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Pakistan Zoo Visitors' Perceptions toward Zoos and Large Native Carnivores

Abid Ali [1,*,†], Sehrish Mehmood [2], Ishtiaq Ullah [3], Eduardo J. Fernandez [4], Muhammad Numan Khan [5], Mujeeb Ullah [6], Kiran Saleem [7], Muhammad Osama [8], Fahad Shahzad [3] and Sarah L. Spooner [9,†]

1   Independent Researcher, Peshawar 25000, Pakistan
2   Department of Zoology, PMAS Arid Agriculture University, Rawalpindi 46000, Pakistan
3   Peshawar Zoo, Khyber Pakhtunkhwa Wildlife Department, Peshawar 25000, Pakistan
4   School of Animal & Veterinary Sciences, The University of Adelaide, Adelaide, SA 5005, Australia
5   Department of Zoology, Quaid-i-Azam University Islamabad, Islamabad 44000, Pakistan
6   Zoology Department, Islamia College Peshawar, Peshawar 25000, Pakistan
7   Punjab Wildlife and Parks Department, Lahore Zoo, Punjab 54000, Pakistan
8   Department of Zoology, Government Postgraduate College Mandian Abbottabad, Abbottabad 22010, Pakistan
9   School of Animal, Rural and Environmental Sciences, Nottingham Trent University, Southwell NG25 0QF, UK
*   Correspondence: abid.biosci@gmail.com; Tel.: +92-345-4051896
†   These authors contributed equally to this work.

Abstract: A primary goal of zoos is to educate their visitors about global conservation efforts. Studying visitors' perceptions and attitudes towards captive and wild endangered species helps target conservation messaging. This is especially important in countries, such as Pakistan, where hunting and human–wildlife conflict pose the greatest threats to species. While there have been some studies about Pakistan's rural communities' perceptions, few studies have examined the perceptions of Pakistan's zoo visitors. We present data from exit surveys (n = 304) collected at three of the largest zoos in Pakistan (Lahore: an established zoo, Peshawar: a newly built zoo, and Jungle Kingdom: a theme park and zoo). Zoo location was a significant predictor for a range of attitudes, suggesting that the way a zoo presents itself strongly impacts visitor perceptions. Perceptions of learning were influenced by high biodiversity appreciation but a low confidence in knowledge about animals. Support for keeping animals in captivity was most likely when animal welfare was perceived as good and amongst respondents who valued biodiversity. Zoo-goers, regardless of location, demonstrated high levels of interest in animals and environmental concerns. However, the primary visit motivator was spending time with family and friends.

Keywords: visitor experiences; visitor perceptions; visitor attitudes; human–wildlife conflict; exhibit signage

1. Introduction

Zoos play an important role in animal and biodiversity conservation [1,2] with ex situ breeding aiding the conservation of species in the wild [3]. Deforestation and habitat destruction caused by expanding human populations have produced many negative consequences, including increasing global warming, species extinction, and biodiversity loss [4–6]. International wildlife organizations, including zoos, strive to preserve ecosystem flora and fauna through various strategies, such as *ex-situ* breeding and reintroducing species [7–9].

Globally, zoos host over 600 million visits each year [10], making them a suitable platform to inform large numbers of visitors about threatened species [11–13]. Whilst zoos are often viewed as leisure venues [14], they provide substantial learning opportunities in addition to entertainment [15–18]. Educating the public about the importance of wildlife conservation is now a critical component of zoo visitor experiences [19]. In Pakistan, where

native wildlife is directly threatened by human actions, education is especially relevant and could help alleviate pressures on native biodiversity [5].

Zoos can evoke empathy, compassion, and emotional belongingness between animals and humans [20]. In addition, zoos look to impact public perceptions about animals in the wild [21–23]. Whilst strong positive connections towards species can inspire conservation, negative attitudes can create reluctance [24]. Understanding zoo visitors' perceptions towards species and conservation strategies is a vital step in addressing conservation-related goals [25,26].

