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https://doi.org/10.1111/cobi.13523
Efectos de los Memes Divertidos sobre el Interés por las Especies Poco Atractivas

Lenda et al.

19-295

Palabras clave: especie amenazada, humor, memes de internet, mercadotecnia de la conservación, mono násico, políticas de conservación, redes sociales, Tendencias de Google

Resumen. El conocimiento existente sobre los mecanismos que pueden incentivar el interés y la participación de las personas en la protección de especies poco populares y poco atractivas actualmente es limitado. Analizamos el interés del pueblo polaco por algunos memes temáticos de internet en los que aparecía el mono násico (*Nasalis larvatus*) y la relevancia que tiene este interés para la mercadotecnia de la conservación. Examinamos los datos en Tendencias de Google, usamos el buscador de Google y buscamos entre los materiales populares en los medios digitales para estimar el interés por el mono násico en Polonia. Las fotografías del mono násico, al ser presentadas con humor en los memes, atrajeron tal nivel de interés como lo hacen otras especies generalmente más populares (p. ej., koalas, panda, orangután) usadas por organizaciones no gubernamentales en su publicidad. Los memes divertidos de distribuidos en las redes sociales tuvieron una correlación positiva con el aumento en el interés por especies poco atractivas, como el mono násico. El interés por estos memes divertidos también tuvo una correlación positiva con las decisión individual de donar a seis acciones de financiación colectiva. Por lo tanto, la mercadotecnia de la conservación que incluye memes divertidos o graciosos y a las redes sociales puede proporcionar un complemento provechoso para las campañas tradicionales y es probable que influya sobre aquellos individuos a los que los medios tradicionales no suelen generar efecto alguno.

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/cobi.13523.

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**Effects of amusing memes on concern for unappealing species**

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**Keywords:** conservation marketing, conservation policy, Google Trends, humor, internet memes, proboscis monkey, social media, threatened species

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Article Impact Statement: Amusing memes published in social media are useful in conservation marketing.

Abstract
There is limited knowledge of the mechanisms that can inspire people’s concern and engagement in the protection of unpopular and unappealing species. We analyzed Polish people’s interest in themed internet memes featuring the proboscis monkey (*Nasalis larvatus*) and the consequences of this interest for conservation marketing. We examined Google Trends data, used Google Search, and searched popular media materials to estimate interest in the proboscis monkey in Poland. Photos of the proboscis monkey when presented with humor in internet memes attracted as much interest as usually more popular species (e.g., koala, panda, orangutan) used in marketing by nongovernmental organizations. Amusing internet memes spread by social media positively correlated with increasing interest in the unappealing species, such as proboscis monkey. Interest in amusing internet memes positively correlated with individuals’ decisions to donate to 6 crowdfunding actions. Thus, conservation marketing that includes amusing memes and social media may provide a worthwhile complement to traditional campaigns and are likely to influence individuals who are unaffected by the usual means.

Introduction
The continued existence of threatened species often depends on conservation programs (Stokes 2006; Colleony et al. 2017). Support for such programmes depends on the available information and may be influenced by individual decision-making, emotions, or...
biases (e.g., in visual perception) (Fleming & Bateman 2016; Colleony et al. 2017; Verissimo et al. 2018). For example, people often show positive attitude toward species that look similar to human infants, in particular, those with a big head in relation to the rest of the body, large eyes, and a small nose (Estren 2012; de Pinho et al. 2014). Conservation organizations take advantage of such preferences (e.g., World Wildlife Fund [WWF]) in their promotional materials aimed at encouraging support for conservation (Verissimo et al. 2017; 2018).

However, the majority of threatened species are unknown to the public or do not look infant like. Consequently, gaining the public’s interest and financial support for the conservation of unappealing species, or those sometimes literally called ugly, is far more difficult (Estren 2012; Smith et al. 2012; Colleony et al. 2017). Conservation of such species may require nonstandard actions, and the efficiency of such actions may be enhanced with marketing strategies (Kidd et al. 2018). One possible way to promote unknown and unpopular species (Kidd et al. 2018) is by using humour-oriented marketing techniques in social media, which are known from business marketing (Eisend 2009). The role of satire in saving species and habitats has been suggested (Chapron et al. 2018, Ripple et al. 2018), and there have been a few attempts to apply humour to promote so-called ugly species, such as The Ugly Animal Preservation Society (O'Callaghan 2013). Nevertheless, evidence that humour in social media can be used to promote species and conservation is limited.

