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RESEARCH ARTICLE

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Exploration of cultural norms and behavioural beliefs about zoo animal behaviour, welfare, ethics and husbandry practices in a sample of the international zoo community

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Abstract

Beliefs influence the intentions of people to behave in certain ways towards animals. This study presents survey responses from 237 people working in zoos in China and Europe and describes their demographic characteristics. It explores their beliefs about zoo animal behaviour, welfare and ethical issues, and zoo practices, using a survey methodology. These beliefs may be influenced by individual demographic or cultural factors such as age, gender and region of employment, as well as experiential or situative 'norms' within the work environment. Beliefs were significantly influenced by the region of employment with Chinese respondents beliefs being significantly different to beliefs from respondents in the United Kingdom or the rest of Europe. Hierarchical cluster analysis of the survey generated clusters of people from both regions who indicated positive beliefs about zoo animal welfare as well as clu sters indicating a lack of understanding of some zoo animal welfare issues. In addition, a cluster suggesting cognitive dissonance between beliefs about animals welfare and zoo practices was generated from Chinese responses. Factor analysis identified that prioritisation of in-situ conservation within good animal welfare was a key feature in Chinese respondents, whereas European beliefs prioritising in-situ conservation were distinct from those on supporting good animal welfare. This paper identifies similarities and differences in beliefs about zoo animal welfare and zoo husbandry practices between Europe and China, and discusses the underlying norms and values that these beliefs may reflect.

KEYWORDS
animal welfare, beliefs, culture, zoo

1 | INTRODUCTION

Much of the research on human-animal interactions in zoos has focussed on the perceptions and beliefs of zoo visitors (e.g., Clayton et al., 2009; Davey, 2007; Godinez & Fernandez, 2019; Reade & Waran, 1996). Additionally, the importance of the behaviours of zoo staff towards their animals has become an increasing focus of research (Birke et al., 2019; Carlstead et al., 2019; Fernie et al., 2012) but gaps still remain in characterising the beliefs of zoo staff towards zoo husbandry practices and zoo animal welfare issues in many countries.

Many definitions of animal welfare exist, however, most definitions incorporate affective/emotional aspects as well as behavioural and physical qualities of animals, and acknowledge that animal welfare may vary in valence from poor to good (Broom, 2011; Hill & Broom, 2009; Ohl & van der Staay, 2012). Across the global zoo community, similar definitions of animal welfare incorporating these aspects are accepted (Bacon et al., 2021a; European Association of Zoos and Aquaria, 2020; Mellor et al., 2015). Stockpersonship is an element of the Human–Animal Relationship that has been identified as being important to animal welfare across a range of industries including zoos (Boivin et al., 2003; Hemsworth et al., 2009; Ward & Melfi, 2015). Stockpersonship comprises both knowledge of, and attitudes towards animals (Ward & Melfi, 2015). Other human factors that have been suggested to be important for good animal welfare, include (1) positive human–animal interaction, (2) consistency and familiarity of keepers, (3) treating animals as individuals and taking account of their personalities, (4) the attitudes and personalities of keepers, (5) the keepers' knowledge and experience, (6) the keepers' own well-being and (7) the influence of facility design on how keepers and others interact with the animals (Cole & Fraser, 2018). Understanding the demographic and educational factors that influence perceptions and beliefs about animal welfare, behaviour and controversial zoo practices is important in developing education, guidance, and policy (von Essen et al., 2020) and ensuring that educational interventions meet the needs of the target audience.

Application of the Theory of Planned behaviour (Ajzen, 1991) to zoos suggests that zoo staff' beliefs may influence the care these staffs give to zoo animals (Figure 1). It seems logical that more positive beliefs about animal needs and the impact of the behaviour of zoo animal caregivers, may lead to stronger intentions to meet animal needs, and this is supported by work done in other industries. For example, a study of pig farmers in Finland found that those with more positive attitudes towards their pigs had improved production measures compared to farmers with more negative attitudes (Kauppinen et al., 2012). Similarly, interventions that have targeted attitude and behaviour change in stockpeople have resulted in improved welfare and production parameters in dairy cows (Hemsworth et al., 2002). Work in China has shown that positive attitudes towards animals are a predictor of future behavioural intentions (Platto et al., 2020), and similar results have been shown in the management of free-roaming cats in the United Kingdom (McDonald et al., 2018).

