because the attribute coefficients indicate the marginal increase in preferences for the levels of each attribute. Moreover, the model can be used to predict group membership for a new respondent on the basis of socioeconomic variable coefficients and the probability of group membership.

This more detailed information on audience preference structure also allows for the detection of which species' characteristics are relevant only for minority groups within a target audience, subgroups that may appear unimportant in an aggregate analysis. For example, the attribute geographic distribution was not significant in the multinomial logit model but was important for group 1 in the latent-class model. The latent-class models also provided the relative size of each audience group and identified the demographic composition of the different audience groups. For example, group 3, which was made up of respondents from rural communities, had a preference structure that revolved around the more utilitarian attributes of visibility and survival in captivity. However, group 1, which mainly consisted of high school students, put more emphasis on attributes related to conservation, such as population size and geographic distribution. This kind of information is key to effective targeting of campaign messages. One caveat to our methods was that by not including an explicit no-choice option, some respondents may have felt forced to choose between 2 options they would have otherwise refused. We believe this was not an issue in our study because selecting flagship species is a relatively benign choice. However, in other contexts it may be important to use qualitative methods as part of the survey design (e.g., focus groups) to identify in advance potentially problematic issues.

That the Orange-bellied Antwren ranked 142 indicated this species was not the best flagship species. Although the flagship suitability score should be used largely as a guide, that this method produced a flagship-suitability ranking for all bird species allowed for a better understanding of the effect of different trade-offs between, for example, audience preference and particular species traits relevant to donors. Moreover, results of this

evidence-based process of flagship selection provide insights into the preferences of the different groups within the target audience and thus improve the potential for marketers to identify audience segments and tailor campaigns accordingly. For instance, this information could be used to reduce costs by identifying when promotional resources are best shared between marketing campaigns. Similarly, when species preferences differ, information on group preferences can be used to emphasize different flagship species or different flagship attributes to different audience groups.

Plurality Flagship Vote

The results of the plurality flagship vote were unexpected because the Orange-bellied Antwren received the most votes, despite doubts of the previous project team as to its suitability as a flagship species. This result may have occurred because the species was the only candidate with traits that were seen as particularly important by the target audience, which then masked any trade-offs between attributes. The Orange-bellied Antwren was the least recognized species, and this also raises questions about the effect of awareness on preference in this context. Awareness is a key factor in commercial marketing (Macdonald & Sharp 2000) and in flagship-species selection (Bowen-Jones & Entwistle 2002). Our findings may have differed because the plurality vote was designed to be compared with the choice experiment, so we provided information on species characteristics to the respondents to enable a more accurate comparison and avoid other sources of variation (Fig. 2). This is in contrast to most other voting systems in which respondents are provided only with candidate names and photos and so may select candidates with which they are most familiar (Baker et al. 1986). For example, a recent online voting process to identify a flagship species for the Atlantic Forest of northeastern Brazil (AMANE 2011) asked respondents to select 1 of 3 species only on the basis of their names and photographs. The Seven-colored Tanager was selected the most. We included this species in our plurality vote, and it was well known by participants in our study. So, awareness is probably more important in flagship voting processes that provide limited information about the species and may lead respondents to use awareness as a guide when choosing their preferred candidate.

Species rankings obtained through the 2 methods differed substantially (Table 4). None of the 5 species had the same ranking, probably because the 2 methods measured preference in different ways. A plurality vote requires respondents to choose one item within a set. The item with the most votes is then selected. However, this pluralist method, although widely used by conservationists to gather information on target-audience preferences (e.g., Ward 2004; AMANE 2011; NCHS 2011), is one of the least robust ways to reveal true preferences (Merrill 1984; Nurmi 1992). Another constraint of this system is that it involves preselecting a subset of candidate species, which can distort the results by accidentally leaving out a potentially preferred species or including a homogeneous set of candidate species and so reducing choice. The latter is especially likely if the selection of candidate species is based only on conservation criteria because selection by conservationists is often driven by biological aspects that could be secondary for a given target audience. Another problem with plurality voting in general is that it provides no information on the factors that drive choice, which means results of such selections are opaque and less easy to apply.