Pakistan has a rich biodiversity and is home to 195 mammal species belonging to 10 orders [27]. Of these 195 species, 44 are regionally endangered [28]. The Asiatic black bear (*Ursus thibetanus*) is listed as globally vulnerable [29], the common leopard (*Panthera pardus*) [30] and snow leopard (*Panthera uncia*) are critically endangered in Pakistan [31], wolves (*Canis lupus*) are locally endangered [32], and the Himalayan brown bear (Ursus arctos isabellinus) is listed in Appendix 1 of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) in Pakistan [33]. These native species are locally threatened in Pakistan as a direct result of destructive human activities [5,34–39]. Hunting is still a common practice [40], and negative attitudes toward large native carnivores and high levels of human–wildlife conflict are prevalent, especially in northern Pakistan. Examples include extensive killing of the Asiatic black bear (*Ursus thibetanus*) [29,41], common leopard (*Panthera pardus*) [30], snow leopard (*Panthera uncia*) [31], and poor tolerance toward wolves (*Canis lupus*) [32] and Himalayan brown bears (*Ursus arctos isabellinus*) [42] amongst communities living close to forests.

Whilst there is some research on the awareness of rural communities towards Pakistan's large carnivores [28,29,33,41], little is known about zoo visitors' perceptions. Zoos attract visitors from both urban and rural areas. As negative activities such as hunting, bear baiting, and use of large carnivores for their body parts (e.g., for traditional medicine or decorations) are still prevalent across the whole of Pakistan [43], it is critical that zoos convey conservation messages to all visitors. The more that is known about Pakistan's zoo visitors and their attitudes, the easier it is to target conservation campaigns [44]. Greater support for such campaigns is likely to result in increased conservation donations and uptake of positive environmental actions.

Thus, knowledge of visitors' perceptions towards zoos are important for improving the zoo experience, communications regarding animal husbandry, and assessing the general acceptance of wild animal protection [45,46]. In this regard, this study aims to report:

- Pakistan zoo visitors' perceptions toward zoos and their general understanding of zoos' contribution to conservation.
- Pakistan zoo visitors' perceptions towards large native carnivores (often blamed for conflict in rural areas) and their awareness about these species' conservation needs.
- Factors which impact Pakistan's zoo visitors' perceptions.

2. Materials and Methods

2.1. Study Site

The study was conducted between January 2021 and April 2022 in three of the largest zoos in Pakistan: Lahore Zoo, Peshawar Zoo, and Jungle Kingdom Zoo of Ayub National Park Rawalpindi. Each zoo housed examples of all the following threatened Pakistani large carnivores: wolves (*Canis lupus*), common leopards (*Panthera pardus*), snow leopards (*Panthera uncia*), black bears (*Ursus americanus*), and brown bears (*Ursus arctos arctos*). However, each of the sites offered different visitor experiences:

Lahore Zoo is one of the oldest, largest, and most established zoos in Pakistan, founded in the 1860s. The zoo is governed by the Zoo Management Committee of Lahore Zoo. The zoo currently houses around 1200 animals representing 120 species. It has a well-advertised education program, runs regular awareness campaigns, and participates in several conservation breeding programs including for black bear and common leopard [47]. In the area

around Lahore, bear baiting, and bear dancing are still commonly practiced and there have been recent publicity campaigns aiming to halt these practices (*Author pers. comms*).

Peshawar Zoo was developed by the Khyber Pakhtunkhwa Government and opened to the public in 2018. It is located next to the Pakistan Forest Institute University of Peshawar and houses 30 species and a total of 160 animals (Peshawar Zoo data). Biodiversity awareness is a key goal of the site, as is encouraging tourism, conservation, and conservation education [48]. Peshawar is the sixth most populous city in Pakistan. Many of the zoo's visitors are from the outskirts of the city near established forests, home to some of Pakistan's large native carnivore species.

Jungle Kingdom (Jungle World Theme Park and Zoo) is an interconnected family amusement park and zoo, focusing on family entertainment and recreation [49]. Jungle Kingdom is the largest zoo in the twin cities of Rawalpindi—Islamabad. It is situated in Ayub National Park, a cultivated green space including a botanic garden and golf course and is located at the center of Pakistan's fourth biggest city. The zoo is advertised as housing a wide range of animals, including white tiger, Bengal tiger, and African lion, in addition to large native carnivore species.

2.2. Questionnaire

A structured questionnaire method was used to evaluate visitors' perceptions regarding wildlife. Adult visitors were randomly selected as they exited each zoo and were invited to answer a questionnaire. Although a pre–post survey design would have allowed us to test changes in opinion resulting from a zoo visit, this was not possible at our study sites due to staff availability. Staff at each zoo had to explain and translate the survey to respondents where English was not understood, and there was a concern amongst the test sites that a repeat survey would be too demanding for visitors and would be viewed negatively (research in tourist attractions is still uncommon in Pakistan and is a challenge to implement). As such, a single exit questionnaire was used, and responses were considered alongside other variables to determine influential factors. Given that the aim of this study was to capture the perceptions of Pakistani zoo visitors and not measure knowledge change, this method provided a workable solution.

