

LETTER

Information Could Reduce Consumer Demand for Exotic Pets

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Animal welfare; biodiversity conservation; consumer demand; exotic pet match; legality; pet ownership; zoonotic disease.

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Abstract

The global wildlife trade is a growing threat to biodiversity, species conservation and animal welfare. A major driver is consumer demand for exotic pets, and there have been calls for information campaigns to combat this. We created a novel, online survey to assess whether such campaigns could be effective. Our website ‘matched’ individuals with an exotic pet, and asked them to rate how likely they were to purchase one. We manipulated the information shown about each pet, giving either a ‘control’ statement, describing the species’ diet, or one of four types of ‘treatment’ statement describing zoonotic disease, animal welfare, legal or species conservation consequences. Respondents shown disease or legality information had a 39% reduced probability of selecting higher purchase likelihoods. Information on welfare and conservation impacts did not significantly lower purchase likelihoods. Information campaigns may reduce demand for exotic pets, particularly if focused on zoonotic disease and legal consequences.

Introduction

The global trade in wildlife (excluding fisheries and timber) is worth an estimated \$30.6–42.8 billion annually, of which approximately \$22.8 billion is legal (Engler & Parry-Jones 2007), and \$7.8–20 billion illegal (Haken 2011; Pires & Moreto 2011). This trade is a substantial, and growing, threat to global biodiversity, species conservation and animal welfare (Sodhi *et al.* 2004; Grieser-Johns & Thomson 2005; Pires & Moreto 2011; Fernandes-Ferreira *et al.* 2012; Baker *et al.* 2013; Dutton *et al.* 2013; Challender *et al.* 2015).

Demand for pets is a substantial driver of global wildlife trade (cited in 22% of 374 reports on this topic), others including luxury goods and food (35% of reports) and traditional medicine (25%) (Baker *et al.* 2013). Substantial proportions of exotic pets sold in consumer regions (e.g., the United States, the Middle East, South East Asia, South America and the European Union; Haken

2011; Bush *et al.* 2014) are sourced from wild populations. CITES records reveal that 23% of birds and 10% of reptiles legally traded between 2006 and 2010 were wild sourced (Bush *et al.* 2014), as were 64.6% of carnivores and primates traded for commercial and personal purposes from 2006 to 2012, many of which entered the pet trade (Harrington 2015). Animals in the illegal trade are typically poached from the wild (Pires & Moreto 2011) and then distributed through criminal organizations to consumers (Dalberg 2012; Ayling 2013; TRAFFIC 2014; D'Cruze *et al.* 2015). While captive breeding facilities meet some of the global demand for pets, many launder wild-caught individuals into the captive-bred market (Nijman & Shepherd 2009; TRAFFIC 2012). As a consequence, purchasers of exotic pets in consumer regions support, whether knowingly or not, the illegal trade in wildlife (TRAFFIC 2012).

International efforts to address illegal wildlife trade are failing (Pires & Moreto 2011; Dalberg 2012; Challender

