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Identifying factors influencing attitudes towards species conservation – A transnational study in the context of zoos

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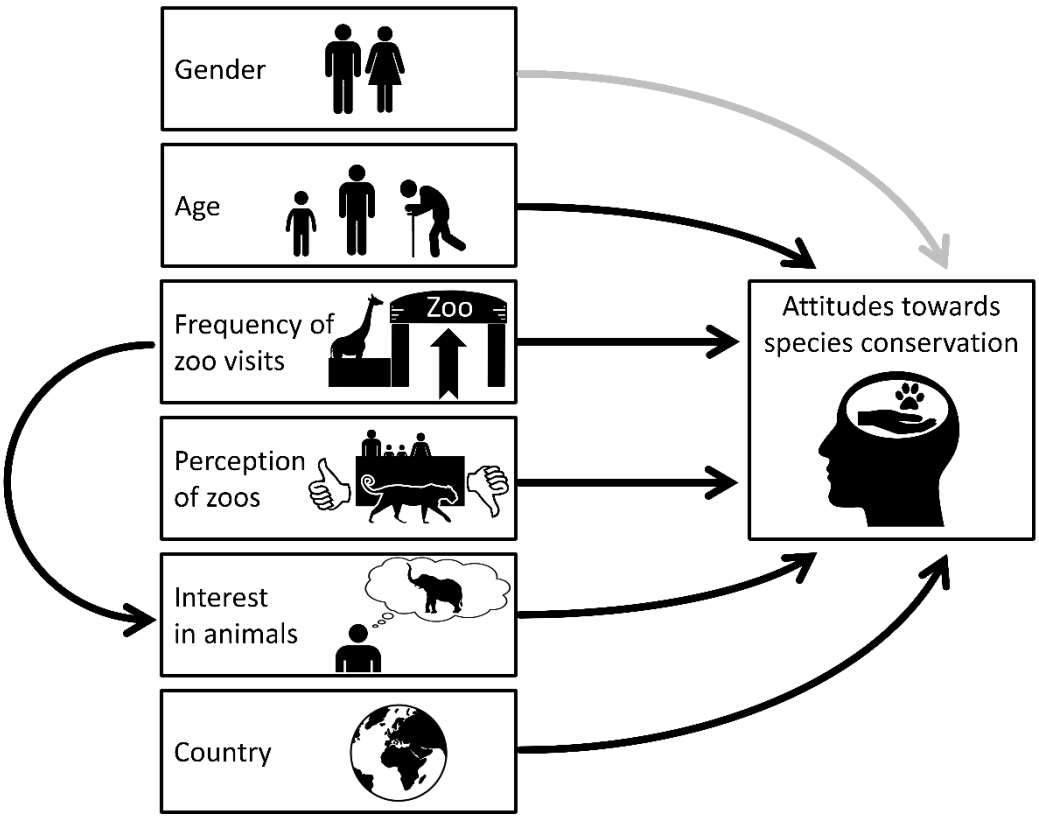
Abstract

In the past decades, zoos have increasingly developed into conservation and education centers and today make an important contribution to environmental education. In this context, this study investigated which factors influence attitudes towards species conservation. The variables examined were gender, age, the number of visits to zoos in the last 12 months, perception of zoos, interest in animals and the country where the survey was conducted. A total of 3347 participants in seven different countries were surveyed. In the hierarchical multiple regression, it was found that all the variables examined were significant influencing factors with exception of gender. A mediator analysis provided evidence that the number of visits to zoos, in addition to the direct effect on attitudes towards species conservation, also has a relevant indirect effect with interest in animals as mediators. Significant differences in attitudes towards species conservation were found between some of the countries studied, but only with a small effect sizes.

