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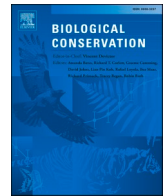
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Assessing preferences and motivations for owning exotic pets: Care matters

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ABSTRACT

Understanding drivers of demand for exotic pets may help inform adequate conservation strategies to address unsustainable trade. Here, we used a best-worst scaling approach to understand the variety of preferences and motivations for owning exotic pets. Respondents (316 from 33 countries) preferred exotic pets that were captive-bred, had rare aesthetic features, and were common in the wild and abundant in the market. Species that were at risk of extinction, in short supply, sourced from the wild, and under trade restrictions were the least favoured by respondents. Feelings of care, such as attachment, affection, nurture, as well as curiosity and being passionate about the species, were dominant motivations for pet keepers. Respondents were willing to support the conservation of species in the wild. Our findings highlight that relational dimensions are among the most important aspects influencing decisions to own exotic pets. Certification systems of origin that supports animal welfare and conservation may help consumers support sustainable trade in exotic pet species. However, attention should be paid to challenges throughout the supply chain and not to incentivize consumers' preferences for rare genetic features as this may pose a risk to the conservation of species in the wild. When planning conservation initiatives and policies, considering relational dimensions may provide novel insights to better foster meaningful expressions of care with animals in the wild, as opposed to animals as exotic pets. Fostering care, as a normative human sense of kinship with non-humans, could help channeling "demand for ownership" towards "stewardship relations" with nature.

1. Introduction

The illegal and/or unsustainable trade in exotic species (i.e., non-domesticated) to be kept as pets affects the conservation of many species globally (Altherr and Lameter, 2020; Auliya et al., 2016; Nijman et al., 2018; UNODC, 2016). This trade also raises animal welfare concerns (Peng and Broom, 2021; Sollund, 2011) and helps facilitate invasion of non-native species (Lockwood et al., 2019) and the spread of emerging zoonotic diseases (Chomel et al., 2007). Assessing drivers of consumers' demand for exotic pets remains key to informing effective conservation decision-making (Challender et al., 2015; Veríssimo et al., 2020). However, characterizing and measuring consumers' preferences and motivations to understand demand remains challenging (Veríssimo et al., 2020), and is still little understood in the exotic pet trade

(Lockwood et al., 2019).

Rare species appear to be particularly preferred across multiple wildlife markets (Hall et al., 2008). Consumers may place disproportionate value on rare species, leading to a process of increasing prices as a species becomes scarcer, incentivizing overexploitation and increasing extinction risk (Courchamp et al., 2006; Hall et al., 2008). Rare species are typically characterized by low population size and/or restricted geographical distribution due to species intrinsic (e.g., slow life histories, high specialization) and/or due to extrinsic attributes (e.g., human pressures) (Flather and Hull Sieg, 2007). Since rarity is a relative concept, the desirability for rare species can be influenced by people's perspectives, thus varying according to social and cultural dimensions (Hall et al., 2008). For example, a species can be locally scarce although abundant elsewhere (e.g., vagrant birds, Brock et al., 2021), or can be

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rarely seen in the wild (e.g., elusive, nocturnal species), or can be rare because it is endangered (e.g., high risk of extinction). In addition, rarity can be perceived as scarcity in the market, referring to a species limited availability in relation to demand. Accordingly, besides species' desirable characteristics, consumers' preferences may be affected by the accessibility of species or products, as well as the availability of alternatives or substitutes (Lockwood Doughty et al., 2021). Hence, any species may be, or become, scarce when the supply is insufficient to meet demand, leading to increasing prices (Lynn, 1991). Species that are scarce in the market might become particularly desirable, due to feelings of privilege and exclusivity, as it happens with luxury products (Hall et al., 2008; Kapferer, 2012). In addition, species that are abundant in the wild can also become artificially scarce in the market due to existing trade restrictions (e.g., trade control on quotas, anti-poaching), which may increase prices and appeal to consumers. On the other hand, species that become frequently traded, e.g. because of captive-breeding initiatives, can lose their value even if rare in the wild, lowering demand (e.g., Krishna et al., 2019). However, it is still unclear how various dimensions of rarity and scarcity interplay to influence desirability of exotic pets.

Another crucial, yet mostly overlooked, dimension influencing consumers' demand is understanding motivations (Verissimo et al., 2020). Uncovering consumers' motivations may provide crucial insights to understand their behaviour and the diversity of responses to conservation strategies (Thomas-Walters et al., 2020a, 2020b). A variety of reasons ranging from experiential (e.g., desire to fulfil hedonistic pleasure) to social (e.g., desire to fulfil social relations), functional (e.g., fulfilment of people's livelihood), financial (e.g., to generate profit) and spiritual (e.g., to fulfil personal beliefs), can explain motivations to consume wildlife across markets (Thomas-Walters et al., 2020a). Although some of these motivations are also relevant to exotic pet owners (Jepson et al., 2011; Marshall et al., 2021; Shukhova and MacMillan, 2020), exotic pet keeping involves living organisms and it encompasses relational dimensions (e.g., companionship, attachment), emerging from human and other-than-human animals interactions and bonding (Fox, 2006; Midgley, 1998). Relations of care about and for non-human nature provide opportunities to understand motivations underpinning human-nature interactions as embedded in eudaimonic values (e.g., those associated with living a "good life"), beyond instrumental (e.g., utility) and intrinsic (e.g., rights) values (Chan et al., 2016). Caring about and caring for are central dimensions of human well-being, fostering social cohesion and responsibility (Jax et al., 2018). According to the Self-determination Theory (Ryan and Deci, 2000), humans may seek such caring relations with other animals as they foster well-being by fulfilling basic psychological needs for autonomy, competence, and relatedness (Kanat-Maymon et al., 2016). In this sense, previous studies have found affection and emotional relations (e.g. loving, caring, nourishing) as important motivations among exotic pet keepers (Azevedo et al., 2022; Shukhova and MacMillan, 2020; Weldon et al., 2021). However, the diversity of motivations, preferences and practices associated with exotic pet keeping remains poorly understood.