In contrast, discrete-choice experiments allow for the development of models that capture audience preference heterogeneity, which is why marketers have long favored these approaches over analyses that are based on ratings and rankings (Louviere et al. 2010). Applying this method to flagship-species selection is technically more complex but allows the adoption of a much broader set of candidate species because it focuses on traits rather than the species themselves. In our case, this allowed us to select a species with the preferred profile and give us the flexibility to select any suitable candidate. Thus, flagship-species suitability models have the potential to better inform conservation campaigns by providing more detailed and accurate data on audience preferences. Further research is needed to test whether this method can work across highly heterogeneous taxa, where attributes have to be more general and so result in less detailed information on the preference structure of the target audience. An experimental approach could be used to clarify the degree to which these theoretical differences in preference assessment produce differences in flagship-species selection and subsequent campaign effect.

Biological diversity conservation is only effective when accounting for human behavior, so understanding human preferences is crucial. By adapting marketing principles to address conservation challenges, we designed an evidence-based approach for selecting conservation flagship species. Our methods provide information for tailoring flagship campaigns to match the preferences of a target audience. Such an approach will allow the conservation community to develop more successful fundraising and behavior-change campaigns that better resonate and engage with stakeholders.

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Supporting Information

Supplemental methods, modeling, and analyses (Appendix S1) are available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

Literature Cited

AMANE (Associação para Proteção da Mata Atlântica do Nordeste). 2011. Concurso promovido pela Conservação Internacional escolhe espécies-símbolo para projeto na Mata Atlântica e no Cerrado. AMANE, Recife, Brazil. Available from http://www.amane.org.br/detalheNoticias.asp?cod=137 (accessed August 2012).

Baker, W., J. W. Hutchinson, D. Moore, and P. Nedungadi. 1986. Brand familiarity and advertising: effects on the evoked set and brand preference. Advances in Consumer Research **13:**637–642.

Bandara, R., and C. Tisdell. 2005. Changing abundance of elephants and willingness to pay for their conservation. Journal of Environmental Management **76:**47–59.

Barua, M., M. Root-Bernstein, R. Ladle, and P. Jepson. 2011. Defining flagship uses is critical for flagship selection: a critique of the IUCN climate change flagship fleet. AMBIO **40:**431–435.

Bateman, I. J., B. Fisher, E. Fitzherbert, D. Glew, and R. Naidoo. 2010. Tigers, markets and palm oil: market potential for conservation. Oryx **44:**230–234.

Bencke, G. A., G. N. Maurício, P. F. Develey, and J. M. Goerck. 2006. Áreas importantes para a conservação das aves no brasil. Parte I – Estados do domínio da Mata Atlântica. SAVE Brasil, São Paulo.

Bowen-Jones, E., and A. Entwistle. 2002. Identifying appropriate flagship species: the importance of culture and local contexts. Oryx **36:**189–195.

Caro, T. 2010. Conservation by proxy: indicator, umbrella, keystone, flagship, and other surrogate species. Island Press, Washington, D.C.

Chiang, W.-y. K., D. Zhang, and L. Zhou. 2006. Predicting and explaining patronage behavior toward web and traditional stores using neural networks: a comparative analysis with logistic regression. Decision Support Systems **41:**514–531.

Filho, J. A. S., and M. Tabarelli. 2006. Bromeliad species of the Atlantic Forest of north-east Brazil: losses of critical populations of endemic species. Oryx **40:**218–224.

Hastings, G. 2007. Social marketing: Why should the devil have all the best tunes? Elsevier, Oxford, United Kingdom.

Home, R., C. Keller, P. Nagel, N. Bauer, and M. Hunziker. 2009. Selection criteria for flagship species by conservation organizations. Environmental Conservation **36:**1–10.

Hope, R. A. 2006. Evaluating water policy scenarios against the priorities of the rural poor. World Development **34:**167–179.

INEP (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira). 2009. Sinopses estatísticas da Educação Básica. Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira, Brasília, Brazil. Available from http://www.inep.gov.br/basica/censo/Escolar/Sinopse/sinopse.asp (accessed August 2012).

IUCN (International Union for Conservation of Nature). 2010. IUCN red list of threatened species. Version 2010.1. Available from http://www.iucnredlist.org (accessed August 2012).