Keywords:

Attitudes towards species conservation, environmental attitudes, interest in animals, zoo education, cross national research

Graphical abstract



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Introduction

Over the last two hundred years, the tasks and role of zoos have changed dramatically. While their function at the beginning of the 19th century was to exhibit taxonomy in cages, they continued to develop into living museums in the 20th century (Rabb, 1994). In recent decades, zoos have transformed more and more into conservation and education centers (Rabb, 2004). Today, modern zoos fulfil four main tasks: Conservation, research, entertainment and education (Carr & Cohen, 2011). The special importance of environmental education for zoos is illustrated by an analysis of 137 mission statements of the American Zoo & Aquarium Association. More than 96% of zoos mentioned education as one of their objectives (Patrick et al., 2007). But also the visitors themselves see education, especially of schoolchildren, as one of the most important tasks of zoos (Roe et al., 2014). In addition, there are also external guidelines that are intended to guarantee the educational mission of zoos. In 1999, for example, the council of the European Union passed a directive requiring zoos to promote education and awareness for biodiversity (1999/22/EC, 1999). Major zoo accreditation organizations such as the World Association of Zoos and Aquariums (WAZA), the Association of Zoos and Aquariums (AZA) or the European Association of Zoos and Aquaria (EAZA) also have educational goals for their members (Moss & Esson, 2013). The evaluation of education success is also an important requirement for zoos (EAZA Council, 2016).

The important role that zoos play in environmental education becomes apparent when looking at the annual number of visitors: The VdZ, an association of zoos mainly in German-speaking countries, recorded more than 43 million visitors for its 71 members in 2018 (Kögler et al., 2020). The EAZA stated in its annual report for 2017 that the EAZA members are visited by 140 million visitors annually (Griffith, 2017). Worldwide, zoos are estimated to attract more than 700 million visitors per year and spend around US$350 million a year on wildlife conservation projects (Gusset & Dick, 2011). By reaching this large target group, zoos play an important role in environment education and have an essential impact.

The contribution of zoos to environmental education has been proven in numerous studies. For example, people have a better understanding of biodiversity after visiting a zoo and are better able to identify factors that contribute to the protection of biodiversity (Moss et al., 2015, 2017). Long-term studies have also shown that the understanding and knowledge of biodiversity can be increased by a visit to a zoo, and that this knowledge increases even further after the visit (Jensen et al., 2017). For environmental education programs in zoos, an increase in knowledge (Clayton et al., 2017; Randler et al., 2012; Sattler & Bogner, 2017), a change in behavior (MacDonald, 2015), conservation learning (Jensen, 2014) and an increase in interest (Seybold

et al., 2014) could also be observed. Interest in and attachment to animals can also be improved by a visit to a zoo (Clayton et al., 2009). A particularly important factor that is often evaluated by zoos are attitudes and connection to nature (Kleespies et al., 2020). A positive effect of zoos on attitudes has also been demonstrated in many studies (Collins et al., 2020a, 2020b; Falk et al., 2007; Miller et al., 2013; Wagner et al., 2009). However, there are also studies that have found only a limited effect of zoos in the field of environmental education. For instance, there are doubts whether the personal zoo or aquarium experience really leads to a change in behavior (Adelman et al., 2000). Another study also found that a conservation station in a zoo had only a very small short-term effect on the intended conservation action of the participants (Dierking et al., 2004). Lukas and Ross (2005) prove that visiting a zoo exhibition does not guarantee the strengthening of pro environmental attitudes and Mellish, Ryan et al. (2019) found methodological weaknesses in many quantitative zoo studies that can decrease the validity of results. These include, for example, the underuse of complex data analysis, the lack of reporting effect size estimates and the overuse of zoo only samples. Especially these weaknesses should be avoided in this study. Therefore, this study attempts to use appropriate methods for data analysis, reported the effect size and its calculation, and surveyed both zoo visitors and people not visiting zoos. This study will focus on the attitude towards species conservation, since the conservation of species from the perspective of zoos is a particularly important task (Conde et al., 2011; Patrick et al., 2007). However, it should be noted that special attitudes in the environmental field can be assigned to broader environmental attitudes (Cruz & Manata, 2020). Therefore, it can be assumed that the attitude towards species conservation also reflects a general attitude towards conservation or even a general environmental concern. This demonstrates the relevance of investigating specific environmental attitudes.