In order to address these gaps, we set out to understand the variety of preferences and motivations of exotic pet owners to inform conservation decision-making. We designed and implemented an online survey using a best-worst scaling approach (BWS), a stated preference method (Louviere et al., 2015). Stated preference methods have been used in different fields of research, including environmental economics and policy-making (Johnston et al., 2017), as well as in wildlife trade studies (Hanley et al., 2018; Hinsley et al., 2015; Krishna et al., 2019), to assess people's preferences for goods and services in hypothetical markets. BWS constructs choice scenarios as hypothetical profiles of an object of interest (e.g., an exotic pet for sale), by using experimental designs. In particular, our objectives were to: (i) assess the most attractive aspects of rarity overall and according to preferred biodiversity groups (among birds, reptiles and amphibians, mammals, aquarium fishes); (ii) evaluate the importance of different motivations and characteristics for keeping

and purchasing exotic pets; and (iii) assess the willingness to pay an extra cost on top of market prices to support the conservation of the species in the wild, the livelihood of local people living where the species occur in the wild, and to both the conservation of species and the livelihood of local people living where the species occur in the wild simultaneously. Finally, we discuss the implications of consumers preferences for rarity, as well as the importance of considering relational dimensions associated with exotic pet keeping when assessing preferences, and how these might inform conservation interventions in the exotic pet trade.

2. Methods

2.1. Survey design

BWS design is a type of discrete choice modeling approach, an econometric method used to estimate values of non-market goods and services (Louviere et al., 2015). The appeal of BWS is that it allows respondents to compare multiple items but in an experimental setting that reduces cognitive demands compared to popular alternatives. For example, compared to other category rating scales or traditional conjoint measurement techniques, BWS has the advantage of valuing items within a random utility framework and of making fewer assumptions about human decision-making, such as how people deal with the meaning of rating scales and with multiple items having similar high importance (Marley and Flynn, 2015). BWS overcomes these issues as the metric of importance is provided by choice frequencies, and the use of a model with an error theory allows to predict the likelihood an item may be chosen over any other. Specifically, we used a Case 2 (profile case) design to construct various profiles of an exotic pet for sale, described by a combination of pre-defined attributes represented by multiple levels, and then asked respondents to select the best and worst attribute levels in each profile. In our survey, respondents were asked to indicate the attribute that would influence the most or the least their decision to acquire an exotic pet. Selection of attributes and levels followed focus group discussions and a pilot survey with different stakeholders. Participants to the focus groups were selected as to cover a wide variety of stakeholders related to the exotic pet trade, including exotic pet owners and experts and non-experts in wildlife trade topics, representing different countries and languages. Experts included academics and practitioners (e.g., members of non-governmental organizations) working in biodiversity conservation topics and specifically in wildlife trade, who were based in different countries. Overall, stakeholders who agreed to participate included 24 participants from 8 countries (United Kingdom, Philippines, Uruguay, Italy, Germany, Brazil, Portugal, and China). The range of stakeholders' background allowed us to ensure relevance, feasibility, and clarity of the survey across each of the languages in which the survey was translated in. Overall, 5 attributes and 13 levels were selected as reflecting the complexity of consumers' preference for rarity in the wild and scarcity in the market of exotic pets and the scope of the problem of the study. We obtained 16 choice cards or scenarios, each showing 5 attributes (Fig. 1). To limit respondent's fatigue, the choice cards were divided into 2 blocks (8 choice scenarios in each block) and distributed with a random selection from the same link to the survey (see Appendix A, for more information about pilot survey and BWS design). The attributes and levels reflected 5 main aspects: (i) source of an exotic pet; (ii) species rarity; (iii) market scarcity; (iv) recent rarity; and (v) recent scarcity (Table 1).

We included source of exotic pets as an attribute to investigate whether a wild-sourced or a captive-bred origin of exotic pets for sale would positively or negatively affect respondents' decision to purchase it. The origin of exotic pets, whether wild-caught or captive-bred, in fact, was found to influence consumers' preferences for exotic pets (Shairp et al., 2016). It also affects the conservation of these species in the wild (e.g., Robinson et al., 2015). Moreover, preference for rarity may lead to increased pressure on wild species in the context of wildlife trade

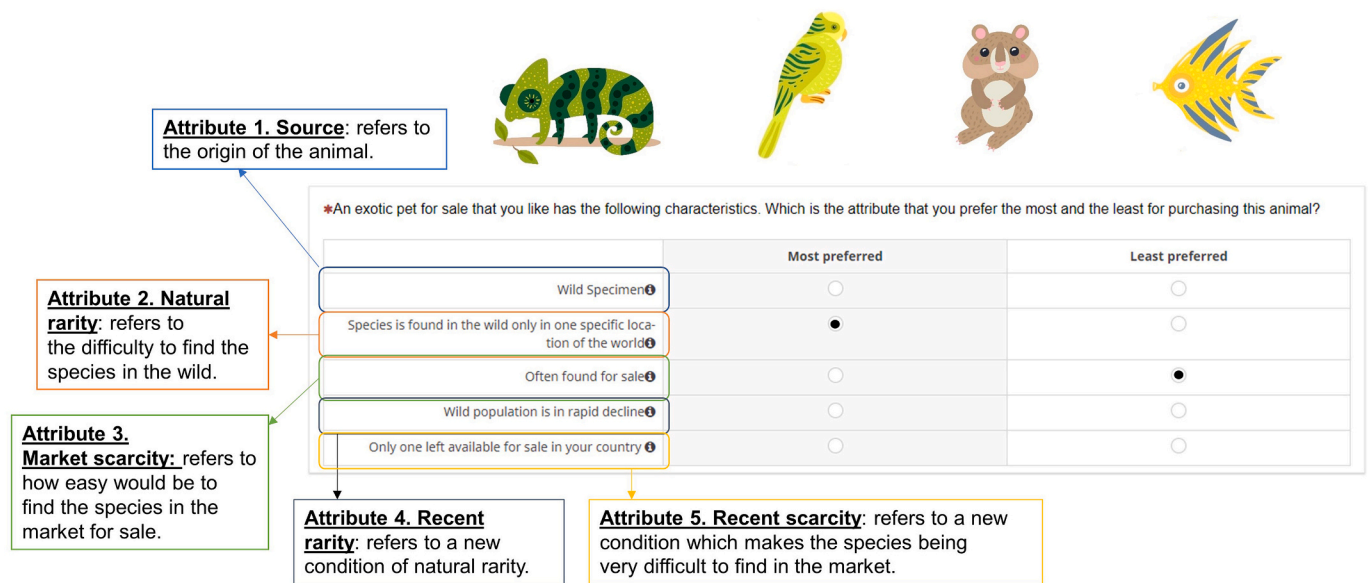


Fig. 1. Choice card example and the description of attributes available to the respondents in the survey.