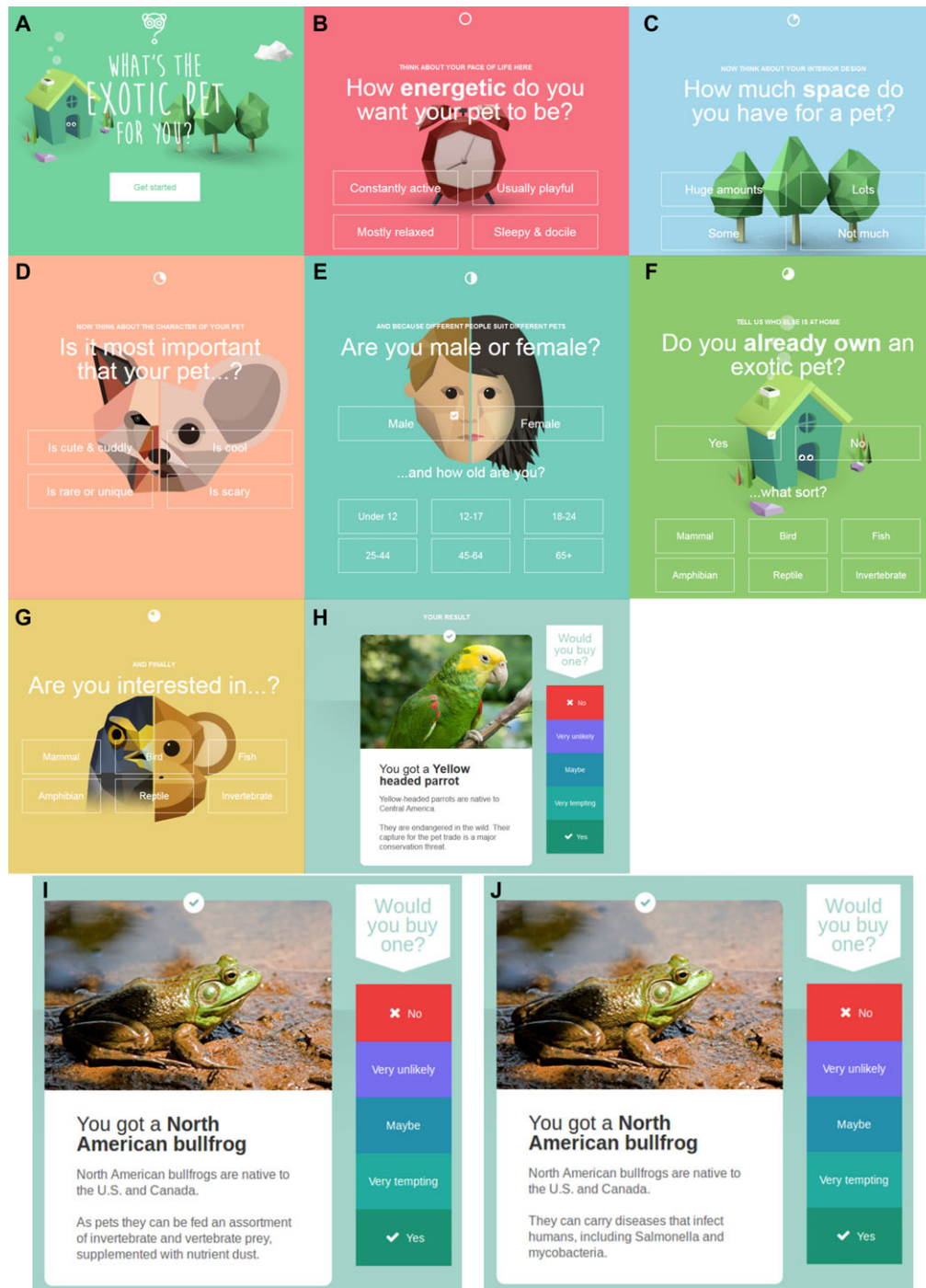


Figure 1 A site sketch of the website, www.exoticpetmatch.com, which hosted our survey. (A)–(H) Show the path of respondents' progression through the site and the options available at each step. The initial seven pages (A–G) did not vary between respondents. The species and information presented on the final page (H–J) varied between respondents in accordance with the experimental design (I and J show control and disease statements for one species).

et al. 2015). There have been recent calls for measures in addition to CITES enforcement including reducing consumer demand through educational and public aware-

ness campaigns (Hayman & Brack 2002; Courchamp *et al.* 2006; Dalberg 2012; Baker *et al.* 2013; Challender *et al.* 2015). To be effective, such campaigns must understand

Table 1 An example set of control and treatment statements for one species, the gray cheeked parakeet (*Brotogeris pyrrhoptera*)

Name	Control statements		Treatment statements			
	Diet in wild	Diet as pet	Disease	Welfare	Legality	Conservation
Gray-cheeked parakeet (<i>Brotogeris pyrrhoptera</i>)	"In the wild, they eat petals, seeds, flowers, fruit, catkins, and bananas."	"As pets, they can be fed commercially available pellets, supplemented with fruits, vegetables, and seeds."	"They can carry diseases that humans can catch including psittacosis, tuberculosis, and paramyxoviruses."	"They are often transported from the wild in conditions that lead to severe welfare issues and deaths."	"Their international trade is illegal as is possession of an individual from this source."	"They are endangered in the wild. Their capture for the pet trade is a major conservation threat."