Attitudes play an important role in environmental education (Pooley & O'Connor, 2000), even if the relationship between attitudes and behavior is considered moderate by some researchers (Marcinkowski & Reid, 2019). There are various definitions of the term in environmental psychology and environmental education. Attitudes can be seen as beliefs, emotions or behavioral intentions in relation to nature (Schultz et al., 2004). It can be assumed that attitudes can be derived from beliefs, emotions or behavior, but also that attitudes influence these three factors (Milfont & Duckitt, 2010). Attitudes can be distinguished from other concepts in environmental psychology, such as values that are broader (Schultz et al., 2004) and more general than attitudes (Schwartz & Bilsky, 1987). Values are also usually seen as a more stable part of the personality and are therefore more likely to be constant (Feather, 1995; Steg & Groot, 2012). In comparison, environmental attitudes can be influenced more easily, for example by

current events or environmental education (Gifford & Sussman, 2012). In the classical view of attitudes, they are formed by three components: The cognitive component, in which thoughts and beliefs about an object are expressed, the affective component, which deals with the expression of feelings towards the attitude object, and the conative component (from some authors also called behavioral component), which expresses intentions to act (Ajzen, 2005; Breckler, 1984; Gifford & Sussman, 2012). For this study we will refer to the definition of Gifford and Sussman (2012), which define environmental attitudes as care for the environment or concern for environmental issues. Attitudes are a crucial factor that encourages environmental behavior (Kaiser et al., 1999; Levine & Strube, 2012) but cannot be translated directly one to one into behavior (Ajzen & Fishbein, 1977; Inglehart, 1997). To explain the relationship between attitudes and behavior, two well-known theories are usually used. One is the value-belief-norm (VBN) theory. This theory postulates, that attitudes and beliefs have a major influence on behavior (Stern, 2000). On the other hand, the theory of planned behavior. This theory assumes that behavior is influenced by intentions, which in turn are influenced by attitudes (Ajzen, 1991). It is frequently shown that environmental education has the ability to significantly promote environmental attitudes (Johnson & Manoli, 2010; Liefländer & Bogner, 2014; Schmitz & Da Rocha, 2018). Although there is no consistency on how much environmental attitudes influence a person's behavior, studies agree that there is a connection between attitudes and behavior (Kaiser et al., 1999; Levine & Strube, 2012; Marcinkowski & Reid, 2019; McIntyre & Milfont, 2015). Over the years the literature has identified numerous other factors that influence environmental attitudes, such as age, gender, cultural background, personality, etc., but sometimes with contradictory results (Gifford & Sussman, 2012). Research and measurement of environmental attitudes is useful because it provides information about the level of support for environmental actions (Gifford & Sussman, 2012). Measuring environmental attitudes also reveals information about individual perceptions and beliefs about the environment (McIntyre & Milfont, 2015), which is an important factor in itself. Therefore, in this study we want to measure the attitudes towards species conservation and investigate which factors influence the attitudes towards species conservation of a person.

Besides the influence of demographic factors such as age and gender, the relevance of aspects such as interest in animals, the number of visits to zoos and perception of zoos were also considered. The zoo-related factors were chosen to investigate the role of zoos on attitudes towards species conservation. The relationship between interest in animals and attitudes was investigated, as there are only limited research results available so far. For attitudes in general (Inglehart, 1995; Schultz & Zelezny, 1999), environmental attitudes (Boeve-de Pauw & van

Petegem, 2010; Evans et al., 2007) or environmental concern (Franzen & Vogl, 2013), previous studies have found differences between countries. In order to determine whether this country difference also exists for attitudes towards species conservation, this study was conducted in seven different European countries. Since species conservation is a particularly important topic, a country comparison is also useful, as it can be used to determine whether attitudes toward species conservation are similar or whether there are cultural and regional differences.