Questionnaires consisted of closed-ended demographic information questions (age, gender, education, frequency of visiting zoos, and reasons for zoo visit) and Likert scale (7-point, strongly agree to strongly disagree) attitude statements (with a balance of positive and negative phrasing). Likert questions assessed: existing attitudes towards wildlife and conservation actions (10 statements); opinions about zoos and their role in conservation (7 statements); opinions about respondent's zoo visit experience (7 statements); perceptions towards Pakistan's native wildlife (7 statements for each of the species: wolf, common leopard, snow leopard, brown bear and black bear).

2.3. Data Analysis

Responses to the survey were analyzed in Excel and R. Basic descriptive statistics, including percentages and mode, were calculated from the accumulated responses from all three zoos.

Responses from the questionnaire were coded or reverse-coded (depending on question phrasing) to give scores used for modelling. A "Confidence in Animal Knowledge Score" was calculated using the (reverse-coded) responses to the statement: *"I don't know about endangered wildlife in Pakistan"*. A "Biodiversity Importance Score" was calculated based on (coded/reverse-coded) responses to the statements *"All living things are important, they have intrinsic value"*, *"Only humans are important, only humans have intrinsic value"*, and *"Large carnivores are important, they have intrinsic value"*. A "Perceived Learning Score" was calculated based on the statements *"I did not learn anything new"*, *"I found out how the Z/A contributes to conservation"*, *"I did not learn about environmental issues"*, and *"I learned animal facts"*. Finally, a "Perceived Animal Welfare Score" was calculated based on the statements *"Animals in the Z/A appear well cared for"* and *"Animals seemed bored"*.

Data were analyzed using GLMs to compare visitor responses against potential predictor variables (see Table 1 for variables tested). Data were checked for skew and heteroskedasticity, and variables were transformed before modelling. The following variables were excluded from modelling: gender (unavoidable bias due to sampling methods), education (these data were only collected at Jungle Kingdom), environmental concern, and animal interest (calculated based on question responses but excluded from models due to exceptionally strong positive bias as nearly all respondents had a high level of environmental concern and animal interest). Motivation for visit was also excluded due to extreme bias; most visits were to "spend time with friends and family".

Table 1. Minimum adequate models (MAMs) demonstrating significant predictor variables for visitors' attitudes.

(a)   Poisson GLM

Model (Variables)	Significant Variable	Direction of Influence (+/−)	%D	*p*-Value	*Model Statistics*
Perceived learning (a, b, c, d, e)	**Location**: Lahore Zoo **Confidence in animal knowledge**: Low **Biodiversity Importance Score**	(+) (+) (+)	1.62 1.43 2.6	0.006 0.006 <0.001	*[AIC = 2094, %D = 10.72, $\alpha_{FDR} = 0.03$]*
Perceived welfare (a, b, c, d, e)	**Location**: Lahore Zoo, Peshawar Zoo	(+)	10.9	<0.001; 0.001	*[AIC = 1495.4, %D = 17.9, $\alpha_{FDR} = 0.025$]*
Zoos should educate (a, b, c, d, e, f, g)	**Location**: Peshawar **Perceived Animal Welfare Score**	(+) (+)	6.38 2.6	<0.001 0.013	*[AIC = 1422.4, %D = 33.7, $\alpha_{FDR} = 0.025$]*
Zoos should entertain (a, b, c, d, e, f, g)	**Location**: Peshawar Zoo **Biodiversity Importance Score**	(+) (+)	4.77 3.7	<0.001 <0.001	*[AIC = 1211.3, %D = 39.77, $\alpha_{FDR} = 0.016$]*