the factors that influence customers' behavior, and must deliver the correct message through the right communications medium (Dalberg 2012; Challender *et al.* 2015). While a lack of information can be a barrier to changing behavior (Schultz 2002), information alone will not necessarily motivate individuals to alter their behavior (Stern 2000). Current demand reduction campaigns typically highlight biodiversity or welfare issues (e.g., Born Free 2016), and sometimes zoonotic disease and legal consequences of purchasing exotics (e.g., Henn 2015; EcoHealth Alliance 2016), but the extent to which these types of information might reduce demand is uncertain.

We undertook an experimental, Web-based survey to ascertain whether consumers' desire to purchase exotic pets might be reduced by the provision of negative information concerning the consequences of such a purchase.

Methods

Experimental design

Our website, www.exoticpetmatch.com, engaged respondents by offering to "match" them with an ideal exotic pet (Figure 1). Seven initial pages (Figures 1A–G), promoted "buy in" from respondents while deriving demographic data for analysis. Respondents entered demographic and preference information including their taxon of interest (mammal, bird, reptile, fish, amphibian, invertebrate) (Figures 1A–G) and were then sent to an eighth page which showed their "matched" species, gave information about it, and asked them whether they would buy one (responses: "No," "Very Unlikely," "Maybe," "Very Tempting" and "Yes") (Figures 1H–J). Our experiment manipulated the information provided on this page. For a given species and respondent the site either showed one of two types of "control" statement, which described the species' diet in the wild or as a pet, or one of four types of "treatment" statements (Table 1; Figures 1I and J). Treat-

ment statements comprised text outlining: the inherent risk of zoonotic disease the pet might represent; the legal implications of owning the pet; the animal welfare implications of buying the pet, and; the conservation implications of buying the pet (Table 1). These types of information are commonly used as "levers" to influence the trade in wildlife (Baker *et al.* 2013). The experimental design therefore comprised two controls and four treatments, with respondents' selected likelihood of purchase forming the response variable. The "matched" species were randomly selected from within the respondents' taxonomic group, stratified by the size of the animal (large and small, to suit respondents' living space). Each type of statement had an equal likelihood of being displayed, meaning that 2/6 (one third) of respondents were given control statements and 4/6 (two thirds) treatment statements.

Respondents were self-selecting, required to find the site through Google promoted links when searching for keywords related to exotic pet ownership. At the end of the experimental period, the website was left active but the experimental page "locked" to only display treatment statements, so that the site could act as a source of information in its own right.

Experimental statements

Experimental statements were as parsimonious as possible to maximize the likelihood of respondents reading and understanding them. All statements are presented in Table S1, but a set of example statements for one species is shown in Table 1. Any statement was a maximum of 20 words, or 120 characters. Mean word and character counts for all types of statements ranged between 11–17 words and 78–97 characters (Table 2). All treatment statements contained a keyword that defined the type of information conveyed: statements about a species' zoonotic potential contained the word "diseases," statements about a species' welfare contained the word "welfare," etc. (Tables 1 and S1). All control statements began

with the phrase “In the wild they eat . . .” or “As pets they can be fed . . .” (Tables 1 and S1).

Not all types of experimental information were available for all species, either because some impacts did not apply or because the impact could not be conveyed within the word and character limit. We aimed to prepare statements for 10 species within each taxonomic group, but were limited by the availability of information for invertebrates, fish and amphibians (taxa, however, that were subsequently excluded from analysis due to low sample sizes). Due to the diversity of mammalian species in the exotic pet trade, and the indication from a pilot study that mammals would be disproportionately selected by the website’s respondents, we created an extended stratified sample of mammals to include multiple canids, felids and primates, as well as frequently traded small mammals from other families.

Overall, we created a pool of 62 species with 303 experimental statements (see Tables 2 and S1).