Materials and Methods

The study was conducted at ten larger zoos and the related cities, in seven different European countries: Sofia Zoo in Sofia (Bulgaria), Yerevan Zoo (Armenia), Attica Zoological Park in Athens (Greece), the Zoological Garden Lyon, more commonly known as Lyon Zoo (France), Lithuanian Zoo, previously known as Kaunas' Zoo (Lithuania), Welsh Mountain Zoo near Colwyn Bay (Wales, Great Britain), South Lakes Safari Zoo near Dalton-in-Furness (England, Great Britain), Heidelberg Zoo, Frankfurt Zoo and Opel-Zoo Kronberg, all three in Germany. In order to also survey groups of people who do not regularly visit a zoo, surveys were conducted in the cities around the zoos (urban location). In Germany an additional online survey was conducted for the same reason.

Measurement

In addition to demographic data, such as age and gender, the frequency of visits to the zoo in the last 12 months was surveyed. There were three possible answers: “Never”, “1-2” or “3 or more”. Over the years, a number of measuring instruments have been developed to measure environmental attitudes (Cruz & Manata, 2020; Milfont & Duckitt, 2010). For our investigation we needed an instrument that is as short as possible, because people should participate in the survey voluntarily in their recreational time. In our experience, people are more willing to take a short break from shopping or visiting the zoo (perhaps with friends or family) to participate in a survey if it is a relatively short questionnaire. In addition, the items of our instrument should have a concrete reference to the zoo and focus on species conservation. Although attitudes have been measured at zoos before, there was no evaluated and validated measurement tool for measuring attitudes toward species conservation with the specific inclusion of zoos. For this reason, we did not use any existing instruments for this study, but selected specific questions based on the constructs used to ensure construct validity. To test interest in animals, individual interest items from a previous study were adapted and expanded. The following three instruments were rated on a 5-Likert scale (disagree to agree, with the exception of the item "How important..." - This was rated on a 5-Likert scale from unimportant to important.)

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Attitudes towards species conservation

In order to guarantee the highest possible content validity and thus construct validity, four items were developed based on the theoretical attitudes construct with reference to the conservation of species. The instrument represents the three components of the attitudes. The behavioral component, which expresses intentions for action, is represented by the question "I would like to do something to help protect species in the wild". The affective component, which deals with the feelings towards an attitudes object, is represented by the item "I feel zoos have an obligation to help protect species". The cognitive component, which expresses thoughts and beliefs, is represented by the questions "How important is conservation of species to you?" and "The conservation of rare species is more important than economic assets".

To prove reliability and internal consistency Cronbach alpha of the four items was calculated. The alpha score was $\alpha = 0.682$, just below the general benchmark of $\alpha = 0.7$ (George & Mallery, 2003). The reason for this could be the small number of items. With a larger number of items the alpha score increases, even if the correlation between the items remains unchanged (Cortina, 1993). Especially in education science, alpha scores below 0.7 are still considered acceptable or sufficient (Taber, 2018). For these reasons, we assume that the measured score is a sufficient value.

Interest in animals

Interest is a complex construct that is often discussed, especially in psychology and educational research (e.g. Krapp, 1999; Prenzel, 1992; Schiefele, 1991, 1992). According to Krapp (1992), interest is the tendency to deal with an object of interest repeatedly and without external cause. Two basic types of interest can be distinguished: The individual interest, which refers to a relatively stable affective attitude towards an object of interest, and the situational interest, which describes a temporary emotional state caused by a particular situation (Schiefele, 2012). In this study the individual interest of the test persons in animals should be determined. For this purpose, three items, similar to the individual interest items of Lawless and Kulikowich (2006) were created on the topic of animals. The items were “I am interested in (1)wild/ (2)zoo/ (3)domestic animals “. Since the individual interest is also formed by emotional and value-related parts (Pawek, 2009; Schiefele & Schaffner, 2015), two additional items were added to reflect this. The emotional component that describes a positive feeling towards the subject of interest (Pawek, 2009; Schiefele & Schaffner, 2015) is represented by question “I feel a sense of connection with animals“ and the value-related component, which describes whether the object of interest is personally important for a person (Pawek, 2009; Schiefele & Schaffner, 2015), is represented by question “I would like to take care of animals“. As in the previous