Table 1

Attributes and levels of rarity used in the best-worst scaling design of section 2 of the surveys. Respondents will be asked to choose the most and least preferred attribute levels within multiple profiles of exotic pets for sale. Each profile will be represented by all attributes, varying according to different combinations of their levels.

Attribute	Levels	Variables
Best-worst scaling		
Source	Sustainable source	Captive-bred certified
	Wild	Wild specimen
Species rarity	Common in the wild	Common species (abundant and widespread in the wild)
	Rare	Species is rarely encountered in the wild (low abundance) (Block 1) Species is found in the wild only in one specific location of the world (restricted range) (Block 2)
	Genetic diversity	The individual has unique colors, patterns or other aesthetic features rarely seen in the species
Market scarcity	Abundant in market	Often found for sale
	General availability	Rarely found available for sale, often sold out
	Temporal scarcity	Available for sale only for 7 days (next availability in 1 year)
	Geographical scarcity	Rarely found available for sale in your country
Recent rarity	New species	Newly discovered species or morph variety
	Extinction risk	Wild population is reducing fast
Recent scarcity	Shortage of supply	Only one left available for sale (next availability unknown)
	Shortage of time	Last chance for sale before trade is prohibited

(Courchamp et al., 2006), including in the exotic pet trade (Altherr and Lameter, 2020; Harrington et al., 2022). We included three levels for rarity, namely common in the wild, rare, and genetically rare (e.g., altered colours and aesthetic features) to assess whether preferences for rarity would affect decision to purchase (Table 1). Rare species referred to species with a small number of populations in the wild, occurring at low abundance of individuals and/or in restricted geographical areas (Flather and Hull Sieg, 2007; Gaston, 1994). As rarity is a relative concept, it has also been referred to as a subjective “perception”, depending on the observer’s position (e.g., species that are difficult to

see because they occur at low densities or have a secretive behaviour). In order to account for both dimensions of rarity, we described the level “rarity” as restricted distribution (objective rarity) in block 1 and as species which are difficult to spot in the wild (subjective rarity) in block 2, as a treatment effect between blocks. In addition, preferences may be driven by the desire of owning species which may be scarce or unusual in the market although common in the wild, as to be among the only ones able to own these species (Harrington et al., 2022). Market “scarcity” was included as an attribute with three levels, as variations from the baseline (often found for sale), of (i) general low availability, (ii) temporal scarcity, and (iii) geographical scarcity. In addition, we included attributes (recent rarity and new market scarcity) to assess whether emerging rarity and scarcity affect demand, as this can then potentially increase trade pressure and increase the extinction risk of abundant and least concern species (Holden and McDonald-Madden, 2017). Recent rarity included two levels, (i) discovery of new species or morphological traits (e.g., aesthetic variations), and (ii) increasing rarity in the wild as a result of increased threats such as overexploitation. Recent scarcity included two levels, (i) supply shortage of animals available for sale, and (ii) limited time remaining for legal purchase before trade restrictions are put in place (time shortage).

The survey was structured in four sections: (i) an introduction page to explain the scope of the study, the context of the choice problem, and to obtain informed consent (see Appendix A for ethical considerations), (ii) the choice scenarios, where each respondent had 8 choice cards, (iii) the biodiversity group section, where respondents were asked to choose their primary biodiversity group of interest (i.e., mammals, birds, amphibians and reptiles, or aquarium fishes) and to rank their preferred families among a list of 7 of the most targeted groups in the pet trade (Table S1, Appendix A), and (iv) the personal part, where respondents were asked to indicate their socio-demographic background, information about their owned exotic pets, motivations for owning an exotic pet, and additional preferred characteristics (e.g. species traits, market type, maintenance effort), as well as type of contributions to support the species conservation in the wild, when choosing an exotic pet for sale. In each choice scenario, respondents were asked to choose the best and the worst attribute-level of an animal for sale that they would consider when purchasing the exotic pet. Respondents having multiple preferences among biodiversity groups were asked to complete the surveys again in order to cover additional groups.

To assess respondents’ motivations for owning an exotic pet, respondents were asked to indicate their agreement (using a 5 points

Likert-scale, Likert, 1932) to 13 statements (Table S2, Appendix A). Statements were formulated based on the framework by Thomas-Walters et al. (2020a, 2020b) on motivations underpinning wildlife trade. We included aspects covering “experiential” (e.g., to fulfil hedonistic pleasure, such as sensory and entertainment), “social” (e.g., to strengthen social relationships with others, such as influence and reputation), “financial” (e.g., to obtain profit) and “spiritual” (e.g., to fulfil cultural and spiritual needs, such as good fortune) motivations. In addition, to better reflect motivations in relation to keeping live animals, we included other dimensions following Self-determination Theory (Ryan and Deci, 2000). These included aspects of “autonomy” (i.e., feeling in control of personal behaviors), such as being able to express passion towards the species and to fulfil personal well-being, “relatedness” (i.e., experience sense of relation with other beings), such as reasons of care and attachment towards the animal, and “competence” (i.e., being able to learn and master about different skills to fulfil personal goals), such as educational reasons and mastery of multiple exotic pet keeping.

Beyond preferences assessed in the BWS, we also asked respondents to indicate preferences for additional characteristics of exotic pets for sale. These included characteristics related to the species traits (breeding, longevity, daily activity, diet, dimension, sound type) and to the type of market (where is the animal sold), care effort (maintenance level) and origin (certification), which were selected according to literature and expert consultations (as part of focus groups) on conservation relevance and novelty (Table S2, Appendix A). To assess respondents’ actions in relation to trade restrictions, we asked respondents to indicate whether they would buy their favourite exotic pet before, during and after hypothetical trade restrictions. Finally, in order to assess whether respondents were willing to donate part of the purchasing cost to conservation, we asked respondents to indicate how much (as extra cost in percentage over average purchasing price) they would be willing to pay for (i) the conservation of species in the wild, (ii) the support to the livelihood of people living where the species occur, and (iii) to support both species and people.