Data collection and analysis

We recorded respondents’ selected likelihood of purchasing their “matched” pet, the experimental statement they were shown (Figures 1H and J), their selected taxonomic group (Figure 1G), the date and time of the start and end of their engagement with the website, their sex and age (Figure 1E), country (identified by IP address via <http://www.wipmania.com/en/api/>), whether they already owned a pet and if so which taxonomic group (Figure 1F) and their responses to the initial pet energy, pet characteristic and pet space questions (Figures 1B–D). Partial responses, in which users did not complete the survey, were not retained. Users were not prevented from revisiting the website but only the first response from a given IP address was retained. No personally identifiable information was recorded.

Our aim was to test whether treatment statements would significantly lower respondents’ selected likelihood of purchasing an exotic pet relative to control statements, and whether such effects were consistent between taxonomic groups, or modified by respondents’ age, sex, and country of origin. We conducted separate analyses, first examining the main effects of the treatment statements and then whether these interacted with taxonomic group or respondents’ sex, age, and nationality. Responses to the experimental question were ranked from No = 1 to Yes = 5, and analyzed using cumulative link models (ordinal logistical regression), employed in Program R using package Ordinal(Christensen & Christensen 2015), with a logit link function. The experimental statements formed the principal explanatory variable, with five levels (control, disease, legality, welfare, con-

Table 3 Main effects ordinal logistic regression model for the effect of experimental statements on respondents’ selected likelihood of purchase for a given pet

Source	df	Likelihood ratio test statistic	P
Country	4	7.48	0.112
Sex	1	0.159	0.690
Age group	4	15.72	0.00342
Pet owner?	1	0.486	0.485
Available space	1	3.53	0.317
Time taken	1	3.29	0.0696
Taxonomic group	2	10.5	0.00521
Experimental statement	4	9.88	0.0424

Note: *N* for test was 825. All values given to three significant figures.

servation), of which the two control statements, pooled, formed the reference level for a priori treatment contrasts. Additional explanatory variables were sex, age group, country, minutes spent on the site, whether respondents already possessed a pet, respondents’ available housing space and their selected taxonomic group. We did not include respondents’ selected pet energy or pet characteristics as these would be confounded with taxonomic group.

For the main effects analysis, 35 responses from eight countries were pooled with those respondents whose country was unable to be determined ($n = 88$) into one group called “Other.” To permit analysis of the interaction terms experimental statement \times age group and experimental statement \times country, it was respectively necessary to pool the top two age categories (44–64, $n = 143$ and 65+, $n = 48$) and all countries except the United States, the United Kingdom, and Australia into a single group.

Results

We gathered complete responses from 1,305 visitors to our site between 15/07/2014 and 27/06/2015. The taxa most frequently selected were mammals (63%), then reptiles (17%), birds (10%), invertebrates (4%), fish (3%) and amphibians (2%). Respondents were primarily from the United States (60%), then the United Kingdom (20%), Australia (7%), Canada (3%), and 10% were from eight other countries or of unknown origin.

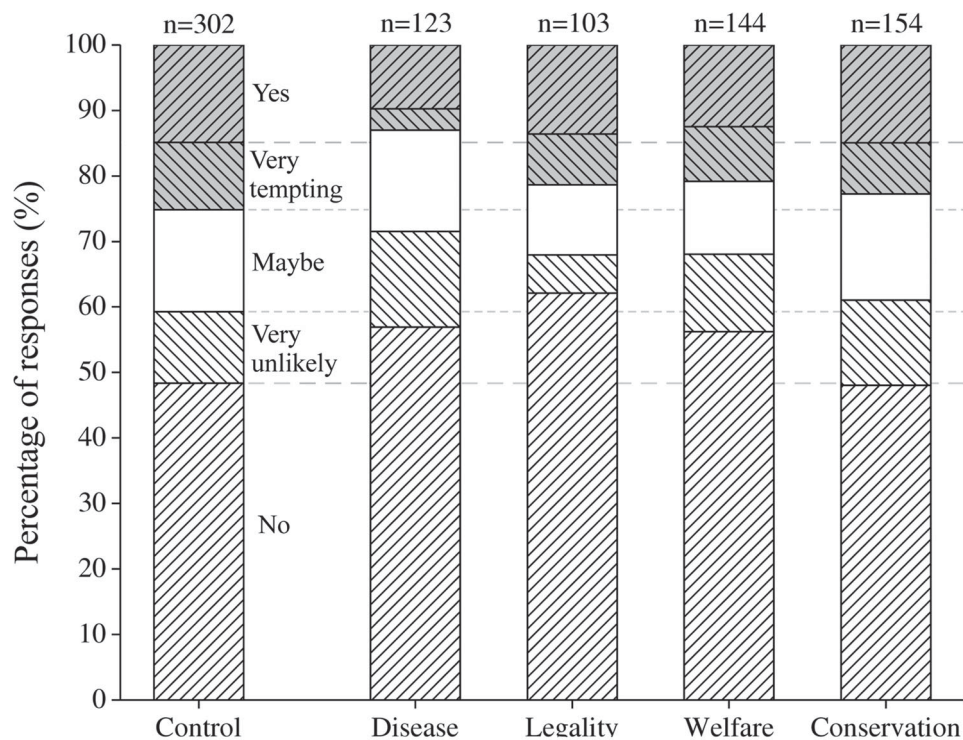
In a pilot study of 37 participants, instructed to ensure they had read all information on each page, the minimum complete response time was 0.89 (range 0.89–2.65) minutes. We excluded faster responses, and responses from those aged under 12 years, from analysis because these respondents may not have fully understood the statements. After exclusions, only 38 invertebrate, 20 fish, and 26 amphibian selections remained, and were removed