scale, the Cronbach alpha was determined to prove the reliability and internal consistency. With $\alpha = 0.790$ it was within the acceptable range.

Perception of zoos

In order to investigate the study participants' views on zoos, the two items "Zoos are unnecessary nowadays" and "animals do not belong in zoos" were used. The calculation of a Cronbach alpha from a scale with only two items must be viewed very critically. With short scales and especially with scales of only two items, the Cronbach alpha almost always underestimates the true reliability (Eisinga et al., 2013). Based on the selection of questions we therefore assume that content validity is given.

Data collection procedure

An electronic version of the questionnaire in English was sent to the participating institutions. The questionnaires were then translated into the national language by native speakers. In order to check the translation, a backward translation into English was performed. In addition, a guide document was provided to promote consistency in data collection. This guidance document explained, for example, that site staff should not assist study participants in answering the questions and that each person should be instructed to complete the questionnaire on his/her own. Study participants were randomly selected. Potential study participants (both in town and at the zoo) were approached when they came close to the survey site (when they crossed an imaginary line around the survey location). According to the possibilities on site, clipboards or a table were provided to fill in the questionnaires. When one person finished the survey, the next person coming near the survey site was approached. In the zoo the questionnaires were distributed at the entrance. In the cities, data was collected at busy locations, such as shopping streets. The participants were informed that participating is anonymous and voluntary. The on-site surveys were conducted from April 2015 to February 2016 and the online survey in Germany in March 2020. Once completed surveys were received by the research team (based at the University in Frankfurt), data were digitized and analyzed.

Participants

A total of 3347 (65.3% female, 32.5% male, 2.2% no answer) persons were surveyed. The distribution by country is shown in Table 1. The age of the respondents was 19 or less (N = 504, 15.2%), 20 to 29 (N = 1200, 36.2%), 30 to 39 (N = 526, 15.9%), 40 to 49 (N = 328, 9.9%), 50 to 59 (N = 304, 9.2%) and 60 or more (N = 243, 7.4%). Two hundred and nine people did not report their age (6.3%).

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Table 1. Distribution of the sample by country and survey location. In Germany an additional online survey was conducted.

Country	Zoo	Street	Online	Total
Armenia	105	93	0	198
Bulgaria	258	245	0	503
France	25	84	0	109
Great Britain	161	253	0	414
Germany	414	96	973	1483
Greece	105	108	0	213
Lithuania	135	292	0	427
Total	**1203**	**1171**	**973**	**3347**

Analysis

All statistical analyses were executed using IBM SPSS 27. As a first analysis step, a principal component analysis (PCA) with varimax rotation with the 11 selected items was performed. This statistical method was chosen to examine the structure of our set of variables. To verify whether the data are suitable for PCA, the Bartlett test and the Kaiser-Meyer-Olkin (KMO) test were applied.

To examine the influence of the different variables on attitudes towards species conservation, a four step hierarchical multiple regression was performed, after the assumptions (assumption of singularity, multicollinearity, autocorrelation, absence of outliers) have been verified. Attitudes towards species conservation was defined as the dependent variable and all other factors as independent variables. In the first step of the regression analysis demographic information (age & gender) were added. In a second step the direct effect of zoo dependent variables (number of zoo visits and perception of zoos) were controlled. The third step included the interest in animals. In the last step the tested countries with Germany as reference category were added. As entry method, forced entry was chosen to insert all selected predictor variables into the model simultaneously.