Social media (e.g., Facebook, Twitter) makes extensive use of visually oriented forms of communication; one of particular popularity is the meme. The term meme was coined by Dawkins (1976), who proposed an evolutionary model of cultural change and development grounded in the replication of ideas and knowledge through imitation and cultural transfer. The concept was later adopted by internet users, and it generally describes the rapid uptake and spread of particular ideas presented as written text, images, movies, or other media on the
internet that go viral (Knobel & Lankshear 2007). Internet viral memes spread through replication in social networks, have certain longevity, and mutate over time (Knobel & Lankshear 2007). We applied a narrower definition of internet memes (used interchangeably with memes): digital images (often containing text) created for the purpose of communication.

We examined the possible role of amusing memes in generating interest in unappealing species and the differences in the perceived emotional context between amusing memes and traditional campaigns of conservation nongovernmental organizations (NGOs). In particular, we studied the possible dissemination of conservation-relevant information regarding threatened species via memes and the association of increased interest in amusing themed memes with individual decisions to support conservation-oriented crowdfunding actions.

We analyzed interest in the proboscis monkey in Poland and in amusing themed memes of this species (hereafter amusing memes) (Supporting Information). The proboscis monkey (Nasalis larvatus) was voted in the British Broadcasting Company’s ranking as one of the ugliest animals in the world (Bates 2013; Marshall 2016). It is listed as endangered species on the International Union for Conservation of Nature Red List, and is endemic to the Southeast Asian island of Borneo. Its total population has decreased by more than 50% in the last 5 decades due to ongoing loss of habitat and hunting (Sha et al. 2008). The species was little known to the general audience of Poland prior to 2016 when the first amusing memes appeared (Fig. 1). We collected data from Google Search, Google Trends, Google Graphics, Facebook, and media articles to test the following hypotheses: increasing interest in the proboscis monkey in Poland correlates with the interest in the amusing memes (hypothesis 1) (Supporting Information); interest in proboscis monkeys is relatively higher.
in Poland than in the species’ range states when compared with a group of typically popular species (hypothesis 2) (Supporting Information); interest in social media profiles with amusing memes involving proboscis monkeys is greater than that in NGO social-media profiles devoted to nature conservation and the monkey (Supporting Information) (hypothesis 3); perceived emotional context of amusing memes differs from the context of traditional campaigns of species conservation performed in social media by NGOs (hypothesis 4) (Supporting Information); and interest in the amusing themed memes coincides with the occurrence of conservation crowdfunding actions (hypothesis 5) (Supporting Information).

Methods

We collected data from Google, Facebook, and media articles. In Poland and other studied countries the Google family of services has very high coverage (estimated market share >95% [Supporting Information]). Facebook had 2.2 billion and 14 million monthly active users worldwide and in Poland, respectively, in 2017 (Facebook 2018). It is globally the most popular internet social media platform (Supporting Information).

The essential feature of memes is their ability to be replicated by user-induced mutations (Knobel & Lankshear 2007). Therefore, it is crucial to measure the inflow of new memes and meme propagation. For this purpose, we created an index based on the number of proboscis monkey images present in time-restricted search results of Google Search browser for the keyword nosacz (common name of proboscis monkey in Polish), and we restricted results to images. Based on the index, we constructed a time series (at a monthly frequency) representing the intensity of the meme-generating process. The index was based on classification of relevant images as memes, according to the definition of meme (classification method in Supporting Information). We refer to this index as the meme index.
We used Google Trends to measure how often a particular search item was entered into Google Search browser relative to the total search volume. Time series obtained from this tool are informative for determining the dynamics of society’s demand for information (Vlastakis & Markellos 2012) about a species and may be a measurement of interest (e.g., Nghiem et al. 2016). We filtered the Google Trends index by turning the “animals” category on to avoid homonyms and restricted trends to a relevant country and language to avoid a geolocation effect in results obtained from Google Trends. The term nosacz has no alternative meaning in commonly used Polish vocabulary.