2.2. Survey implementation

The target population of the study included owners or potential future owners of exotic pets, over 18 years of age. The survey was translated in 6 languages including English, Spanish, Portuguese, German, Italian and Mandarin. The survey was implemented online, as it provided opportunities to reach out on a broader target population, a more diverse set of respondents at a worldwide scale, allowing for flexible timings, platforms and devices used to advertise and to complete the survey (Wardropper et al., 2021). Overall, we used a snowball sampling technique (Newing et al., 2011), where initial contacts (i.e., exotic pet owners, people in organizations involved with wildlife trade topics), and then each respondent to the survey, were asked to circulate the survey within their network including exotic pet owners. This allowed us to capture an increasing chain of participants beyond researchers’ direct reach. We circulated the survey between June and December 2021 by using three main channels of initial contact links: i) experts and non-governmental organizations working in wildlife trade were asked to help distributing the survey among known exotic pet owners and groups of owners (external to their organizations), ii) administrators and organizers of exotic pet groups and communities were asked to help distribute the survey through their internal channels and iii) advertisements on social media. Social media platforms, including Facebook and Instagram, are becoming a popular venue for trade in wildlife, especially live animals (Harrington et al., 2019; IFAW, 2018; Sardari et al., 2022; Siriwat et al., 2019). Although some countries have denied access to Facebook and Instagram (e.g., China, Iran, North Korea) the platforms have currently a global distribution and are popular among users both from Western and non-Western countries worldwide (Statista, 2022). To integrate preferences from social media

users, we advertised the link in each of the languages (except for the survey in Mandarin, which was shared through the other distribution channels) on Facebook and Instagram by using Facebook Ads. The Facebook Ads application allowed to target users according to their age, country, and topics of interest (see Appendix A for further information in social media advertisement). Beyond replying to the survey, users on social media also chose to write about their favourite exotic pets spontaneously and voluntarily using comments to the posts. We recorded all the comments anonymously and deleted the posts to foster users’ privacy on the platform. This research was reviewed and approved by the University of Helsinki Ethical Review Board in the Humanities and Social and Behavioural Sciences and was designed to comply with the General Data Protection Regulation of the European Union (see Appendix A for additional ethical considerations).

2.3. Analysis

To analyse responses from the BWS, and reveal respondents’ preferences for levels, we used a counting approach (Louviere et al., 2015). Given that i is an attribute-level, and n is a respondent, the scores were calculated by counting the number of times i was selected as the best (B) and the worst (W) among all the questions for n . A best minus worst (BW) score is obtained:

$$BW_{in} = B_{in} - W_{in} \quad (1)$$

In order to account for variations of the number of levels in each attribute, we calculated the standardized BW as:

$$std.BW_{in} = \frac{BW_{in}}{f_i} \quad (2)$$

where f_i is the frequency with which level i appears across all questions according to the design structure. We analysed results both overall and for each biodiversity group, to assess differences among respondents’ preferences according to the chosen group. In addition, to assess whether respondents’ choosing different biodiversity groups or with different socio-demographic background showed differences in other preferences and motivations, we used non-parametric tests, specifically the Kruskal-Wallis with pairwise comparisons using Dunn’s test. All analyses were performed in R software (R Core Team, 2022) (see Appendix A for additional method description). The grouping of countries into geographical Regions for analytical purposes was done by following the United Nations “Standard Country or Area Codes for Statistical Use” (<https://unstats.un.org/unsd/methodology/m49/>).

3. Results

A total of 1180 potential respondents landed at least on the survey’s first page or partially completed the survey. Among these, 316 fully completed the survey, with an equal share between blocks (50 % each). Respondents were mostly (63 %) between 18 and 30 years of age, followed by respondents in age classes 31–40 years (17 %), 41–50 years (7 %), 51–60 years (6 %) and ³ 61 years (5 %). Most respondents took the survey in English (41 %), Italian (24 %) and German (14 %), followed by Spanish (10 %), Portuguese (8 %) and Mandarin (3 %). Respondents were from 33 different countries, mostly from Europe (46.8 %), Asia (18.4 %), Latin America and the Caribbean (18.0 %), and North America (13.3 %). Most respondents had completed or attended high school (43 %) or had a Bachelor’s degree (36 %), while 18 % had completed a Masters, PhD or professional degree program. Most respondents (60 %) owned exotic pets, followed by exotic pet breeders (22 %), including rare exotic pet breeders (29 % of pet breeders) (see Appendix A for additional results).

Species rarity was mostly chosen as best attribute when purchasing exotic pets, followed by source and market scarcity, while recent rarity and recent scarcity were mostly chosen as worst attributes (Fig. 2A).