Surveys are a widely used tool in assessing beliefs about animals (Hacker & Miller, 2016; Heleski et al., 2005; Signal & Taylor, 2006). Whilst large-scale surveys of zoo staff have provided insight into specific controversial practices, for example, population management euthanasia (Powell & Ardaiolo, 2016) and live-feeding in aquaria (Keller, 2017), more general data across a variety of animal welfare or ethical issues is lacking. Additionally, the published data is often focused on countries in the Anglosphere (English-speaking nations that share cultural, ancestral, and historical ties to the United Kingdom) (Peters, 2021), such as zoo staff in the United States, Australasia, and the United Kingdom (Marshall et al., 2019; Melfi et al., 2021; Powell & Ardaiolo, 2016; Powell et al., 2018; Riggio et al., 2020). There are increasing international connections across the global zoo community as animals are managed at the population level to promote success in conservation (Asa et al., 2011;

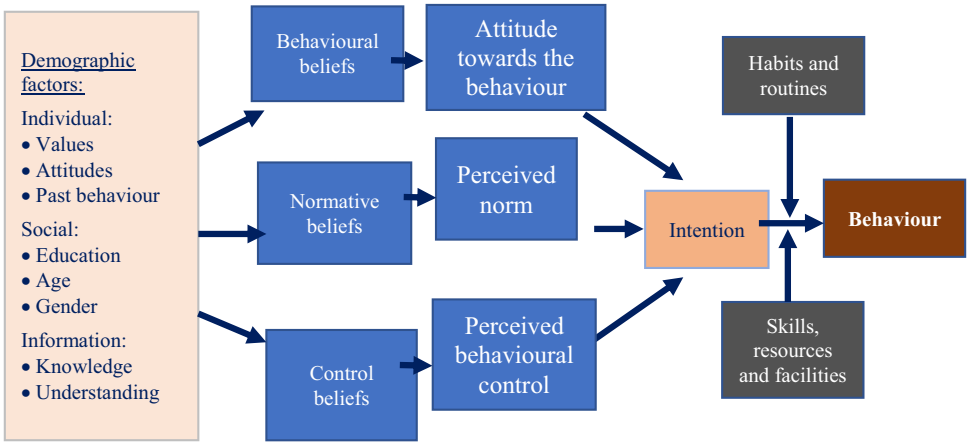

FIGURE 1 The interaction between various intrinsic (blue) and extrinsic (grey) factors which influence a human's behaviour in response to a recognised animal welfare problem, adapted from the theory of planned behaviour (Ajzen, 1991). [Color figure can be viewed at wileyonlinelibrary.com]

Schulte-Hostedde & Mastromonaco, 2015; Traylor-Holzer et al., 2019). Because of this, evaluating the beliefs of a more regionally diverse sample of zoo staff to a broader selection of animal welfare issues is important in characterising the international zoo community and identifying similarities and differences in beliefs.

For this project, two study areas were selected—a single large country—China and a region—Europe. Both China and Europe have active zoological membership associations (European Association of Zoos and Aquaria, and Chinese Association of Zoos and Aquaria), but face different cultural and geographical challenges. The European zoo community is ethnically and linguistically diverse, but well connected to the global zoo community, and with access to animal behaviour and welfare information via a range of English language publications, research and educational initiatives (Binding et al., 2020; European Association of Zoos and Aquaria, 2020). Conversely, the Chinese zoo community is more ethnically and linguistically homogenous (whilst regional variation does occur, there is a single written language, and the majority of the population is Han). It is also more disconnected from the global zoo community, and from many of the outputs of animal behaviour and welfare research due to linguistic and political barriers (Goulart et al., 2009; Sinclair et al., 2020). These differing cultural characteristics provide a diverse landscape upon which to explore the demographic characteristics of zoo staff, and to investigate their normative, behavioural and control beliefs about zoo animals, This study aims to describe the demographic characteristics of staff working in zoos in China and Europe and to explore their beliefs about zoo animal behaviour, welfare and ethical issues, and zoo practices using a survey methodology and discuss the underlying norms and values that these beliefs may reflect.

2 | MATERIALS AND METHODS

A questionnaire was drafted based on the literature and the study aims, resulting in a four-part questionnaire instrument (see Supporting Information) comprising:

(1) Respondent demographics;
(2) Perceptions of truth relating to animal behaviour, welfare and husbandry issues;
(3) Agreement with statements on animal welfare, behaviour and husbandry practices and
(4) Zoo staff training needs.

Questions on perceptions of truth about animal welfare, animal behaviour and animal husbandry practices were developed in a true/false/don't know format. Questions relating to the agreement with animal welfare, animal behaviour and animal husbandry practices were developed on a 6-point Likert scale where 1 = Strongly disagree, and 6 = Strongly agree. An even-numbered scale was chosen as this forced the respondents to make a choice and reduce neutral responses. Items within these sections covered a range of issues that may be influenced by normative, behavioural and control beliefs.

The questionnaire was piloted to ensure content validity by three European (EU) and four Chinese colleagues, all of whom worked with captive wildlife. Questionnaires were translated into Chinese characters, and both questions and responses were back-translated with the questions checked against the original English to ensure the accuracy of the translation. Based on feedback from both European and Chinese pilots, a final version of the questionnaire was then sent to all pilot respondents for final review and agreement. The final questionnaire instrument comprised 16 demographic questions, 18 true/false/don't know questions, 12 questions exploring an agreement with statements/beliefs relating to animal welfare and ethics and 9 questions relating to training needs and barriers (see Supporting Information). This paper will report the questionnaire sections relating to (1) Respondent demographics; (2) Perceptions of truth relating to animal behaviour, welfare and husbandry issues; (3) Agreement with statements on animal welfare, behaviour and husbandry practices.