(b)   Binomial GLM

Model (Variables)	Significant Variable	(+/−)	%D	*p*-Value	*Model Statistics*
	Wolves	**Location**: Lahore Zoo; Peshawar Zoo **Confidence in animal knowledge**: Low; Mid **Biodiversity Importance Score**	(+) (−) (+)	12.15 2.05 3.18	<0.001; 0.02 0.01; 0.02 <0.001	*[AIC = 319.86, %D = 21.95, $\alpha_{FDR} = 0.05$]*
Perceive the animal as threatened with extinction: (a, b, c, d, e, f, g)	Common Leopard	**Location**: Lahore Zoo **Biodiversity Importance Score**	(+) (+)	8.8 2.6	<0.001 0.001	*[AIC = 352.97 %D = 17.14, $\alpha_{FDR} = 0.025$]*
	Snow Leopard	**Location**: Lahore Zoo **Biodiversity Importance Score**	(+) (+)	8.34 2.59	<0.001 0.001	*[AIC = 352.97, %D = 17.14, $\alpha_{FDR} = 0.025$]*
	Brown Bear	**Location**: Lahore Zoo **Confidence in animal knowledge**: Mid **Biodiversity Importance Score**	(+) (−) (+)	2.95 1.65 2.04	<0.001 0.01 0.003	*[AIC = 386.2, %D = 9.4, $\alpha_{FDR} = 0.03$]*
	Black Bear	**Location**: Lahore Zoo **Confidence in animal knowledge**: Low; Mid **Biodiversity Importance Score**	(+) (−) (+)	2.86 3.32 3.53	0.001 0.01; <0.001 <0.001	*[AIC = 387.61, %D = 9.35, $\alpha_{FDR} = 0.04$]*

Table 1. *Cont.*

(b) Binomial GLM

Model (Variables)		Significant Variable	(+/−)	%D	*p*-Value	*Model Statistics*
Believe that the animal should be kept in captivity for conservation reasons: (a, b, c, d, e, f, g)	Wolves	**Location**: Peshawar Zoo **Biodiversity Importance Score** **Perceived Animal Welfare Score**	(+) (+) (+)	12.93 5.6 1.82	0.006 <0.001 0.005	*[AIC = 227.06, %D = 27.42, α_{FDR} = 0.0375]*
	Common Leopard	**Location**: Peshawar Zoo **Biodiversity Importance Score** **Perceived Animal Welfare Score**	(+) (+) (+)	10.62 4.26 <1	0.002 <0.001 0.02	*[AIC = 218.9, %D = 24.24 α_{FDR} = 0.025]*
	Snow Leopard	**Location**: Peshawar Zoo **Biodiversity Importance Score** **Perceived Animal Welfare Score**	(+) (+) (+)	14.37 7.8 2.14	0.001 <0.001 0.02	*[AIC = 217.35, %D = 27.69, α_{FDR} = 0.05]*
	Brown Bear	**Location**: Peshawar Zoo **Biodiversity Importance Score** **Perceived Animal Welfare Score**	(+) (+) (+)	14.59 6.0 3.42	0.001 <0.001 0.003	*[AIC = 219.98, %D = 27.32 α_{FDR} = 0.025]*
	Black Bear	**Location**: Peshawar **Biodiversity Importance Score** **Perceived Animal Welfare Score**	(+) (+) (+)	15.37 6.04 2.81	<0.001 <0.001 0.007	[AIC = 214.01, %D = 25.91 α_{FDR} = 0.025]
Believe Poaching is acceptable for: (a, b, c, d, e, f, g)	All Species	**No significant variables**	-	-	-	*[AIC = 156.38–171.38%D = 8.2–15.59, α_{FDR} = 0.012–0.05]*
Believe there is an urgent need to protect/conserve: (a, b, c, d, e, f, g)	Wolves, Common Leopard, Snow Leopard, Brown Bear	**No significant variables**	-	-	-	*[AIC = 77.85–132.73, %D = 0–17.24 α_{FDR} = 0.016–0.05]*
	Black Bear	**Perceived Learning Score**	(+)	4.61	0.02	[AIC = 107.09, %D = 4.61, α_{FDR} = 0.05]

MAM variables: location—which zoo visited (Jungle Kingdom, Lahore, Peshawar), (b) age—respondent's age (log-transformed), (c) visit history—whether first-time visitor, up to 3 zoo visits per year, 4 or more visits per year, (d) biodiversity importance score—based on (coded/reverse-coded) Likert responses to statements: "All living things are important, they have intrinsic value", "Only humans are important, only humans have intrinsic value", (e) confidence in animal knowledge—based on (reverse-coded) Likert responses to statement: "I don't know about endangered wildlife in Pakistan", (f) perceived learning score—based on (coded/reverse-coded) Likert responses to statements: "I did not learn anything new", I found out how the Z/A contributes to conservation", "I did not learn about environmental issues", "I learned animal facts", (g) perceived animal welfare score—based on (coded/reverse-coded) Likert responses to statements: "Animals in the Z/A appear well cared for", "Animals seemed bored". +/− = positive/negative relationship. AIC = Akaike information criterion. %D = percentage deviance explained (significant variables only).