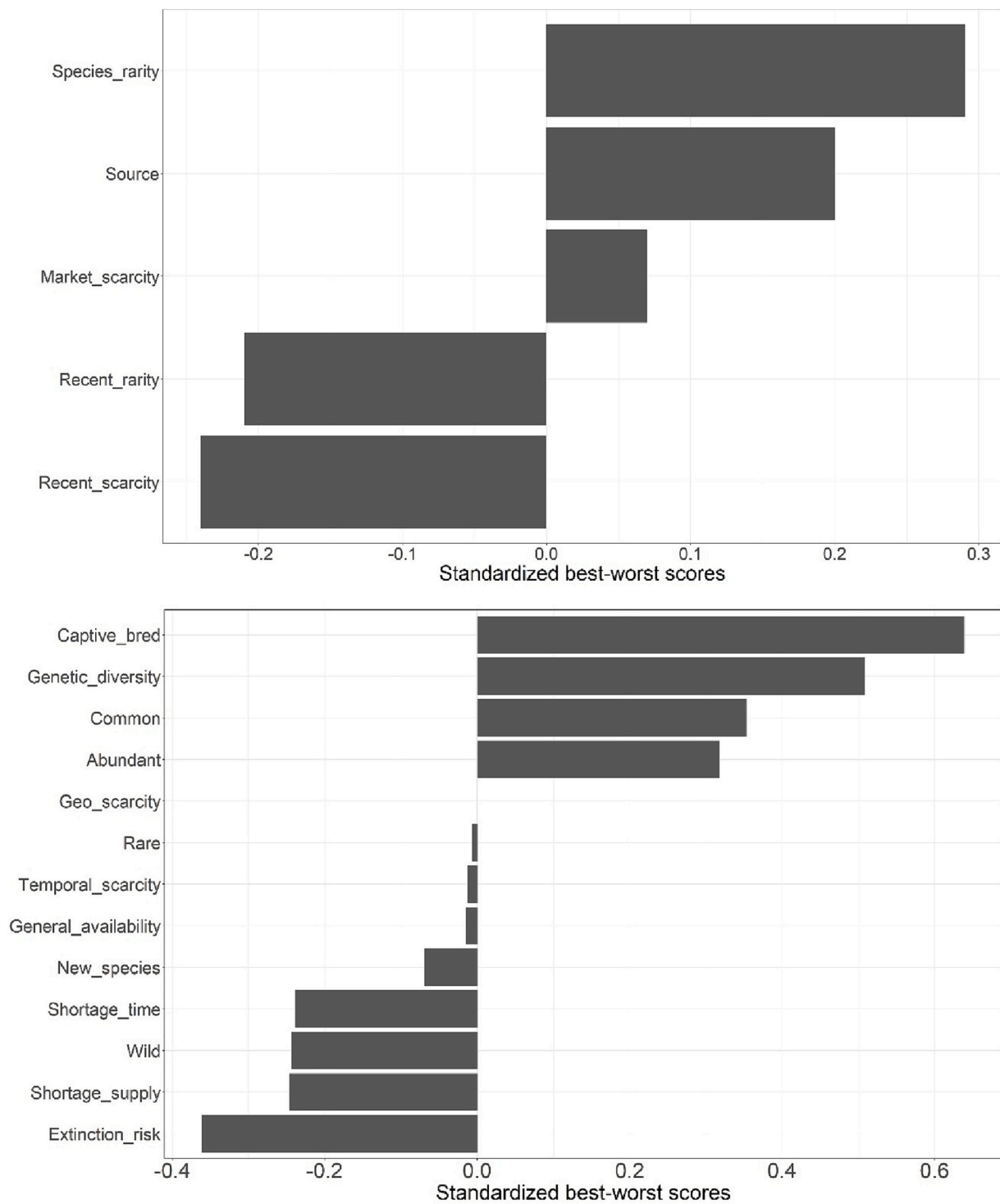


Fig. 2. Best and worst attributes (A) and levels (B) of exotic pets for sale that respondents would consider when purchasing it.

Within each attribute, best levels of an exotic pet for sale were animals that were captive-bred (source attribute), had unusual or rare aesthetic features, were common in the wild (species rarity attributes) and abundant in the market (market scarcity attribute). Worst levels were exotic pets at risk of extinction (recent rarity), in supply shortage (recent scarcity), wild specimens (source), and under trade restrictions (recent scarcity) (Fig. 2B). Within taxonomic groups, preferences showed similarities in overall best and worst attributes, yet also some differences in levels' scores and related ranking (Fig. S1, Appendix A). Among these, while rarity was relatively more positively preferred among mammals, it

appeared negative in the other groups. Geographical scarcity (i.e., general low availability of the species in the market in respondents' country) was slightly positively preferred for birds and aquarium fishes, but the opposite was for mammals and herptiles (reptiles and amphibians). Finally, wild specimens were more negatively considered among herptiles and birds, while this was neutral among aquarium fishes.

Most respondents indicated herptiles as their favourite group (36%), followed by birds (27%), mammals (22%) and aquarium fishes (16%). Preferences for herptiles were particularly higher among respondents who answered the surveys in German (57%), Italian (38%) and English

(32 %), while birds were preferred among respondents who answered the survey in Portuguese (54 %) and Spanish (39 %) (see Table S1 and supplementary results in Appendix A for family and species level preferences). Respondents' age was significantly different between groups (chi-squared = 15.705, $p < 0.001$), with respondents' preferring aquarium fishes being significantly older than those choosing herptiles ($z = 3.871$, $p < 0.001$) (see Table S3, and Appendix A for additional results).

In relation to motivations of owning exotic pets, the statements that received the highest scores were on average those related to caring, learning and being passionate about the species (Table 2). The statements that received the lowest scores were those related to getting financial earnings, cultural reasons, and personal beliefs. Scores differed among biodiversity groups (Table S3, Appendix A). Scores assigned to passion, mastery and sensory motivations were statistically different among taxonomic groups (respectively: chi-squared = 12.358, $p < 0.001$, chi-squared = 17.792, $p < 0.001$, chi-squared = 22.139, $p < 0.0001$), with scores for herptiles being higher than for mammals ($z = 3.180$, $z = 3.763$, $z = 4.097$, $p < 0.001$). Scores for well-being motivations also differed (chi-squared = 14.665, p -value = 0.0021) and were lower for aquarium fishes compared to birds ($z = -2.816$, $p < 0.05$) and higher for birds compared to mammals ($z = 3.410$, $p < 0.01$). Educational motivations were higher for herptiles compared to mammals (chi-

Table 2

Ranked motivations for owning exotic pets according to average Likert scale scores and standard deviations.

Motivational category	Sub-category	Statement	Average score	Standard deviation
Relatedness	Care	I enjoy taking care of it and ensure its well-being	4.41	1.16
Competence	Education	It provides me with opportunities to learn about the species	4.20	1.22
Autonomy	Passion	I am passionate about the species	4.15	1.32
Experiential	Sensory	I like its appearance and/or other special features of it	4.08	1.24
Relatedness	Attachment	It keeps me company	3.77	1.40
Autonomy	Well-being	It is important for my everyday well-being	3.65	1.41
Experiential	Recreation	I like it for entertainment and/or leisure purposes	3.24	1.48
Social	Reputation	It provides me with opportunities to socialize with others (e.g., pet owner communities, family, social media, etc.)	2.87	1.52
Competence	Mastery	I am passionate about collecting different exotic pets	2.52	1.54
Social	Social influence	I was recommended to get it by people I trust (e.g. friends, and family)	2.33	1.56
Financial	Profit	It provides me with the opportunity to generate an income (e.g. sell it, breeding, photographs with tourists)	2.03	1.50
Spiritual	Cultural	It is meaningful for my cultural/family traditions	2.00	1.46
Spiritual	Religion	It is important for my personal beliefs (e.g., religion, good fortune)	1.88	1.45

squared = 9.912, p -value = 0.01933; $z = 2.774$, $p < 0.05$). Care motivations were also different among taxonomic groups (chi-squared = 21.551, $p < 0.0001$), with scores aquarium fishes being lower than for birds and herptiles ($z = -4.046$, $z = -3.805$, $p < 0.001$). Moreover, scores regarding attachment motivations were also significantly different (chi-squared = 19.42, $p < 0.001$) with scores for aquarium fishes being lower than for birds and for birds higher than herptiles ($z = -3.938$, $z = 3.486$, $p < 0.01$). Financial motivation was higher among breeders (chi-squared = 18.353, $p < 0.0001$).