Table 2 The number of experimental statements of each type (two control, disease, welfare, legality and conservation) available for each taxonomic group, and the mean number of characters comprising each statement

		<i>Taxonomic group</i>					
		Mammals	Birds	Reptiles	Amphibians	Fish	Invertebrates
Control (wild food)	Statements	17	10	10	7	9	9
	Mean (sd) characters	84 (16)	85 (10)	84 (14)	81 (16)	78 (14)	80 (25)
Control (pet food)	Statements	17	10	10	6	8	9
	Mean (sd) characters	88 (10)	95 (10)	86 (15)	83 (17)	84 (10)	78 (26)
Disease	Statements	17	10	10	5	6	6
	Mean (sd) characters	92 (7)	97 (11)	82 (17)	80 (10)	78 (15)	82 (32)
Welfare	Statements	17	10	10	7	7	0
	Mean (sd) characters	87 (14)	91 (19)	95 (11)	85 (16)	82 (34)	–
Legality	No. statements	16	9	7	6	4	0
	Mean (sd) characters	95 (10)	97 (6)	96 (6)	86 (17)	87 (13)	–
Conservation	No. statements	9	5	6	6	5	3
	Mean (sd) characters	89 (14)	93 (7)	90 (12)	88 (0)	93 (19)	91 (20)

from analysis due to concerns with low sample sizes. The final dataset comprised 826 datapoints (583 mammals, 96 birds, and 147 reptiles).

Treatment statements lowered respondents' selected likelihood of purchasing an exotic pet, relative to control statements (Table 3; Figure 2). Wald tests of the state-

**Figure 2** The effect of experimental treatments (x axis) on the percentage of respondents selecting a given likelihood of purchase. Percentages are stacked for clarity. For a given bar, the regions, bottom to top, represent the percentage of respondents selecting, “No,” “Very unlikely” (both hashed without shading), “Maybe” (unshaded), “Very tempting,” and “Yes” (both hashed and shaded). Number of respondents reported are those remaining in the dataset after exclusions of cases unsuitable for analysis. Reference lines represent the boundary of each category for responses to the control statements.

ments' a priori contrasts revealed that disease statements significantly reduced respondents' selected likelihood of purchase (n for test = 826, $z = -2.376$, $P = 0.0175$) as did legality statements ($z = -2.106$, $P = 0.0352$) but the effects of welfare ($z = -1.694$, $P = 0.0902$), and conservation ($z = -0.215$, $P > 0.82$) statements were nonsignificant (Figure 2).

Of respondents shown disease statements, 72% selected "No" or "Very Unlikely" (low likelihood of purchase), c.f. 59% for controls, and 13% selected "Yes" or "Very Tempting" (high likelihood of purchase), c.f. 25% for controls (Figure 2). For both legality and welfare statements 68% selected low likelihoods and 21% high likelihoods, but the percentage of "No" responses was larger for legality statements (62%, c.f. 56% for welfare and 48% for controls) (Figure 2). All percentages for conservation statements were within 3% of those for the controls (Figure 2).