Variables with a high degree of correlation were not modelled together, i.e., all variables had a VIF score < 2 and Pearson's correlation coefficient < 0.7 [50]. GLMs were created using R (Version 4.1.2). Endpoint adjustment was calculated after each model, and αFDR was used as a significance threshold.

Likert statements were analyzed as binomial distribution GLMs (e.g., 1 = slightly to strongly agree, 0 = slightly to strongly disagree), or using Poisson's distribution where a numerical score had been calculated (e.g., perception of learning score).

2.4. Ethics

Official written permission was acquired from the Official Administration of Zoos, Pakistan, before conducting the study, and verbal informed consent was obtained from all participants.

3. Results

A total of n = 304 visitors from across the three zoos completed the survey. Demographic details of the study sample are given in Table 2. Over 75% (n = 226) had visited a zoo at least once in the past year (in addition to this visit), with most visiting zoos 1–3 times per year (Table 2).

Table 2. Demographics of zoo visitors completing the survey. * These data were only collected for Jungle Kingdom Zoo.

	Demographics
Number of respondents	304
Gender: no. of males	182
(% of respondents)	(59.9)
Modal age range	18–25
(% of respondents)	(38.8)
Modal education level *	Masters
(% of respondents)	(39.5)
Number of visitors with an annual pass (% of respondents)	159 (52.3)
Modal frequency of visits	1–3 times per year
(% of respondents)	(52.3)
Number of first-time visitors	73
(% of respondents),	(24)

Respondents generally had a positive interest in wildlife. Over half the respondents agreed on some level that they enjoyed watching TV documentaries about wildlife (63.4%), enjoyed learning about environmental issues (61.8%), and actively considered their actions regarding wildlife (61.1%).

3.1. Perceptions towards Zoos

Most of Pakistan's zoo visitors agreed (slightly–strongly) that the zoo was a place for relaxation (74.3%) and fun (70.4%). Generally, respondents agreed (slightly–strongly) that zoos should inform their visitors about animals (77%) and should house rare species (68.7%). Over half (59.9%) of the respondents felt (slightly to strongly agreed) that the zoo animals were well cared for, and that the animals were not bored (50.9%). Although visitors felt they had found out about the zoos' contributions to conservation (63.2%), fewer believed they had participated in any conservation activities (35.2%).

3.2. Perceptions towards Pakistan's Threatened Large Carnivores

Over half (55.2%) of respondents felt that they knew about Pakistan's threatened wildlife, and the majority (77.6%) felt that large carnivores were important and had intrinsic value.

Attitudes towards each of the large native carnivores were broadly similar regardless of species. There was a general awareness that each of the large carnivores were at risk of extinction in Pakistan (62.2% to 67.7% agreed that the animals were threatened in some way). Around 40% (38.8% to 40.5%) believed the species to be very rare locally. Although only slightly (and not significantly) lower, wolves were viewed as the least threatened, with common leopard, snow leopard, and black bear jointly viewed as most threatened. Most of the visitors (>80%) were opposed to poaching as being acceptable for these species.

3.3. Factors Influencing Visitor Perceptions

The location (which zoo the respondent visited) was a significant predictor and explained the most deviance of the model for perceptions of animal welfare, the education and entertainment roles of zoos, and for several key attitudes towards Pakistan's large carnivores, explaining between 1.6% to 15.37% of the model deviance (Table 1). Visiting Peshawar Zoo had a positive and significant influence on attitudes towards keeping animals in captivity (for conservation purposes). Visiting Lahore Zoo had a positive and significant influence on perceived learning, perceived welfare, and perceived threat level of species. In contrast, attendance at Jungle Kingdom was not identified as a significant factor in any of the question areas.

Other variables identified as being significant include perception of animal welfare (<5% of model deviance), respondent's Biodiversity Importance Score (explaining between 2.04% and 7.8% of each model's deviance), and confidence in animal knowledge (which was negatively associated with awareness of animals' threat status but had a positive impact on whether visitors believed they had learned during their visit).