We analyzed regional differences in the interest in proboscis monkey and compared interest in proboscis monkey with interest in related species. We compared interest in the proboscis monkey determined from Google Trends interest in Poland with the interest in the region where it is indigenous (all 3 countries on Borneo island: Malaysia, Indonesia, and Brunei) and with interest in English-speaking population of internet users. We checked how interest has changed with the publication of amusing monkey memes in Poland. We used the species’ Polish name to check for interest in Poland. For Borneo we used the Indonesian and Malaysian (bekantan) and Brunei (bangkatan) words for the species and restricted the region to the relevant country. We used the English proboscis monkey to estimate interest in the species globally. Using Google Trends, we also checked whether the appearance of amusing memes was associated with the interest in Poland in 2 other primates, uakari (Cacajao calvus) and Yunnan snub-nosed monkey (Rhinopithecus bieti), which sometimes appear in such memes.

We also checked how many times the proboscis monkey could be found in Google Search browser in Poland in Polish and worldwide in English. We compared the Google Search browser search results for proboscis monkey with 5 popular species used by WWF in
crowdfunding: macaques, orangutans, gorillas, pandas, koalas. The latter 2 are not primates, but they are 2 of the most popular species used for crowdfunding by WWF globally (Supporting Information). We used the same procedure for other animal names (Supporting Information). To collect the data from the Google Search browser, we used filters recommended by Google to get an accurate count for up to 1 million documents and to avoid duplications to improve data quality (procedure in Supporting Information). We also conducted a search with this set of species to see if there were differences in the interest over time among these species based on data from Google Trends in Poland and worldwide. To avoid geolocation effect in data from Google searches in global searches, we applied the "global search area" filter and collected data from 2 different computers in Poland and 2 different computers in Australia. For data collection from Google Search browser in Poland, we restricted the search area to Poland and performed the search with 2 different computers in Poland and 2 different computers in Australia.

We used Facebook to collect data on relative interest in the amusing proboscis monkey memes compared with the interest in the memes published on conservation NGO Facebook webpages. The Facebook data allowed us to construct an alternative measure of interest in the species in social media based on the number of people who followed proboscis monkey profiles on Facebook, regardless of their purposes. There were 2 types of proboscis monkey profiles in Facebook: amusing proboscis monkey profiles and profiles dedicated to the protection of the species (referred to as official monkey profiles) developed by organizations, such as WWF Poland and Polish Greenpeace. The list of profiles with amusing proboscis monkey and official monkey profiles in English are in Supporting Information. Facebook allows members to share, publish, comment on, exchange content uploaded by people throughout the world,
and express opinions by clicking like. Since mid-2016, users can also express other opinions toward posts or images with 5 other emoticons: love, haha, wow, sad, and angry. We used the number of followers and the number of people who clicked like for a single meme as a gauge of interest (Cristofaro et al. 2014) in published memes; that is, as a measure of the effectiveness in gaining users’ attention. We used the number of likes as in Cristofaro et al. (2014) and because they have been used by Facebook users since 2004. Emoticons were relatively new in 2017, so there had not been sufficient time for people to become familiar with them.

We compared all 6 types of emoticons assigned by Facebook users with the memes of the cute species presented in the profiles of WWF Poland (https://www.facebook.com/WWFpl/) with the 6 types of emoticons assigned to the most well-known amusing profile of the proboscis monkey in Poland (Nosacze Polskosći). We refer to these WWF memes as cute WWF memes, and they pertain only to memes on WWF Poland’s Facebook profile. In addition to the analyses of Google and Facebook data, we analysed differences in the number of media releases involving information about the proboscis monkey in Poland (through various search engines) over time. We searched all content in traditional Polish media, such as newspapers, radio, and television, for information about proboscis monkeys released from 2004 to 2018. Since 2004, the largest traditional media sources in Poland publish their content online. We noted the dates of publication, names of the sources, and keywords in Polish that occurred in the text. The keywords were nosacz, nosacz sundajski (full name of the species in Polish), mem (meme), Borneo, and media URLs for identification. We also marked the cases where the species (or its images or memes) was explicitly referred to as funny or entertaining. The articles were analyzed to confirm relevance of the keywords.
Finally, we analysed crowdfunding actions related to proboscis monkey conservation emerging from internet websites with amusing memes of the species. We recorded the date of publication and an organizer and whether amusing proboscis monkey profiles promoted donating to the conservation of the species. We also checked how many times Polish people shared information about the crowdfunding action in social media and the amount of collected money. All of the above-mentioned data were publicly available on Facebook and did not include user names.