Electronic distribution was via SurveyMonkey (Usabilla, London, UK) The electronic questionnaire link was promoted across Europe by the European Association of Zoos and Aquaria (EAZA). In addition, electronic copies of questionnaires were sent directly by personal e-mail to a convenience sample of zoo professionals in Europe. In China, the questionnaire link was emailed directly to a convenience sample of zoo staff. Due to low responses to the electronic survey, a paper-based version of the questionnaire was also administered during a face-to-face workshop in Chengdu, China, hosted by the Chinese Association of Zoological Gardens and attended by 80 participants from zoos around China.

2.1 | Statistical analysis

2.1.1 | Assessment of similarities and differences between regional groups

The 237 responses were cleaned and descriptively analysed. Seventy-four (31.22%) respondents were from the United Kingdom, 74 (31.22%) from the rest of Europe (rEUR) and 77 (34.49%) from China. Data from European countries not including the UK, were agglomerated as these represented 74 responses from 22 countries, with no dominant respondent country (responses per country 1–9).

A binomial logistic regression assessed the effect of age, gender, pet ownership, education, diet, years worked in zoos, number of zoos worked in, visiting zoos as a child, watching documentaries as a child, job role and number of pets on being employed in China versus Europe (UK plus rEUR).

A multiple correspondence analysis (MCA) was used to analyse the relationships between and within the groups of categorical dependent variables, by reducing the dimensions of the data and creating new principal dimensions (Husson, 2016). Demographic variables were run as supplementary variables in the MCA analysis of agreement and true/false/don't know statements to test if they were associated with the responses to these items.

Generalised linear modelling, using a weighted model-averaging technique with the glmulti package in RStudio, applied a genetic algorithm to identify a set of candidate multivariable models with various combinations of explanatory variables.

Based on these results, the European and Chinese data sets were then analysed separately using exploratory factor analysis, Mann–Whitney and Hierarchical clustering using Wards methods and Euclidean distance.

Hierarchical clustering on principal components with the number of clusters calculated using Ward's method and the squared Euclidian distance as a similarity measure (Husson, 2020; Husson et al., 2010) generated 5 clusters from Chinese respondents and 10 from European Respondents. Variables that were significantly linked by contributing to the inertia of each cluster were identified using the V.test (test-value). A V.test of >2.00 corresponds to a p-value of <.05 (Husson et al., 2010).

Exploratory factor analysis using varimax rotation in SPSS (IBM) was used to identify common groups of issues from the Likert item responses. Items with loadings >0.3 were retained within the factors and factors with >3 items were retained for interpretation.

3 | RESULTS

3.1 | Survey responses

The European (EU) survey generated 326 responses to the SurveyMonkey link plus six responses to the emailed word document. Of these responses, those that were from respondents outside the sampling frame, or that contained missing data that was deemed to be 'missing not at random' (Porter & Ecklund, 2012), were eliminated, leaving 160 questionnaire responses from 23 countries across Europe. Of these, the response numbers were similar in terms of responses from the United Kingdom ($n = 74$) and those from the rEUR ($n = 86$). The Chinese (CN) survey generated 16/31 responses (51.6%) to the SurveyMonkey link directly emailed out. A further 61 responses were obtained from the face-to-face paper-based survey (76.3% return). All 77 responses were retained for inclusion in the analysis.

MCA of the 'perceptions of truth' data with demographic characteristics run as supplementary variables showed significant separation of responses by region only, with the United Kingdom and rEUR responses not significantly separated, from each other but significantly separated from Chinese responses.

MCA analysis of Likert items condensed to dichotomous 'agree/disagree' responses showed that there was overlap between regions, with the Chinese respondents separating out into one group overlapping European respondents, and one distinct group (Figure 2).

Confidence ellipses suggested the Chinese responses were significantly separated ($p < .05$) from the United Kingdom and rEUR responses, and this was confirmed by multivariable analysis including all demographic predictor variables which showed that only region of origin (UK and rEUR) was a predictor value for agreement with Likert item responses (incident rate ratio 1.36, 1.11–1.36) (Figure 3).