Odds ratios for the effects of disease and legality statements were 0.612 (2.5–97.5% CIs: 0.409, 0.918, respectively) and 0.615 (0.391–0.967), respectively indicating that the participants were 39% more likely to select likelihoods of purchase that were lower than in the control group. Odds ratios for welfare and conservation statement effects were 0.716 (0.487–1.05) and 0.961 (0.666–1.38), respectively.

The effects of the experimental statements did not interact with the age group of respondents (likelihood ratio test [LR] = 19.57, $df = 12$, $P = 0.0757$), their sex (LR = 2.17, $df = 4$, $P > 0.70$), country of origin (LR = 8.56, $df = 12$, $P > 0.74$) or the taxonomic group selected (LR = 9.72, $df = 8$, $P > 0.28$) in separate models including the main effects of sex, country, age group, pet ownership, animal type, and time taken. However, respondents were twice as likely to express a higher likelihood of purchase for birds, than for mammals or reptiles: Wald test a priori contrasts for mammals and reptiles with birds, $z = -3.273$, $P = 0.00107$ and $z = -2.16$, $P = 0.0306$, respectively; odds ratios 0.511 (0.342–0.764) and 0.585 (0.360–0.951), respectively (Figure 3).

Likelihood of purchase did not vary between the two types of control statements used (LR = 0.0077, $df = 1$, $P > 0.93$) in a separate analysis including main effects of sex, country, age group, pet ownership, animal type, and time taken.

Discussion

Our findings indicate that informing prospective exotic pet purchasers about either the zoonotic disease risks associated with, or potential illegality of, buying exotic pets could reduce consumer demand, potentially by up to

40%. The principal ethical arguments against exotic pet ownership—that their purchase may precipitate species declines and impact on animals' welfare—appear unlikely to significantly influence consumers. Welfare information resulted in reduced likelihoods of purchase, but with smaller effect sizes—statistically significant at $P < 0.1$ —than for disease and legality information. We speculate that respondents were motivated to avoid costs that might directly affect them. Contracting zoonotic disease and participating in illegal activities represent personal risks against which respondents may counterbalance any anticipated "good" of acquiring a pet. Welfare and conservation impacts could directly affect respondents through stimulating ethical concern, but these impacts occur before purchase and may be more easily discounted. Plausible explanations for the extreme relative lack of effect of conservation statements (Figure 2) are that a subset of exotic animal owners believe private exotic animal ownership to be a valid species conservation approach (Beetz 2005; Slater 2014) and that rarity (for which conservation status is a proxy) may increase species' attractiveness to some collectors (Courchamp *et al.* 2006; Lyons & Natusch 2013).

We could find no conclusive explanation for why respondents who selected birds expressed a greater motivation to purchase them than those interested in mammals or reptiles (Figure 3) but our findings were otherwise consistent across taxa: there was no indication that the effect of treatment information varied between taxonomic groups. We were, however, unable accurately to analyze data for fish, amphibians and invertebrates due to low sample sizes.

To be useful, our findings must be generalizable to the relevant portion of the consuming population. Our website engaged with a relevant survey group in a medium designed to yield results with a reduced probability of biases. The Internet is heavily implicated in facilitating the trade in illegally sourced animals in consumer countries (Haken 2011; Lavorgna 2014), and online fora act as meeting places, for the exchange of information on exotic pets, and to arrange transactions (Lavorgna 2014). Hosting the survey online in the guise of an exotic pet matching tool meant that respondents were unaware that their choices formed an experimental survey, eliminating many biases that may arise from questionnaires, especially those examining a socially sensitive subject (Warner 1965; Dilman 2007; Rosenbaum 2009; Krumpal 2013). Covert recording of responses was unavoidable to avoid respondents altering their behavior but was balanced against the anticipated merit of the research and mitigated by respondents' anonymity (see British Psychological Society 2014). The self-selecting nature of