When choosing their next exotic pet, respondents indicated that characteristics of certification (16.1 %), market (15.6 %) and maintenance level (14.6 %) were more considered (Table S2, Appendix A). Among these, respondents were mostly interested in pets that are certified as captive-bred; sold by a private breeder; and require a medium level of maintenance effort (Fig. 3). However, preferences differed among groups, with exotic pets sold in a shop and with a diurnal activity being among the most preferred characteristics for aquarium fishes and birds respectively. In case respondents' favourite exotic pets were to be listed as under trade restrictions, the majority (30 %) of respondents said that they would most likely buy it before restrictions were in place; would definitely not buy it during restrictions (61 %); and that they would maybe (31 %) and most likely (44 %) buy it if restrictions were lifted (Fig. 4A). On top of market prices, the vast majority of respondents were willing to pay an extra cost to donate only to the conservation of the species (89.2 %), only to support the livelihood of local people living where the species occur in the wild (74 %), and to both the conservation and people's livelihood (86.4 %) (Fig. 4B). In order to support the conservation of the species, most respondents (34 %) were willing to pay up to 10 % more of the market price for their favourite pet (especially 67 % of respondents from Africa and 50 % from Asia; Appendix A, Table S4), followed by 29 % who were willing to pay >30 % of the price (especially 30 % of respondents from Latin America and the Caribbean; Appendix A, Table S4). For the support only to local people's livelihood, the majority (43 %) were willing to pay up to 10 % more on top of the price (especially 48 % of respondents from North America, 47 % from Asia, and 44 % from Europe; Appendix A, Table S4), followed by 25 % who were not willing to pay any extra cost (especially all respondents from Oceania and 67 % from Africa; Appendix A, Table S4). For the support to both the species and local people's livelihood, 31 % were willing to pay >30 % of the price (especially 33 % of respondents from North America and 32 % from Latin America and the Caribbean; Appendix A, Table S4), followed by 30 % of respondents were willing to pay 10 % more (especially 34 % of respondents from Asia and 33 % from North America; Appendix A, Table S4).

4. Discussion

Our results highlight the fact that survey respondents were concerned about species conservation and preferred captive-bred exotic pets and/or species that were commonly found in the wild and available in the market, suggesting that respondents' preferences may be aligned at least with some conservation objectives (e.g., sustainable use). While preference for rarity has been identified as a key threat driving demand in the wildlife trade (Courchamp et al., 2006; Hall et al., 2008), including in the exotic pet trade (Altherr and Lameter, 2020; Krishna et al., 2019; Ribeiro et al., 2019), we found that, among various aspects of rarity, respondents favoured only aesthetic or morphological rarity, mostly disregarding other aspects. Furthermore, respondents were least interested in exotic pets of wild origin, with higher extinction risk, and under trade restrictions, further suggesting that respondents were aware and concerned about the conservation status of species and intended not to harm them. In line with these preferences, we found that the most important reasons underpinning ownership among respondents were relational motivations, such as caring about the exotic pet, as well as learning and being passionate about the species. Most respondents were willing to contribute to species conservation both by respecting trade

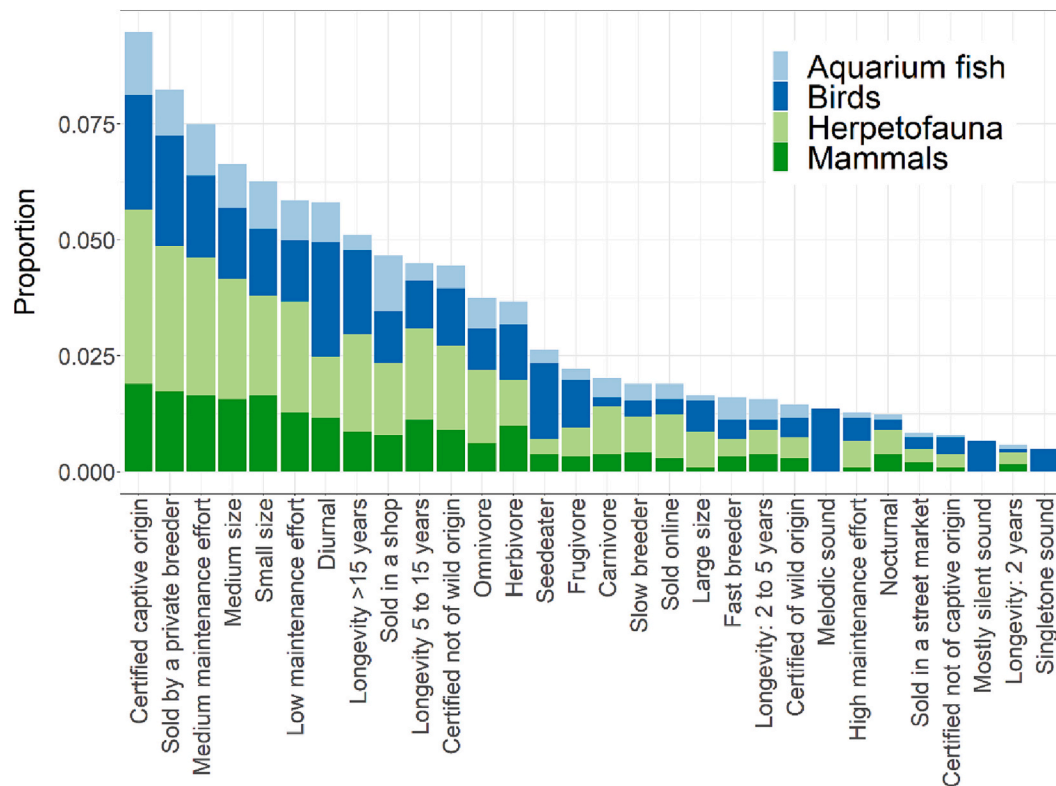


Fig. 3. Preferred characteristics and conditions for purchasing respondents' next exotic pet. X-axis shows different characteristics of exotic pet for sale. Y-axis shows the proportion of chosen characteristic (multiple choices were allowed) overall and according to different preferred biodiversity groups.

restrictions and by paying extra cost to support their conservation on the ground, although the majority also were likely to buy them before trade restrictions, potentially leading to trade spikes before protection (Rivalan et al., 2007). Overall, our results suggest that exotic pet owners may establish emotional relationships with their exotic pets and may be concerned by the fact that their interest and care does not impact, but instead supports the conservation of the species in the wild.