Some variables were highly significant predictors, but only explain a very small part of the model, suggesting that there may have been other influences affecting visitor opinions which were not captured by the variables measured. Respondent's age and visit history (the frequency of zoo visits per year) had no influence on any of the models.

4. Discussion

Understanding visitors' attitudes towards threatened native species is an important step in addressing the human causes of biodiversity loss and habitat destruction, as it allows conservation messages to be targeted. Similarly, being aware of the perceptions towards zoos and the contributing factors in holding these attitudes can help zoos maximize their conservation messaging abilities.

A consistent and significant factor in predicting an individual's responses to attitude statements was location (i.e., which zoo was visited). This is not surprising given that the three test sites differed dramatically in their presentation style and aims. However, what is of note is that location was responsible for explaining the most deviance in nearly every model, suggesting that the site itself plays a significant role in how information is conveyed. Attendance at Lahore Zoo (a well-established zoo with strong educational focus) predicted positive perceptions of learning, welfare, and understanding of species extinction risk. This indicates that visitors perceive conservation messages as being conveyed at this site, possibly due to the strong site-wide-focus on education. Attendance at Peshawar Zoo was a strong predictor for a positive association with the need to keep animals in captivity for conservation grounds. This may be as Peshawar is a newly established zoo with a connected research institute and is supported by government initiatives, all indicators which suggest a need to bring species into captivity for their protection. In contrast, attendance at Jungle Kingdom was not a predictor for any of the attitude statements, potentially as the site is marketed as entertainment, rather than conservation or education, focused. This is supported by other studies which also found that location had an impact on visitors' knowledge, attitudes, and behaviors [18], including from combined theme park zoos which suggests that conservation messages can become blurred when presented in a highly entertainment-driven environment [51]. Actor Network Theory suggests that the way an organization presents itself (its brand) can fundamentally affect how visitors

interpret the messages conveyed [52]. As such, it is imperative that where a zoo intends to convey conservation messages and actions, their whole site and brand need to echo the concept of conservation and positive environmental actions.

Zoos are, however, viewed as source of entertainment and recreation for visitors [15,21,26]. We found that most respondents stated spending time with friends or family as their primary motivation for their visit. This mirrors similar results reported by Vernon & Boyle [53] and Puan & Zakaria [54], who found that whilst there was a desire to be shown the natural world, leisure was the priority. Zoos must engage visitors in learning during their free time, however; if they succeed, they have the potential to educate a vast audience. Various studies have shown that zoos can convey animal facts to their visitors and instill compassion and empathy for animals [55,56]. Zoos must ensure conservation information is also conveyed [57] to guarantee that their role in species conservation is known [58,59].

We found that perceptions of learning were influenced both by a high Biodiversity Importance Score and by a low confidence in animal knowledge. This indicates that zoo education currently targets those with only a basic awareness of animals, but a high interest level. It is possible that given the already high animal awareness of most zoo-goers, many feel they have not learned anything new. Zoos should target their information at a more advanced level, potentially posing questions to stimulate discussions around conservation [60,61]. A similar finding was noted in Spooner et al. [51], who found that increases in visitor knowledge were limited by the type of information conveyed.

Visitors' Biodiversity Importance Score (how much they intrinsically value all living things) was another significant predictor across most statement areas; however, it explained less than 8% of each model's deviance. As the individuals attending Pakistan's zoos already have high environmental concern and interest in animals, this may explain why the effect size was not larger. The finding that zoo visitors have high existing interest in animals echoes that of Ballantyne and Packer [17], indicating that, despite cultural differences, zoos attract a similar type of visitor worldwide.

We found high Biodiversity Importance Scores were often associated with attendance at Peshawar Zoo. Given that Peshawar Zoo has prioritized biodiversity awareness across its site and through its online marketing, this finding is perhaps unsurprising. However, it further confirms the need to echo core messages throughout zoo branding.

The finding that Biodiversity Importance Scores are a significant predictor of support for keeping animals in captivity is especially important for zoos. Zoo visits have been shown to increase understanding about biodiversity [13], and in turn, it appears that this increased understanding has positive implications for how visitors view the role of zoos (as a place where biodiversity is being protected). We note that ultimately the best habitat for native species is in the wild, and many zoos are working to protect native habitats and reintroduce species. However, until threats in the wild are removed, captive breeding, education, and funding through zoos remain important.