We used general additive model (GAM) to estimate the temporal changes in the species interest. The regression package segmented in R was used to estimate the breakpoint of the function slope change, corresponding to changes in the index of interest in the species (Muggeo 2008). Associations in Google Trends among different species were tested using nonparametric correlation analysis. Generalized linear mixed models (GLMM) were used to compare the number of Google Search records for different species on the different computers used to perform the searches. Nonparametric correlations were used to compare temporal changes in relative interest among different species based on Google Trends in Poland, worldwide, and in the proboscis monkey’s native countries. We used general linear modeling (GLM) to check the differences in the number of Facebook likes among 30 of the most recent photos or memes published on amusing monkey profiles (3), conservation of proboscis monkey official profiles (3), and conservation of animals in general (2 [WWF and Greenpeace]). We also controlled the time of a day (hour) when the post was published, and this variable was a covariate in the model. The GLM was used to compare the type and number of emoticons associated with memes published in the largest profiles associated with amusing monkey memes and the profile of the largest animal conservation agency, WWF Poland. Data on likes and emoticons collected from Facebook profiles were log transformed to minimize the influence of detached data points. These calculations were based on
Facebook data and were performed with raw data and with data scaled by the number of Facebook users in a given country and by the number of followers of a Facebook profile (Supporting Information). Both procedures gave similar results; thus, we present analyses on raw data in the main text for simplicity. All calculations were performed in R (R Core Team 2017), and formulas for GLMs and GLMMs are in Supporting Information.

Results

Hypothesis 1

The number of memes with proboscis monkeys published in Poland was negligible prior to 2016 and increased afterward (Fig. 1). The first proboscis monkey-themed entertaining internet content appeared in April 2016, and meme mutation and propagation behaviour appeared in August 2016. The largest relative increase in the meme index was in January 2017. Google Trends index of interest in the proboscis monkey in Poland was negligible prior to 2016 and increased afterward (GAM parametric effects: \(F=55.477, \text{df}=1, \ p<0.001;\) GAM nonlinear effects: \(F=35.053, \text{df}=5, \ p<0.001, \ R^2=0.98;\) segmented regression breakpoint July-August 2016) (Fig. 1). The indices displayed strong cotrending (Kendal correlation coefficients, \(\tau=0.905, \ p<0.001\) (Fig. 1). The increase in the number of traditional press articles about proboscis monkeys followed the number of amusing memes with proboscis monkeys (\(\tau=0.874, \ p<0.001\) (Fig. 1). Two species (uakari and Yunnan snub-nosed monkey), often co-occurring with the proboscis monkey in memes, also gained interest in Poland, and this data from Google Trends correlated with data on the proboscis monkey (Kendall correlation coefficients between the proboscis monkey and uakari: \(\tau=0.396, \ p<0.001;\) between the proboscis monkey and Yunnan snub-nosed monkey: \(\tau=0.239, \ p<0.001\) [Supporting Information]) but not with data on each other (\(\tau=0.022, \ p=0.317\).
Hypothesis 2

The Google Trends index of interest in the proboscis monkey was constant among English-speaking global users (Kendal tau = 0.087, \( p = 0.242 \)) of the internet and among Indonesia internet users (\( \tau = -0.041, p = 0.581 \)), but the index value increased among Malaysia users (\( \tau = 0.360, p = 0.001 \)), where the proboscis monkey is native (Supporting Information). In contrast, in Poland the interest in the proboscis monkey increased after 2016 (before 2016: \( \tau = 0.398, p < 0.001 \); after 2016: \( \tau = 0.909, p < 0.001 \)) (Fig. 1 & Supporting Information). In Poland interest in proboscis monkey was at least as high as interest in species typically used by WWF in crowdfunding (Fig. 2).

Similar results were achieved when we compared Google Search volume among the considered animals within Poland (GLMM \( F = 10.01, df = 9, 70, p < 0.001, R^2 = 0.59 \)) (Fig. 3), although the search volume for koalas (estimate = 1846432 [SE 705967], \( p = 0.011 \)) and pandas (estimate = 2200560 [SE 705967], \( p = 0.003 \)) were the highest (Fig. 3). In the global analysis, we found very low search volume on Google Search browser for the proboscis monkey compared with other species (GLMM \( F = 9.364, df = 9, 70, p < 0.001, R^2 = 0.599 \)) (Figs. 2 & 3).