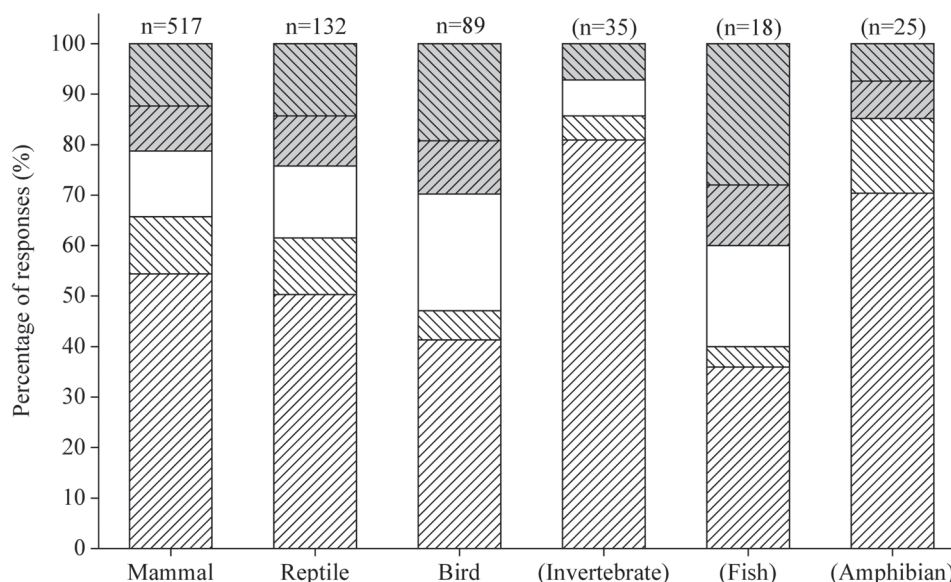


Figure 3 The effect of taxonomic group on the percentage of respondents selecting a given likelihood of purchase. For a given bar, the regions, bottom to top, represent the percentage of respondents selecting, “No,” “Very unlikely” (both hashed without shading), “Maybe” (unshaded), “Very tempting,” and “Yes” (both hashed and shaded). Number of respondents reported are those remaining in the dataset after exclusions of cases unsuitable for analysis. Columns in brackets were excluded from analysis, and included here for completeness.

online surveys can create bias (Bethlehem 2010) but in our case was desirable: we required respondents to find the website through internet searches, thereby increasing the probability of receiving responses only from those interested in purchasing exotics.

Our study was limited to respondents with internet access (Bethlehem 2010) and whose Web browsers searched for English language websites. While we found no discernible differences between countries in the effect of treatment statements, a number of global regions that drive demand for pets were excluded from our study (e.g., SE Asia, South America and the Middle East; Bush *et al.* 2014), and our findings may not apply to these regions.

It is possible that respondents selecting a low likelihood of buying a pet on our site may nonetheless make a purchase when faced with the real thing. We have no data to argue against this possibility, but one study of exotic pet owners in Utah found that their stated beliefs were typically reflected in their actions (Klaphake & Smith 2002). This observation notwithstanding further work could examine the longevity of the changes in attitudes we observed, and the extent to which these translate into real-world decisions. Also, our conclusions were based on information provided to respondents as written text but alternative approaches could have yielded different results—for instance, welfare campaigns using

graphic photographs could have a larger impact than text describing zoonotic or legal risks. Future work should investigate such possibilities.

Recognition is growing that wildlife protection solutions must include strategies for influencing people’s behavior (Balmford & Cowling 2006; Wright *et al.* 2015). Social marketing is an underused tool (Veríssimo 2013; Wright *et al.* 2015), a recognition encapsulated in the 2014 founding of the SCB Conservation Marketing Working Group (ConsMark 2015). Our novel experimental survey demonstrated that two of our four arguments against exotic pet ownership effectively lowered selected likelihoods of purchase among potential exotic pet buyers. These arguments could be used to focus demand reduction campaigns, especially if coupled with calls to positive action (Wright *et al.* 2015). Approaches could include leveraging the desire to avoid zoonotic disease and/or legal consequences to encourage the substitute purchase of nonexotic species or to advise that exotics are sourced either from rescue centers or from legitimate captive-breeders in the consuming country, thereby reducing the global demand for wild-caught individuals.

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