Although perception of animal welfare only explained a small amount of the model deviance, it was a consistent factor in all statements regarding keeping species in captivity for conservation purposes. This supports the idea that when zoos clearly convey the purpose of keeping animals in captivity and demonstrate high levels of animal welfare, public support will follow. We note that this finding is based on notions of perceived animal welfare and, in some cases, an enclosure which looks appealing from a public perspective may not always be in the animal's best interest. For example, research has shown that visitors often prefer naturalistic enrichment and enclosures regardless of whether it is the best for that species [62]. As such, it is imperative that zoos make an effort to explain their husbandry practices to their visitors.

Interestingly, there were no clear predictors for statements regarding urgency to conserve each species, with one exception: the need to conserve the black bear was associated with increased perceptions of learning. Individuals who believed they had learned something new during their visit were also more likely to believe the black bear is urgently in need of conservation, suggesting that conservation messages regarding black bear were

effectively conveyed. Black bear conservation is a focus across Pakistan due to the continued prevalence of bear baiting and dancing, as well as other significant threats from human–wildlife conflict [41]. Location was not a factor in predicting this conservation concern. This may indicate that all three zoos clearly conveyed threats to this species, but it also indicates that national media campaigns to protect black bears [63] (Author pers. comms.) may be having a positive influence on public opinion. Despite this, the black bear remains a problematic human–animal conflict species for rural communities [41].

There was a high awareness amongst zoo-goers about Pakistan's large native carnivores. This may be reflective of the high level of animal interest and conservation concern amongst zoo-goers. Reassuringly, there were also strong views against the idea of poaching or killing these threatened large carnivores. There were no specific variables identified which influenced this attitude, suggesting that these views are pre-existing and not influenced by the zoo environment itself. This "anti-poaching" stance is, in principle, good news. However, we acknowledge that the individuals questioned were visiting inner city zoos and may live in urbanized areas. Therefore, they may be less likely to come into direct conflict with large carnivore species. Whilst urban communities may appear to be far from the habitat of Pakistan's large native carnivores, education of this group is still needed. In Pakistan it is still common for illegally trapped species, including large carnivores, to be transported to urban areas for purposes such as street circuses, decoration (e.g., skin, paws), traditional medicine (e.g., gallbladder, fat), and even as pets [43]. Zoos can provide opportunities for both rural and urban dwellers to encounter endangered species positively, thereby developing the connections needed to support species conservation [64,65].

We acknowledge that our study has several limitations. Specifically, as a survey at a single timepoint, we cannot claim any visitor opinions to be attributed to the visit itself, instead we can only suggest factors which appear to influence opinions. We additionally recognize that perceived learning scores may be inflated due to respondent bias (respondents are likely to say they have learned in order to please the researcher or themselves). Our survey measures the opinions and attitudes of a given group (Pakistan's zoo visitors) at a given timepoint (after a day visit to a Pakistan zoo) and is, therefore, not generalizable to the views across Pakistan. Additionally, as we did not directly ask visitors where they lived, we cannot differentiate between effects on rural or urban dwellers. However, the study is of value as a starting point for future research (very few studies have been conducted at Pakistan's zoos) and helps to identify the factors influencing visitor awareness and opinions. This is critical for targeting future zoo conservation messages. Additionally, in seeking mentorship from researchers internationally, Pakistan's zoos are modelling how they can work with other organizations to strengthen their skills.

5. Conclusions

Understanding visitor perceptions of the role of zoos and attitudes towards threatened (and locally persecuted) large native carnivores is an important step in targeting conservation messages. We identified several factors which influence visitor attitudes, including how the zoo is portrayed, how prevalent conservation and biodiversity messaging are throughout the zoo site, the perception of animal welfare, the confidence in visitors' animal knowledge, and how much visitors value biodiversity.

Overall, Pakistan's zoo visitors have a high level of interest in animals and environmental concern. Similar to other countries, visitors' primary motives during a visit are spending time with family and friends. As such, Pakistan's zoos, like others across the globe, must balance a need to convey conservation education with a desire for leisure. We suggest that zoos can maximize their chance of success through modelling conservation action and attitudes throughout their site and across their marketing. Given the high level of existing animal awareness amongst zoo-goers and the tendency for repeat visits to zoo sites, zoos should target their education at a more complex level than simply providing animal facts. For example, zoos could encourage visitors to engage in conservation discussions, find sustainable lifestyle solutions, or identify ways to protect native species.

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