Hypothesis 3

The Facebook profiles featuring the amusing monkey memes had a fewer followers than the Facebook profiles of WWF Poland and Greenpeace and many more followers than the official profiles dedicated to the conservation of proboscis monkey in English and Malay (Supporting Information). The amusing monkey memes had similar numbers of likes as the official memes dedicated to the conservation of nature released by WWF Poland and Greenpeace (GLM \( F = 264.92, df = 7, 219, p < 0.001, R^2 = 0.65 \)) (Fig. 4 & Supporting Information). The effect of time of day on the number of likes was not significant (estimate =
0.011 [SE 0.021], GLM $F= 0.408, \text{df} = 1, 219, p= 0.503$). However, amusing monkey memes had, on average, statistically more likes than official monkey memes published on the Facebook profiles of the organizations focused on the conservation of the species in English and Malay (Fig. 4 & Supporting Information).

**Hypothesis 4**

Traditional media in Poland described the proboscis monkey memes as amusing (22 cases out of 38, none before 2016). When we compared the emoticons associated with 30 amusing monkey memes presented and 30 WWF memes with popular species, we found the former were more associated with emotions haha and like than with the latter (interaction terms between the emoticon type and webpage type in GLM: $F = 141.745, \text{df} = 5, 348, p< 0.001, R^2 = 0.72$) (Fig. 5). Overall, the number of recorded emoticons was larger for the amusing monkey memes published by the largest humouristic profile than any meme in the profile of WWF Poland (effect of webpage type in GLM, $F = 50.449, \text{df} = 1, 290, p< 0.001, R^2 = 0.61$; estimate for WWF Poland = - 0.82 [SE 0.09]).

**Hypothesis 5**

We found 38 media releases about the proboscis monkey in Poland, and the number of these publications increased following interest in the amusing memes (Fig. 1). The 5 articles published before 2016 were not related to amusing memes of the proboscis monkey. Thirty-two media releases after 2016 were linked to the amusing memes. Twenty-two media articles provided information about the biology, ecology, conservation status, and threats to the proboscis monkey. There were 6 crowdfunding actions organized relative to the amusing profiles of the proboscis monkey in Poland, all started in 2018. They raised funds for the species’ conservation in Borneo (Table 1) and collected PLN2,318 (~US$610) from 218 donors (Table 1).
Discussion

There has been a large debate about what kind of methods may work best to make conservation marketing more popular, although there is still not enough evidence (Sutherland et al. 2018). Multimedia campaigns using theatre, film, print media, and discussions may help primate conservation because they can increase societal awareness of endangered species (Sutherland et al. 2018).

We found that the proboscis monkey’s popularity increased in Poland and correlated with people’s interest in amateur memes that appeared in social media. We suggest the memes could help gain widespread attention for proboscis monkey protection. The increasing interest in amusing memes with proboscis monkeys was also evident in the general search volume for the species’ name. Our findings are consistent with those of Kidd et al. (2018), which suggests that increased presence of an unpopular species on social media may increase people’s interest in protecting unpopular threatened species. We found that an increase in interest in amusing memes in Poland was correlated with a subsequent increase in traditional media reporting about the proboscis monkey (with a 1-year lag). This suggests that internet memes can generate interest in subjects that are later picked up in traditional media.

Similarly, the rise of such trends regarding uakari and the Yunnan snub-nosed monkey suggests they are benefitting from the increased interest in proboscis monkey. The powerful impact of memes on the worldwide interest in species (as measured with the Google Trends index) has also been noted in association with gorillas. This happened after a child fell into a gorilla’s enclosure in a zoo (Judah 2017) and the gorilla was euthanized for safety reasons (Fig. 2).

Our study has revealed that in contrast to Poland interest in proboscis monkey has been relatively low and constant among English-speaking internet users and users in...
countries where the species is native, Indonesia and Malaysia. This is to some extent contradictory of the finding that people expect charitable donations to have more impact on nearby rather than faraway targets (Touré-Tillery & Fishbach 2017) and tend to donate to local causes (Schlegel & Rupf 2010). Our results are promising in that they show how a good marketing action may possibly break distance-related biases in the conservation propensities of people. Moreover, we have found that the interest in proboscis monkeys has increased so much in Poland that it currently exceeds interest in orangutans, gorillas, even koalas, and pandas, species typically used in marketing by the WWF.