In order to investigate the indirect influence of the number of zoo visits on attitudes towards species conservation through interest in animals, a mediator analysis was performed. For this purpose, the SPSS extension PROCRESS 3.5 from Hayes (2018) was used. The frequency of zoo visits was defined as independent variable (X), the attitudes towards species conservation as dependent variable (Y) and the interest in animals as moderator (M). The remaining variables operated as covariates.

To investigate the attitude difference between the different countries a Kruskal-Wallis test was performed after the Kolmogorov-Smirnov test was highly significant ($p < 0.001$). With significant results a pairwise comparison was made using a post hoc test with Bonferroni

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correction. The effect size (r) was calculated according to Fritz et al. (2012) formula $r = \frac{z}{\sqrt{N}}$ for non-parametric data. The evaluation of the effect size is based on the criteria of Cohen (1988): For r > .1 a small effect is assumed, for r > .3 a medium effect and for r > .5 a large effect.

Results

The Barlett test was highly significant and the KMO test approved sampling adequacy (KMO = .808) therefore the conditions for a factor analysis were fulfilled. The PCA showed three factors with eigenvalues > 1 (Table 2). The first factor accounted for 33.64% of the variance, the second factor for 12.29% and the third factor for 10.83%. Overall, 56.76% of the variance could be explained by the factor analysis. In the factor analysis, the items show a separation by scales, as assumed in theory. It can therefore be assumed that the scales have internal coherence and are appropriate for further analyses.

Table 2. Results of the PCA with varimax rotation for the 11 items (N = 3347). Results < .3 are not shown and loadings > .5 are printed bold.

	Interest in animals	**Attitudes towards species conservation**	**Perception of zoos**
I am interested in domestic animals.	**.818**		
I would like to take care of animals.	**.815**		
I feel a sense of connection with animals	**.720**		
I am interested in zoo animals.	**.580**		
I am interested in wild animals.	**.526**	.450	
The conservation of rare species is more important than economic assets		**.717**	
Conservation of species is important for me.		**.688**	
I would like to do something to help protect species in the wild.	.348	**.667**	
I feel zoos have an obligation to help protect species.		**.645**	
Zoos are unnecessary nowadays.			**.817**
Animals do not belong in zoos.			**.805**

The first model of the hierarchical multiple regression analysis could make a significant contribution to the explanation of the dependent variable attitudes towards species conservation ($F(2, 2836) = 19.46$, $p < 0.001$) and could explain 1.4% of the variance ($R = 0.116$). The second model was also significant ($F(4,2834) = 20.28$, $p < 0.001$) and was able to explain another 1.4% ($R = 0.167$; $\Delta R2 = 0.014$) of the variance. Model 3 ($F(5, 2833) = 223.27$, $p < 0.001$) could

explain an additional 25.5% ($R = 0.532$) and Model 4 ($F(11, 2827) = 134.83$, $p < 0.001$) another 6.1% of the variance (Table 3). In total, Model 4 could explain 34.4% of the variation.

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Table 3. Results of the hierarchical multiple regression analysis for variables predicting attitudes towards species conservation. The significant variables are marked with *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001.

Variable	***Step 1***			***Step 2***			***Step 3***			***Step 4***		
	B	***SE B***	***ß***	***B***	***SE B***	***ß***	***B***	***SE B***	***ß***	***B***	***SE B***	***ß***
Age	-.005	.009	-.010	-.007	.009	-.013	.018*	.008	.037*	.027***	.008	.054***
Gender	.179***	.028	.118***	.182***	.028	.120***	.067**	.024	.044**	.046	.024	.030
Frequency of the zoo visit				.117***	.019	.114***	.013	.017	.012	.047**	.016	.046**
Perception of zoos[1]				.022	.012	.036	.015	.010	.025	-.023*	.010	-.037*
Interest in animals							.422***	.013	.523***	.422***	.013	.523***
Armenia[2]										-.413***	.014	-.139***
Bulgaria[2]										-.097**	.033	-.050**
France[2]										-.317***	.061	-.084***
Great Britain[2]										-.489***	.037	-.226***
Greece[2]										-.256***	.047	-.088***
Lithuania[2]										-.348***	.036	-.167***
ΔR^2				.014			.255			.061		
R^2	.014			.028			.283			.344		

B = unstandardized beta coefficient, SE B = standard error, β = standardized beta coefficient.