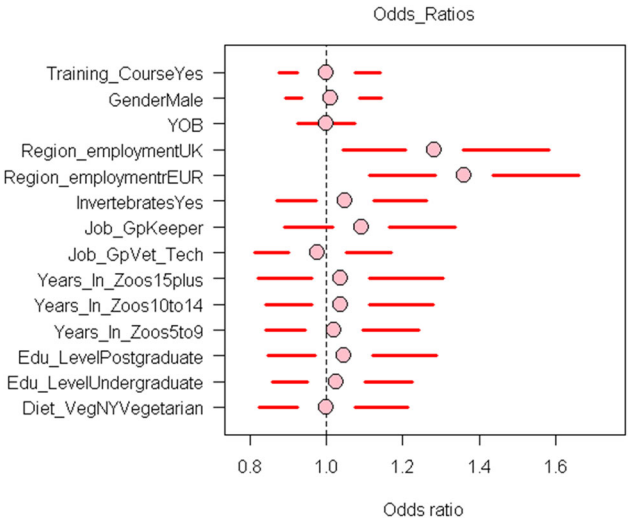

FIGURE 3 Output image from multivariable analysis of all agreement items showing the predictor variables (training course attendance, gender, year of birth, region of employment, taxon worked with, Job group, number of years worked in zoos, education level and diet) and their associated odds ratios and confidence intervals. [Color figure can be viewed at wileyonlinelibrary.com]

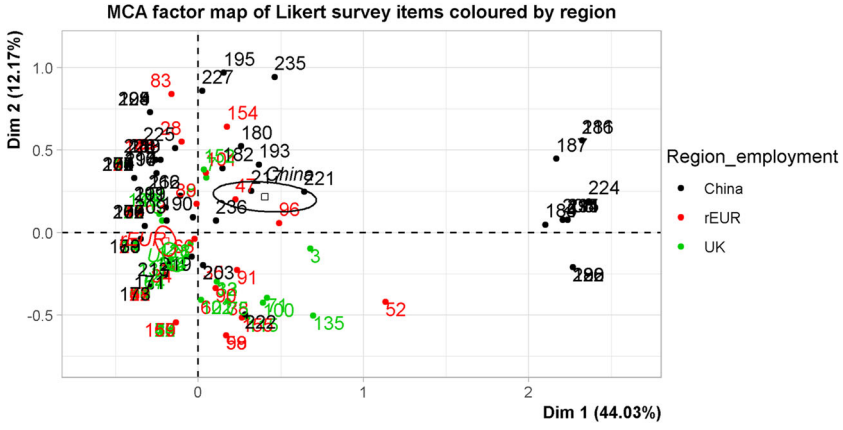

FIGURE 2 MCA factor map of individual respondents to agreement items, coloured by region of employment and separated by underlying dimensions 1 (x-axis) and 2 (y-axis). Chinese respondents are shown in black, UK respondents in green and respondents from the rest of Europe in red, with corresponding confidence ellipses for each region. MCA, multiple correspondence analysis. [Color figure can be viewed at wileyonlinelibrary.com]

Based on the separation of survey response items by region, the regional data sets were analysed separately.

3.2 | Analysis of regional Chinese and European data sets

3.2.1 | Demographic characteristics

Between 62 and 77 responses from Chinese zoo staff were received to each demographic item 62–77 (80.52%–100%) with the training experience questions receiving the lowest responses. The Chinese survey sample were predominantly male zoo vets with an undergraduate education, who ate meat and fish, had worked in a single zoo and worked with terrestrial mammals.

Response rates from European respondents to demographic items on the questionnaire varied from 143 to 160 (100%–89.38%) with items asking about prior training receiving lower responses. Respondents were primarily female pet owners from the United Kingdom or mainland Europe, working in a single zoo, across a range of roles and with a range of species. The Chinese zoo staff were younger than the Europeans (odds ratio [OR] = 1.34, confidence interval [CI] = 1.07–1.69, $p = .013$).

3.3 | Influence of demographic variables on survey responses

A significant relationship was identified between attending prior specific training in animal welfare and believing that 'The husbandry of zoo animals influences their welfare', was a true statement, in Chinese respondents only (OR = 10.58, CI = 1.81–61.74, $p < .05$).

Generalised linear modelling of the Chinese sample identified a significant relationship between watching documentaries as a child and agreement with all of the Likert scale items OR = 0.55 (0.31–0.91). No associations were found between European respondent demographic characteristics and item survey responses.

3.4 | Cluster analysis

3.4.1 | Chinese responses cluster analysis

Five clusters were generated but as two clusters contained only one or two survey items, the particular beliefs of the respondents in these clusters could not be clearly elucidated but these clusters suggested a lack of knowledge or information about specific items as they comprised either 'don't know' responses or beliefs that were contraindicated by the literature.

The largest three clusters comprised significant clustering of items which indicated: (a) a positive affect towards animals, (b) a possible dissonance between the impacts of animal husbandry on zoo animal welfare, (c) Responses that contradict the literature to items about animal welfare.

3.4.2 | European responses cluster analysis

Ten clusters were generated from the European responses these included several small clusters (1, 2, 6, 9) of respondents who believed statements that are well supported in the literature were false, and several small clusters (4, 7, 8, 10) of respondents who indicated that they did not know whether they believed specific items to be true or false. However, the majority of respondents comprised two larger cluster representing (a) a positive affect towards animals, (b) don't know responses to several items.