The profiles of WWF and Greenpeace were of higher interest in social media than the amusing monkey profiles. However, interest in the amusing proboscis monkey memes were of similar interest to the cute WWF memes. The strength of the amusing social media profiles featuring the proboscis monkey is also striking when the number of its Facebook followers is compared with the interest in the official monkey profiles. One might think comparisons of the interest in amusing profiles to serious, official profiles are a mistake because the audience is different. However, regardless of their purpose, memes that gain more people’s reactions increase interest in the featured species.

Amusing monkey memes gained similar or higher levels of positive emotional responses and more responses than the memes with cute species in the WWF Facebook profile. This suggests the positive emotions associated with the animal and the amusing way of showing the species may be effective in persuading people to be interested in the conservation of even very geographically distant species. Cavanaugh et al. (2015) found that positive emoticons, such as love, increase donations from people who would otherwise be geographically distant and unconnected because such emotions generated a feeling of connection, regardless of geography. According to a study by Dyck and Coldewin (1992), a
positive picture of a child leads to higher than average donation than a negative picture of a child.

The increasing popularity of the proboscis monkey in Poland can be explained not only by the humour, but also by face-ism, the Zajonc effect, and humouristic identification with the species due to storytelling. In the Zajonc effect, frequent exposure to an image of an ugly species in media can decrease the subjective mental impression of its ugliness and can induce sympathy toward the species (Zajonc 1968). Proboscis monkeys in Polish amusing memes are also usually shown with a high face-to-body ratio, which is characteristic for face-ism but is rarely used in nature photography. This may generate more positive attitudes and ratings with regard to intelligence and physical appearance than photos with lower face prominence (Archer et al. 1983). Using many pictures of the species, mostly taken in native habitats, in different poses, of different sexes and ages, and performing different types of behaviors and texts creates a kind of continued story of a typical Pole’s life, where the proboscis monkey has become a kind of character. This is not usual for memes and could be a good example of how storytelling can further conservation (Dahlstrom & Scheufele 2018).

Moreover, the increasing interest in amusing memes of the species inspired the establishment of some amateur donating actions that were advertised on Facebook by profiles featuring the amusing memes. The number of donations has been growing since November 2017, and according to the declarations of the owner of the leading amusing proboscis monkey profile, the money is being transferred to Orangutan Foundation International, a nonprofit organization dedicated to the conservation of wild orangutans, other primates, and their rainforest habitat (https://orangutan.org/). The amount of money collected (US$610) does not seem impressive, but relative to the minimum salary in Indonesia in 2017 (3.35 mln Indonesian Rupiah which is US$246) and considering that it was an unprofessional effort
organised by unknown people without established public trust, it is substantial. This is a typical situation in crowdfunding actions (Gallo-Cajiao et al. 2018). However, the described crowdfunding actions were spontaneous and conducted by amateurs. Future crowdfunding should include professional planning and implementation (Gallo-Cajiao et al. 2018).

Our results present a different point of view to the hypothesis presented by Courchamp et al. (2018), that the frequent presence of a species in media may result in people having less knowledge about the species’ extinction and habitat loss and that there is a reduced probability that people will search for information about its ecology. The media releases about amusing memes with proboscis monkeys usually included information on species ecology. Moreover, searches could result in unintentional finds of ecological and conservation-relevant information.

**Study limitations**

We attach certain reservations to our findings. First, our analyses encompassed the fields of social media, internet marketing, and conservation policy, and there are currently no generally accepted, unambiguous, and common theoretical frameworks or terminology among these fields. Moreover, there are big semantic problems because different authors use terms differently, for example, *popularity, familiarity, charisma, interest*. This is why we used terminology consistently in this article (e.g., *interest*). Google Search browser and Google Trends data may provide inaccurate numbers due to geolocation, homonyms, duplication, counting multiple occurrences of records on the same page. However, they avoid biases in classic psychological questionnaires and experiments (Kemmelmeier 2016) and thus may accurately indicate fluctuations in public interest in various subjects. To increase accuracy of our data, we applied search filters in Google Trends to avoid geolocation and
homonyms. Also, we used filters officially advised by Google to request an accurate result count for up to 1 million search returns and to avoid duplications in Google search engines. Of course, experiments are always the best, but not always possible especially in social sciences at a large spatial extents.