1. The scale perception of zoos is coded negative.
2. For the countries, Germany serves as the reference category. Therefore, the B and ß values of the other countries are set in reference to Germany. Since Germany has reached the highest value in attitudes towards species conservation, the B and ß values of the other countries are negative.

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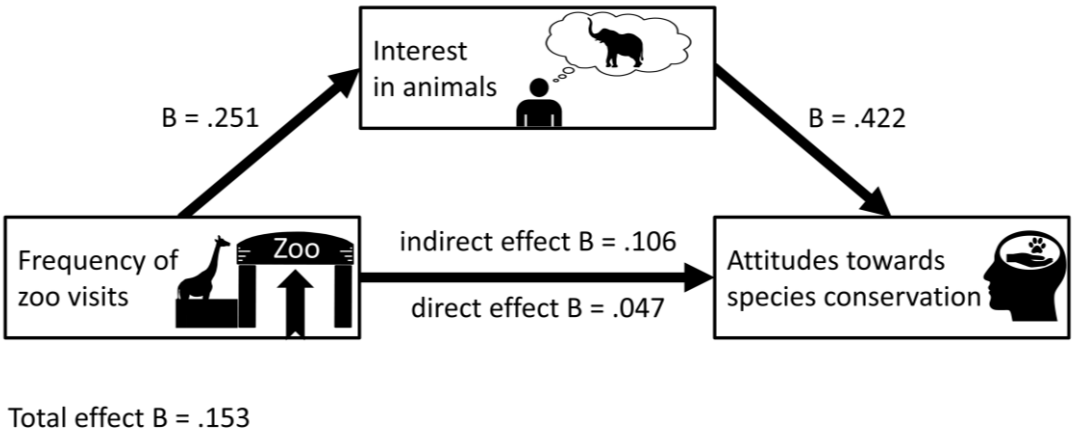
The mediator analysis showed a direct effect of frequency of zoo visits on attitudes towards species conservation of B = 0.047 and an indirect effect of B = 0.106 (Figure 1). This leads to a total effect of B = 0.153. The Pearson correlation between attitudes towards species conservation and interest in animals is r = 0.513.

Figure 1. Results of the mediator analysis with frequency of zoo visits as independent variable, the attitudes towards species conservation as dependent variable and the interest in animals as moderator. The total effect is B = .153. For better clarity, the covariates are not shown in the figure. All results were statistically significant ($p < 0.05$).



In the country comparison of attitudes towards species conservation, the Kurskal Wallis test was a highly significant ($p < 0.001$). The pairwise comparison using a post hoc test with Bonferroni correction showed a significant result for slightly more than half of the comparisons. The exact p-values and for significant results the effectsize (r) can be found in the appendix (Table A1). Also the mean values and standard deviation for the attitude to the protection of species for each country are in the appendix (Table A2). The calculated effect sizes indicate small effects (Figure 2).