3.4.3 | Association of item responses with regions

Binomial logistic regression of the remaining true/false/don't know items showed that the overall model explained 90.0% of the variance of region of employment (Nagelkerke R^2). Some beliefs were significantly associated with a particular region, these were:

China

'The ethics of animal welfare considers an animal to have experienced a good life and a humane death' is a false statement, $p = .038$ (OR = 57,473.11 and CI too large to report).

'The husbandry of zoo animals influences their welfare' is a false statement (CN), $p = .037$ (OR = 33.87, CI = 1.23–934.47).

Europe

'The live feeding of vertebrate animals such as rodents, rabbits or fish to carnivores is necessary to provide balanced nutrition' is a false statement, $p = .002$ (OR = 962.95, CI = 13.74 = 67,480.92).

These significantly different items were all perceptions of truth about ethical beliefs or husbandry practices. This information suggests a range of beliefs about and acceptability of ethically challenging zoo animal husbandry.

European respondents were more likely than Chinese respondents to select a 'don't know' response to:

'The 5 freedoms are a framework for animal welfare', $p = .012$ (OR = 162.69, CI = 3.122–8478.85).

'Animal welfare is a scientific concept describing a measurable state of an animal's quality of life at a particular time', don't know $p = .040$ (OR = 590.957, CI = 1.33–262,920.60).

Large confidence intervals suggest the precision of the OR is poor and further exploration of these beliefs in each region is encouraged, but the differences in responses are statistically significant. There was no difference detected in other survey items relating to animal welfare science and animal behaviour. This

information suggests broadly common beliefs about animal welfare between the two regions. Common beliefs about statements relating to zoo animal behaviour include a recognition of the usefulness of zoo animal behaviour as an assessment method in zoo animal welfare assessment.

3.4.4 | Likert items

Six items differed significantly in terms of median agreement scores between the two regions (Table 1). These items related to (1) animal husbandry (Good animal welfare is essential for effective zoo animal husbandry; I have a good understanding of a variety of zoo animal management practices such as euthanasia, culling, enrichment, operant conditioning; Environmental enrichment should be provided for all zoo animals), (2) The role of the zoo (Zoos should prioritise the protection of biodiversity in the wild over the maintenance of animal populations in captivity) and (3) behavioural needs (Zoo animals may suffer if their physical or behavioural needs are not met; Zoo animals do not have the same behavioural needs as wild animals). Respondents from the two regions self-assessed their understanding of a variety of zoo animal management practices such as euthanasia, culling, enrichment, operant conditioning differently with European respondents significantly more likely to agree that they had a good understanding of a variety of zoo animal management practices.

3.5 | Exploratory factor analysis of Likert scale items

3.5.1 | Chinese responses exploratory factor analysis

Three factors were generated from exploratory factor analysis. One was excluded as it loaded onto only a single questionnaire item. The remaining factors aligned with items that suggested the underlying factors may relate to (1) Welfare needs, choice and opportunities (loaded strongly on to acknowledgement of suffering if needs are not provided for, providing choices to animals, and offering environmental enrichment). (2) Good welfare and conservation (loaded strongly onto agreement that zoos could be improved in many cases, that animal behaviour could provide us with useful information and that enrichment should be provided (Table 2).

3.5.2 | European exploratory factor analysis

Five factors were generated from exploratory factor analysis (Table 3). One was excluded as it only loaded onto a single questionnaire item. These factors aligned with items that suggested the underlying factors may relate to (1) the animals agenda, (2) traditional beliefs, (3) behavioural husbandry and (4) nonknowledgeable conservationists/behaviouralists.

TABLE 1 Mann–Whitney *U*-test of agreement item Likert responses between Chinese and European respondents with 1 = strongly disagree and 6 = strongly agree

Agreement item	CN median	EU median	Significance $p < .05$
Good animal welfare is essential for effective zoo animal husbandry	6.00	6.00	**<.001**
As long as an animal is physically healthy, well-fed and protected from injury, its welfare is good	2.00	2.00	.771
I have a good understanding of a variety of zoo animal management practices such as euthanasia, culling, enrichment, operant conditioning	4.00	5.00	**<.001**
Natural enclosure design will meet the animal's behavioural needs	5.00	4.00	.755
Zoos should prioritise the protection of biodiversity in the wild over the maintenance of animal populations in captivity	4.00	3.00	**.002**
Zoo animals may suffer if their physical or behavioural needs are not met	6.00	6.00	**<.001**
Abnormal behaviours such as stereotypy always indicate a current or previous welfare problem	5.00	4.00	.397
I think zoo animal management could be improved in many cases	6.00	5.00	.484
Diversity and duration of animal behaviours can provide us with useful information about an animal's welfare state	6.00	5.00	.566
Giving zoo animals the opportunity to make choices about their daily activities can improve their welfare	6.00	6.00	.079
Zoo animals don't have the same behavioural needs as wild animals	4.00	2.00	**.005**
Environmental enrichment should be provided for all zoo animals	6.00	6.00	**.009**

Note: Significantly different items are highlighted in bold $p < .05$.