In our internet trend and search-volume data exact numbers may not be accurate, but relative trends reflect reality. People searching for names or items are honest because most of them feel anonymous and do not think anyone will collect data on their activity; thus, there is no investigator effect (Golder et al. 2017). The extent to which our findings can be generalized is unclear. However, our main results regarding temporal trends and from comparisons among species seem resistant to change because for data collected through Google Trends, Google Search browser, and Google Graphics results were the same, even for different parts of the world (Poland and Australia).

**Recommendations**

We formulated 3 practical recommendations. First, easy access to meme-friendly visual content related to endangered species (good quality pictures, animations, etc.) should be provided because the interest in memes may correlate with an increased interest in species as indicated by our results from the meme index and Google Trends data. Second, conservation NGOs should monitor worldwide interest in social media images of endangered species (perhaps using automated algorithms) because we found that a local interest boom associated with proboscis monkey in Poland could result in gains in terms of spontaneous small donations. Third, conservation NGOs should provide trusted connections between donors and beneficiaries of conservation actions even in distant parts of the world, and social media may be appropriate solution to achieve this goal.
Acknowledgments

We acknowledge 5 anonymous reviewers from Conservation Biology for their suggestions. M.L. was financed by Mobilnosc Plus IV, a grant by Polish Ministry of Sciences (1324/1/MOB/IV/15/2016/0); Centre of Excellence for Environmental Decisions, Australian Research Council; Australian Government; and Institute of Nature Conservation, Polish Academy of Sciences (Kraków, Poland). B.M. was financed by National Science Centre, Poland (2017/25/B/HS4/02529). W.J.S. was financed by Arcadia.

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Table 1. Donations for conservation of the proboscis monkey made through Polish Facebook profiles with amusing memes of the species.*

| Name of action                        | Advertised by | Media  | Value (PLN) | Year | Month    | Number of shares on Facebook | Number of people who contributed |
|---------------------------------------|---------------|--------|-------------|------|----------|------------------------------|---------------------------------|
| Nosacz Sundajski                      | Nosacze Polskości | Facebook | 90          | 2019 | February | 10                           | 3                               |
| Uratuj populację Januszy!            | Nosacze Polskości | Facebook | 1290        | 2018 | January  | 2017                         | 136                             |
| Ratuj Janusza Nosacza                 | Nosacze Polskości | Facebook | 11          | 2017 | November | 1                            | 11                              |
| Uratuj Janusza - edycja wiosenna!    | Nosacze Polskości | Facebook | 711         | 2018 | March    | 630                          | 48                              |
| Na ciepłe koce dla Somsiada           | Nosacze Polskości | Facebook | 216         | 2018 | October  | 81                           | 20                              |
| Xiaomi                                | WWF           | all media | NA          | 2018 | September | NA                           | NA                             |

*The URLs to crowdfunding actions are in Supporting Information.*
Figure 1. Frequency of proboscis-monkey related internet content in Poland from 2014 to 2019. The first proboscis-monkey-themed entertaining internet content appeared in April 2016.

Figure 2. Relative changes in the Google Trends index of interest in the proboscis monkey (clear from key) and flagship species in (a) Poland and (b) the world. In (a) data were derived from searches of species names in Polish in sources from Poland. In (b) data were derived from searches of species names in English in English-speaking countries, but no geographical restriction was set. In both cases, the search was restricted to the “animals” category.
Figure 3. Results from Google Search searches on of animals (i.e., existing records with the names of animals in Polish and in English). The numbers above the bars show how many times the name was found on internet pages. Names in Polish come only from Poland, and names in English are from countries where English is the native language. The last two bars are number of people who speak Polish and English (Crystal 2006). The y-axis is logarithmic. The data were collected on 2 February 2019.

Figure 4. Comparison of the number of Facebook likes (log transformed) given to posts with amusing memes of the proboscis monkey on humorous web pages, web pages devoted to conservation of the proboscis monkey, and web pages of the largest conservation organizations (colored dots, data on Facebook likes for the 30 latest posts; black dots, means; whiskers, SE). The data were gathered on 22-24 February 2018.
Figure 5. Comparison of the mean number of Facebook emoticons (log transformed) given to posts with amusing memes of the proboscis monkey in the largest Polish humorous web page, Nosacze Polskości, and web pages of the largest nature conservation organization in Poland, WWF Poland (colored dots, data on Facebook emoticons of the 30 latest posts; black dots, means; whiskers, SE. The data were gathered on 22-24 February 2018.