Rare attractive aesthetic features of species were sought after by consumers, and respondents supported captive breeding of species as a source for exotic pets. This may suggest that conservation actions could help reduce pressure on wild caught individuals (e.g., rare colour varieties that are not yet present in the market) by saturating the market with sustainable captive-bred alternatives of otherwise uncommon desirable features (Hall et al., 2008). This may, help reduce scarcity, and thus perceived rarity in the market. On the other hand, the combined preference for rare aesthetic features and for captive-bred animals may lead to the deliberate selection of individual animals for breeding purposes based on specific traits through intensive breeding, in which animals are potentially taken from the wild, or artificially selected for rare aesthetics that do not exist in the wild. These large scale intensive and selective breeding initiatives can have detrimental effects on biodiversity (e.g. decreasing genetic diversity; Haitao et al., 2007; McMillan et al., 2021) but also raise animal welfare concerns (Bush et al., 2014; Lyons and Natusch, 2011). For example, the intended or accidental release of captive-bred animals may cause “genetic pollution” on wild populations (e.g., potentially associated loss of local adaptations) and long-term negative effects to their conservation (Auliya et al., 2020). Developing and implementing reliable certification systems may provide exotic pet owners with information about the animal welfare and the biodiversity conservation standards adopted during breeding of the species (Tensen, 2016). This would facilitate consumers to make informed choices, influencing the value of animals and consequently phasing out unsustainable intensive breeding. Importantly, we found that respondents to the survey would support this option, as they

showed interest for both captive breeding and sustainable certification of origin of the animals. However, only implementing a system of certification of origin would not ensure the sustainability of the trade. For example, lack of resources for supporting regulation and enforcement may limit the efficacy of such systems in combatting illegal activities, such as purchases in black markets or misuse for laundering illegally bred, or harvested wild-caught animals (Bush et al., 2014; D’Cruze et al., 2020; Lyons and Natusch, 2011). Our results showing that consumers would mostly choose to purchase exotic pets from private breeders, highlights their key role in fostering effective certification systems. The combined support from both external (e.g. governmental) and internal (e.g. engagement of stakeholders, including private breeders) actors is therefore crucial to promote successful certification systems along the supply-chain (t Sas-Rolfes et al., 2019).

While other studies highlighted instrumental, spiritual, and personal motives behind wildlife trade (Dang Vu and Nielsen, 2018; Marshall et al., 2021; Shukhova and MacMillan, 2020), in this study we found that feelings of care, such as attachment, affection, nurture, as well as learning and being passionate about species, were dominant motivations among respondents. Throughout history both domesticated and wild animals have been part of human communities (e.g., as farm animals or family members) and people feel a sense of care and responsibility as they are seeing them as being of moral relevance (Irvine and Cilia, 2017; Midgley, 1998). Accordingly, feelings of affection and care towards exotic pets may resemble relations that people establish with domesticated animals, entailing one of the deepest forms of human non-human interactions in modern societies (Fox, 2006; Kieswetter, 2017). As 60 % of the respondents in our sample were from Europe and North America, our findings may especially reflect preferences of respondents in these Regions where demand for exotic pets is strong (Altherr and Lameter, 2020; Auliya et al., 2016; Bush et al., 2014; Rhyne et al., 2012). In addition, we found that care, as key motivation to own exotic pets, was not limited to respondents from specific regions. Sense of respect and care are important aspects underpinning relations with nature across

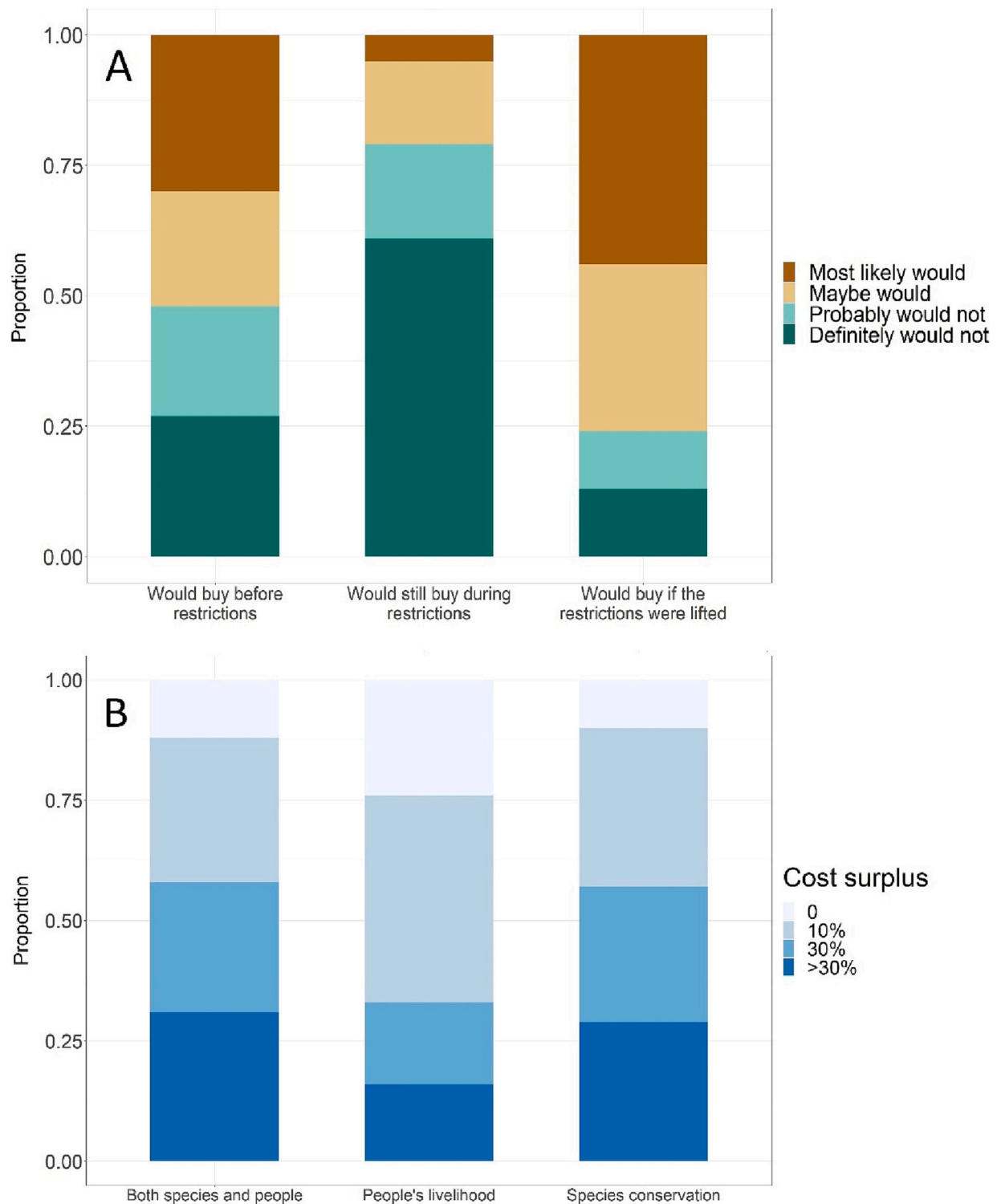


Fig. 4. Proportion of respondents' intending to buy their favourite exotic pet before, during and after trade restrictions (A), and willing to pay an extra cost (0, 10 %, 30 % and >30 % on top of the selling price of their favourite exotic pet) to support the conservation of the species in the wild, the livelihood of local people living where the species occur in the wild, and to both the species' conservation and local people's livelihood (questions were multiple choice across donation types and single choice of surplus within each type, see Table S2 in Supplementary Material) (B).