TABLE 2 Results of factor analysis with varimax rotation of agreement items on a 1–6 Likert scale, from Chinese survey respondents

	(1) Welfare needs, choice and opportunities	(2) Good welfare and conservation
Good animal welfare is essential for effective zoo animal husbandry	**0.638**	**0.387**
As long as an animal is physically healthy, well-fed and protected from injury, its welfare is good	**−0.486**	−0.228
I have a good understanding of a variety of zoo animal management practices such as euthanasia, culling, enrichment, operant conditioning	−0.004	−0.005
Natural enclosure design will meet the animal's behavioural needs	**0.561**	0.253
Zoos should prioritise the protection of biodiversity in the wild over the maintenance of animal populations in captivity	0.141	**0.300**
Zoo animals may suffer if their physical or behavioural needs are not met	**0.815**	**0.357**
Abnormal behaviours such as stereotypy always indicate a current or previous welfare problem	**0.498**	**0.525**
I think zoo animal management could be improved in many cases	**0.627**	**0.703**
Diversity and duration of animal behaviours can provide us with useful information about an animal's welfare state	**0.723**	**0.647**
Giving zoo animals the opportunity to make choices about their daily activities can improve their welfare	**0.923**	**0.384**
Zoo animals don't have the same behavioural needs as wild animals	0.279	**0.350**
Environmental enrichment should be provided for all zoo animals	**0.658**	**0.591**

Note: Loadings greater than 0.3 are significant and shown in bold.

4 | DISCUSSION

Analysis of the survey results indicated that there are clusters of zoo staff in both Europe and China who hold beliefs supportive of good animal welfare and clusters in both regions that express uncertainty or a lack of knowledge about zoo animal welfare issues. Whilst sample sizes are relatively small, factor analysis suggests a number of factors underlying the beliefs about zoo animal welfare and zoo practices, with more factors produced from Europeans than from Chinese responses reflecting a potentially greater diversity of factors supporting beliefs about zoo animal behaviour and welfare in Europe.

When considering how we behave towards animals, beliefs about the impact of a particular behaviour are known as behavioural beliefs, whilst normative beliefs relate to the perceived behavioural expectations of important referent groups or individuals (Ajzen, 1991; Ballantyne et al., 2007; Göckeritz et al., 2010). Within the zoo context, these are tied up in workplace culture and norms, and maybe a source of situative or experiential learning (Bacon et al., 2021c). Previous qualitative research has suggested that there may be a common positive effect towards, and understanding of, animal welfare between Chinese and European zoo staff (Bacon et al., 2021a). This survey, which incorporated items assessing beliefs on a range of animal welfare, ethical and husbandry issues, also indicates that respondents from both regions demonstrate a positive effect towards zoo animals as shown by the generation of clusters indicating this from both regional data sets.

This analysis suggests that beliefs relating to animal welfare, ethical issues and zoo animal husbandry practices are more similar across Europe despite its cultural diversity, than between Europe and China. It is likely that the beliefs of zoo staff about zoo animal ethics and husbandry practices are more influenced by cultural and social norms than by individual demographics, as has been shown in other animal industries (Burton et al., 2012; Jones McVey, 2021).

The analysis generated a large European cluster of respondents who appear to have positive beliefs towards animal welfare issues. Similarly, analysis of the Chinese responses generated a cluster that believed statements indicating a positive effect towards animals were true. However, there were some specific item differences between these two clusters that indicate slightly different beliefs. The Chinese Cluster appeared empathetic towards animals but also thought that humane euthanasia was a welfare problem. This may suggest that the Chinese population could align more with an animal rights ethic than a utilitarian ethic or animal welfare perspective, something which may create conflict in zoo management (Browning, 2018; Lindburg, 1999). Animal rights philosophy arises from deontological ethics and focuses on the intrinsic value of animals and their rights to live their lives free of human interference (Regan, 2004). Discussions of animal rights including Regan's philosophy have been published in Chinese literature (e.g., 田錦宏, 2019). In the West, zoos primarily follow a utilitarian ethic where zoo animals are valued for their contribution to education and genetically sustainable populations (European Commission, 1999), but Chinese ethics based on Confucianism may value

TABLE 3 Results from exploratory factor analysis of European responses to agreement questionnaire items