Jaeger, S. R., and J. M. Rose. 2008. Stated choice experimentation, contextual influences and food choice: a case study. Food Quality and Preference **19:**539–564.

Jenks, B., P. W. Vaughan, and P. J. Butler. 2010. The evolution of Rare Pride: using evaluation to drive adaptive management in a biodiversity conservation organization. Evaluation and Program Planning **33:**186–190.

Kotler, P., and N. R. Lee. 2008. Social marketing: influencing behaviors for good. Sage Publications, Thousand Oaks, CA.

Kruger, O. 2005. The role of ecotourism in conservation: Panacea or Pandora's box? Biodiversity and Conservation **14:**579–600.

Louviere, J., T. Flynn, and R. Carson. 2010. Discrete choice experiments are not conjoint analysis. Journal of Choice Modelling **3:**57–72.

Macdonald, E. K., and B. M. Sharp. 2000. Brand awareness effects on consumer decision making for a common, repeat purchase product: a replication. Journal of Business Research **48:**5–15.

Mangham, L. J., K. Hanson, and B. McPake. 2009. How to do (or not to do) . . . Designing a discrete choice experiment for application in a low-income country. Health Policy and Planning **24:**151–158.

Merrill, S., III. 1984. A comparison of efficiency of multicandidate electoral systems. American Journal of Political Science **28:**23–48.

Meuser, E., H. W. Harshaw, and A. O. Mooers. 2009. Public preference for endemism over other conservation-related species attributes. Conservation Biology **23:**1041–1046.

NCHS (North Carolina Herpetological Society). 2011. We need your help! NCHS, Raleigh. Available from http://www.ncherps.org/state_amphib_poll.shtml (accessed October 2012).

Nurmi, H. 1992. An assessment of voting system simulations. Public Choice **73:**459–487.

Pereira, G. A., and M. T. Brito. 2005. Diversidade de aves silvestres brasileiras comercializadas nas feiras livres da Região Metropolitana do Recife, Pernambuco. Atualidades Ornitológicas **126:**14–20.

Scarpa, R., and M. Thiene. 2005. Destination choice models for rock climbing in the northeastern alps: a latent-class approach based on intensity of preferences. Land Economics **81:**426–444.

Simberloff, D. 1998. Flagships, umbrellas, and keystones: Is single-species management passe in the landscape era? Biological Conservation **83:**247–257.

Smith, R. J., D. Veríssimo, N. J. B. Isaac, and K. E. Jones. 2012. Identifying Cinderella species: uncovering mammals with conservation flagship appeal. Conservation Letters **5:**205–212.

Smith, R. J., D. Veríssimo, and D. C. MacMillan. 2010. Marketing and conservation: how to lose friends and influence people. Pages 215–232 in N. Leader-Williams, W. Adams, and R. Smith, editors. Trade-offs in conservation: deciding what to save. Blackwells, Oxford, United Kingdom.

Stokes, D. L. 2007. Things we like: human preferences among similar organisms and implications for conservation. Human Ecology **35:**361–369.

Tversky, A., and D. Kahneman. 1991. Loss aversion in riskless choice: a reference-dependent model. The Quarterly Journal of Economics **106:**1039–1061.

Veríssimo, D., I. Fraser, R. Bristol, J. Groombridge, and D. MacMillan. 2009. Birds as tourism flagship species: a case study on tropical islands. Animal Conservation **12:**549–558.

Veríssimo, D., D. C. MacMillan, and R. J. Smith. 2011*a*. Marketing diversity: a response to Joseph and colleagues. Conservation Letters **4:**326–327.

Veríssimo, D., D. C. MacMillan, and R. J. Smith. 2011*b*. Toward a systematic approach for identifying conservation flagships. Conservation Letters **4:**1–8.

Walpole, M. J., and N. Leader-Williams. 2002. Tourism and flagship species in conservation. Biodiversity and Conservation **11:**543–547.

Ward, D. 2004. Humankind's favourite animal is a tiger. The Guardian. Available from http://www.guardian.co.uk/uk/2004/dec/06/davidward (accessed October 2012).