both Western and non-Western cultures and ethical approaches (Cortés-Capano et al., 2022; Jax et al., 2018). Thus, our study complements recent findings (Azevedo et al., 2022; Shukhova and MacMillan, 2020), by highlighting the need for further investigating the role of relational aspects as key motivations for exotic pet ownership, representing potential drivers of demand in the market. Moreover, our findings provide

a first understanding that motivations underpinning exotic pet ownership, and especially the role of care, may differ across biodiversity groups and in relation to owners' demographic background. By collecting more targeted information, future studies may help further develop our understanding of the role of contextual factors and their interplays in driving demand within and across taxonomic groups and

regions globally.

While respondents showed feelings of care, interest, and responsibility towards the conservation of exotic pet species, practices of breeding, trading, keeping and other close contact opportunities (e.g., exotic pet cafes, McMillan et al., 2021) present several conservation and animal welfare challenges (Macdonald et al., 2021), which can potentially threaten both species and people's well-being (e.g., spread of zoonotic disease). Rather than essential characteristic of human-animals' relations the concept of 'petness' can be intended as a social construct that emerges from how the investment of human emotions into other-than-humans animals is conceived (Wrye, 2009). In order to enhance conservation of exotic pet species and people's well-being, there is need to explore alternative ways of conceiving and practicing such emotional investment in human relations with nature. Care, as embodied and practiced in the context of human-exotic pet relations, can act as an important motivation for stewardship, supporting conservation goals (West et al., 2018). Existing frameworks such as ethics of care and relational values (Himes and Muraca, 2018; Jax et al., 2018) may provide normative and descriptive insights to better understand how to foster meaningful expressions of care with animals in the wild, as opposed to animals as exotic pets. For example, this might include developing biodiversity conservation programs that are based on people's relational motivations to care about animals with own resources and capabilities, helping to foster sense of autonomy and competence to do so in line with conservation objectives. Designing policies that would support existing local environmental stewardship (e.g., fostering species conservation in people's own lands, gardens and neighbourhoods) with participatory activities, might contribute to enhance social cohesion and responsibility towards other-than-human natures, thus satisfying people's needs while contributing to biodiversity conservation goals (Bennett et al., 2018; Cetas and Yasué, 2016). We found that most respondents were willing to provide monetary support to conservation actions, creating opportunities to also support actions beyond local involvement. Exploring the implications of human-exotic pet relations through a "leverage points" perspective may help identifying deep points (i.e., points to intervene in a system with higher level of transformative potential) (Fischer and Riechers, 2019; Riechers et al., 2021), to shift 'demand for ownership' towards 'stewardship relations' (responsibly caring for the interrelated needs of both humans and non-humans according to diverse motivations and capacities) (Bennett et al., 2018; Whyte and Cuomo, 2016).

Potential limitations of our study include the representativeness of our sample of respondents compared to the unknown characteristics of the global population of exotic pet owners. While our results could not be inferred to the entire population, they contribute to the broader understanding of preferences and motivations driving wildlife trade, and specifically in relation to the demand for exotic pets. Our findings may help raise further discussions on the role of owners to support a well-regulated and sustainable trade in exotic pets. The stated preference method employed in this study unveils behavioural intentions of respondents which, according to the theory of planned behaviour, act as a precursor of actual behaviour (Greiner, 2015). However, it is important to consider that actual behaviour may be inconsistent with stated behavioural intentions. Consequently, respondents may act differently in different circumstances according to other factors, such as perceptions of access (resources and opportunities available influencing behavioural achievement) and ability (behavioural control; Ajzen, 1991). For example, while we found that respondents would overall prefer buying captive-bred animals, it remains unknown whether they would act accordingly, especially when the control over their decision is perceived to be low (e.g., desirable pets are not available as sustainably bred or sustainability of practices being anyway unknown). Certifying origin and welfare of exotic pets could help owners choose to support practices that align with conservation goals and provide a sense of behavioural control, bridging the gap between intentions and actual behaviour. However, certification schemes hold important underlying

issues along the supply chain that could undermine a sustainable trade and the effectiveness of such schemes as a conservation solution. Challenges include ensuring animal welfare for commercial purposes, as well as laundering of wild-sourced animals as captive-bred, illicit markets and corrupted trade networks (D'Cruze et al., 2020; Macdonald et al., 2021; Tensen, 2016). In addition, market-based instruments, such as certification schemes, by themselves cannot provide comprehensive solutions to the plurality of preferences, values and needs driving people's demand for exotic pets.

To conclude, in this article we highlight the importance of considering relational dimensions to understand motivations driving exotic pet demand in pet owners. We argue that a Self-determination theory lens may help understand expressions of care as keepers' way for fulfilment of basic needs of autonomy, competence, and relatedness towards nature. Accordingly, keeping exotic pets may represent a way people express, and practice, care towards other-than-human natures, which however may not be aligned with conservation goals. Understanding people's needs underpinning exotic pet keeping may help identify deep leverage points for transformation which could help inform conservation actions aimed at fostering stewardship and care as normative human sense of kinship with non-humans.

CRediT authorship contribution statement

Anna Hausmann: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Software; Project administration; Visualization; Roles/Writing - original draft; Writing - review & editing. **Gonzalo Cortés-Capano:** Conceptualization; Formal analysis; Roles/Writing - original draft; Writing - review & editing. **Iain Fraser:** Formal analysis; Methodology; Writing - review & editing. **Enrico Di Minin:** Conceptualization; Funding acquisition; Project administration; Resources; Roles/Writing - original draft; Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.biocon.2023.110007>.

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