Questionnaire items	(1) Animal's agenda	(2) Traditional	(3) Behavioural husbandry	(4) Conservationists/behaviouralists
Good animal welfare is essential for effective zoo animal husbandry	0.040	0.073	**0.426**	0.036
As long as an animal is physically healthy, well-fed and protected from injury, its welfare is good	−0.209	**0.966**	−0.079	−0.108
I have a good understanding of a variety of zoo animal management practices such as euthanasia, culling, enrichment, operant conditioning	0.101	−0.046	0.171	**−0.321**
Natural enclosure design will meet the animal's behavioural needs	−0.008	**0.422**	0.135	0.176
Zoos should prioritise the protection of biodiversity in the wild over the maintenance of animal populations in captivity	0.180	0.296	0.076	**0.569**
Zoo animals may suffer if their physical or behavioural needs are not met	0.220	−0.087	0.232	**0.367**
Abnormal behaviours such as stereotypy always indicate a current or previous welfare problem	0.245	0.007	**0.415**	**0.318**
I think zoo animal management could be improved in many cases	**0.438**	−0.193	0.143	0.164
Diversity and duration of animal behaviours can provide us with useful information about an animal's welfare state	**0.385**	−0.050	**0.624**	−0.118
Giving zoo animals the opportunity to make choices about their daily activities can improve their welfare	**0.955**	−0.011	0.218	−0.011
Zoo animals don't have the same behavioural needs as wild animals	−0.024	0.041	0.081	0.064
Environmental enrichment should be provided for all zoo animals	0.086	−0.074	0.139	**0.327**

Note: Items that generate at least ±0.3 loadings are considered significant for that factor and are shown in bold.

principles of benevolence more highly (Fuse et al., 2010). Themes of animal care and protection came across in interviews of Chinese zoo staff described in previous research (Bacon et al., 2021b) and align with the beliefs expressed by Chinese respondents in this cluster.

Like the European cluster, the empathetic Chinese cluster did not believe live feeding was necessary for either enrichment or nutrition, a belief that makes them distinct from other Chinese respondents as this was one of the key issues that distinguished many Chinese responses from European responses. Beliefs that live feeding was necessary for nutrition were significantly higher in the Chinese population than in the European population. There are many ranges of zoo animal diets commercially available, in addition to increasing data on zoo animal nutritional requirements for diets prepared within institutions (e.g., European Association of Zoos and Aquaria, 2021; Oonincx and van Leeuwen, 2017) and so the need for live feeding to provide nutrition does not seem self-evident. Further work is needed to elucidate specific logistical and economic factors driving live-feeding practices. Specifically, it is unclear how a live prey animal might be necessary for nutrition, when humanely killed prey animals would provide the same nutritional composition as a live animal. An exception where live feeding may be necessary for nutrition could be that of wild-caught reptiles or other carnivores rescued from the wild who have not yet been trained to take humanely killed prey, or that of carnivores in reintroduction-to-the-wild programmes where live feeding may be a necessary part of training for survival (Marinath et al., 2019). However, depending on the species, carcass feeding may also work well in such situations (Chudeau et al., 2019).

Differences in beliefs between regions were found in relation to items that reflected ethical beliefs and husbandry practices. Such beliefs may be normative (the beliefs and expectations of important other people) or control beliefs (beliefs about our ability to change things and behave differently). For example, research in abattoirs has shown that where people have beliefs that their control is limited, their behaviour towards animals remains poor (Coleman et al., 2003). This may explain the response seen from the second Chinese cluster, which suggested a level of dissonance between the respondents' understanding of animal welfare and the impacts of animal husbandry on zoo animal welfare. Despite being aware that the Five Freedoms are an animal welfare framework, and that abnormal repetitive behaviours may be caused by central nervous system dysfunction, which suggests some underlying animal behaviour and welfare knowledge, this cluster did not believe that zoo animal husbandry, or the keeper–animal relationship, were important for welfare. Such responses could be due to cognitive dissonance, which occurs when the actions an individual is required to carry out, conflict with the individual's own attitudes towards (Watson et al., 2017) or knowledge of the situation (Festinger, 1957). Whilst husbandry in Chinese zoos is reported to have improved, welfare problems still exist (Haili et al., 2015; Zhao et al., 2015). If Chinese zoo staff have limited abilities to improve the husbandry of their zoo animals, or are required to feed live vertebrate prey to zoo-housed carnivores because of a lack of alternatives, it may be emotionally easier for them to believe that this does not generate animal welfare problems than to accept that such practices may create welfare problems when they believe they have no ability to change things.

This 'dissonant' Chinese cluster also did not believe that good animal welfare could be summarised as feeling well, functioning well and expressing normal and natural behaviour, and it may well be that the concept of zoo animals expressing natural behaviours is a challenging concept in China and does not reflect underlying societal ethics about the role of zoo animals. In previous work, discussions of animal behaviour centred around a theme of further education in animal behaviour and biology being required (Bacon et al., 2021c). It may be that the importance of expressing natural behaviours as an element of good zoo animal welfare is not well understood because of the lack of training in zoo animal ecology and natural behaviour in zoo staff. It was suggested during the piloting of the survey that Chinese respondents found the term 'natural living' (Fraser et al., 1997) originally used in the item 'good animal welfare may be summarised as feeling well, functioning well and expressing normal and natural behaviour' confusing as zoo animals are in captivity and cannot 'live naturally' and so 'expressing normal and natural behaviour' was substituted. It may well be that even the concept of zoo animals expressing natural behaviours is challenging to Chinese zoo staff, and this change may not have been enough to align with Chinese ethical perceptions of zoo animal management.

Both European and Chinese data sets generated clusters of 'Don't know' responses. These clusters also included negative V-tests statistics for beliefs which are supported by the literature, for example, 'The keeper–animal relationship is important for animal welfare'. As such, these clusters can be interpreted as a generalised lack of knowledge/misunderstanding of animal welfare concepts. The presence of these clusters in both regions suggests that there is an international need for education on zoo animal behaviour and welfare. Education is suggested to impact beliefs about animal behaviour and welfare issues (Descovich et al., 2019; Dwyer et al., 2021; Melfi & Hosey, 2011). This is supported by the multivariable analysis in this study that showed prior animal welfare training was predictive for Chinese respondents believing that animal husbandry influences animal welfare. Further work in this area may be helpful in understanding the role of formal education and of situative workplace learning on beliefs and practices influencing zoo animal welfare.

Analysis of the agreement statements also identified significant regional differences between ethical beliefs and husbandry practices as well as self-assessment of understanding zoo practices. Exploratory factor analysis generated several factors indicating consideration of animal behavioural needs and behavioural husbandry practices in both regions. The specific items within each factor varied, suggesting a common agreement between regions that behaviour and choice is important, but potential differences in how behavioural needs are provided for.

European respondents who agree that zoos should focus on in-situ conservation did not believe they had a good understanding of zoo husbandry practices, but also agreed with statements relating to the potential negative consequences of not accommodating animal

behaviour in zoos perhaps suggesting a more naturalness-focussed or 'respect for nature' ethical perspective (Chinnadurai et al., 2022; Learmonth, 2020). A Western 'conflict' between animal welfare and conservation ethics is reported in the literature (Clay & Visseren-Hamakers, 2022; Gray, 2017; Paquet & Darimont, 2010), and this conflict may explain this factor with respondents valuing the expression of natural behaviours, prioritising in-situ conservation and considering their knowledge of zoo animal management practices to be relatively poor.

Conversely, prioritising in-situ conservation was related to the factor supporting positive beliefs about animal welfare in the Chinese population. The separation of good animal welfare and zoo conservation priorities was not seen in the Chinese zoo staff who agreed with both the protection of biodiversity in the wild and supporting good zoo animal behaviour and welfare. This finding potentially reflects the 'conservation is care' theme identified in earlier research (Bacon et al., 2021b).

The similarities and difference in beliefs and perceptions of truth presented in this paper form a useful basis for future cooperation and learning, and may go some way to explaining the similarities and differences in zoo husbandry and conservation activities around the world. Increasingly, cooperation and educational activities to support good zoo animal welfare are being developed (e.g., de Mori et al., 2019; Kagan et al., 2015; Walraven & Duffy, 2017) but as demonstrated in this paper, differences in perceptions and standards of zoo animal welfare exist (Veasey, 2022; Ward et al., 2020) and in order for education to be effective, it is important that it is relevant to the pre-existing beliefs of the target audience (Brown, 2009; Stringer et al., 2011, 2018).

4.1 | Limitations

Several survey items required a simplistic 'true', 'false' or 'don't know' forced choice to complex or contextual issues. Analysis of items with high 'don't know' responses elucidated only one item that appeared to generate ambiguity and this item was removed from further analysis, however, the survey generated high response rates which support the construct validity work done to ensure the items were understandable and relevant. Zoo staff in keeper roles who did not speak English were underrepresented in the European sample, and zoo staff in a diversity of roles were underrepresented in the Chinese sample. Thus, the survey finding has limited generalisability of these results. Sample sizes were relatively small and so the results presented should be considered exploratory and provide indications for further research.

5 | CONCLUSIONS

Both European and Chinese zoo staff populations include clusters of people who hold positive beliefs about zoo animal welfare as well as clusters of people with a lack of understanding of some concepts of zoo animal welfare. European respondents may be less likely to be familiar with the Five Freedoms as a welfare framework compared to Chinese respondents. Regional beliefs about the truth of some items relating to ethics and zoo practices were significantly different and may be influenced by normative and control beliefs arising from cultural and experiential informal education within the zoo setting. In particular, the relationship between conservation and zoo animal welfare may vary geographically. These findings present a basis upon which future research and international zoo staff dialogue and education may be directed.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

Ethical approval was given by the Human Ethical Review Group at the University of Edinburgh.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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