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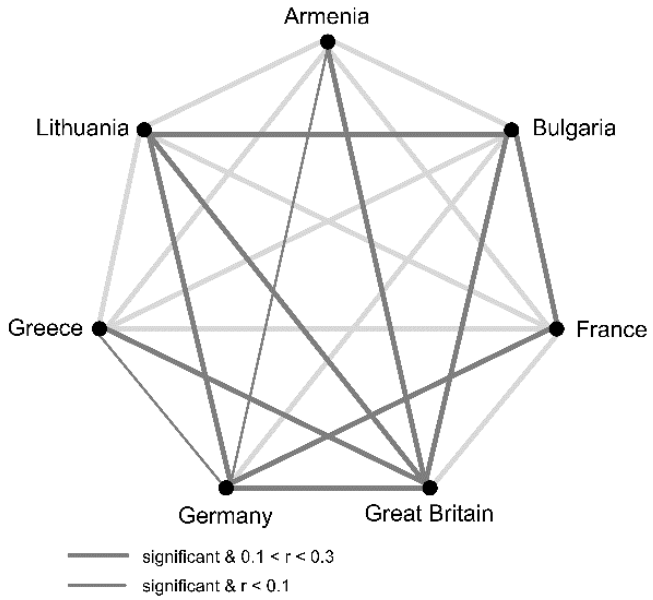
Figure 2. Effect sizes for the pairwise comparison of attitudes towards species conservation between countries. Significant results ($p < 0.05$) are highlighted by black lines. Thin black lines represent effect sizes $r < 0.1$.



Discussion

A large number of scales have been developed in research to measure environmental attitudes (Gifford & Sussman, 2012). Environmental attitudes are often examined in environmental education to assess the success of environmental education programs, as they are an important indicators of positive environmental behavior (Kaiser et al., 1999; Levine & Strube, 2012; Marcinkowski & Reid, 2019). In this study, a one-dimensional scale was used to assess the attitudes towards species conservation. The number of dimensions of different scales for measuring environmental attitudes differs. The original version of the New Ecological Paradigm is dimensionless (Dunlap & van Liere, 1978), while other attitudes scales such as the Environmental Attitudes Inventory consist of up to 12 dimensions (Milfont & Duckitt, 2010). In the zoo context, environmental attitudes are often used to verify the success of a zoo visit or an environmental education program at the zoo. In most cases, as in this study, attitudes are assessed with questionnaires (Ballantyne et al., 2011; Kelly et al., 2014; Lukas & Ross, 2005), but also interviews (Adelman et al., 2000) or behavioral observations (Clayton et al., 2011) are used occasionally.

The hierarchical multiple regression showed that although gender and age are significant, they explain only a small proportion of the variation in attitudes towards species conservation

(1.4%). Gender is the only factor in the regression analysis that did not have a significant influence on the dependent variable. This is surprising, since previous studies have repeatedly found gender differences in environmental attitudes. With few exceptions, it has been shown in the past that women generally have higher environmental attitudes than men (Gifford & Sussman, 2012) but also a number of recent studies confirm this (Bogner & Wiseman, 2002, 2004; Fremerey & Bogner, 2015; Oerke & Bogner, 2010). In their attitudes, men tend to see nature as something that should be used to personal advantage (Boeve-de Pauw & van Petegem, 2011; Oerke & Bogner, 2010), while women see nature as something worth preserving (Milfont & Duckitt, 2004). However, there are also some studies that, like us, have not found a gender effect in environmental attitudes (Eagles & Demare, 1999; Hariohay et al., 2018; Kideghesho et al., 2007; Liefländer & Bogner, 2014). One possible explanation for the lack of gender difference could be the social relevance of the issue of species conservation. Thus, the topic is of great current relevance and the society is informed about the topic. Therefore, it is possible that there is a gender-independent awareness of the topic in society.

Age has a significant but small influence on attitudes towards species conservation. In the literature the connection between age and attitudes is often reported and often explained with the age hypothesis. It is assumed that younger people are more concerned about nature and therefore have higher environmental attitudes than older people (Fransson & Gärling, 1999). Although some studies confirm this age effect (e.g. Liefländer & Bogner, 2014), there are also contradictory results. For example, often only a small effect (Hayes, 2001; Wiernik et al., 2013) or no age effect at all (Kafková, 2019; Sarigöllü, 2009; Tarrant & Cordell, 1997) has been found in relation to environmental attitudes. Our results confirm the findings of these studies in terms of attitudes towards species conservation.

In the second step of the analysis zoo-specific factors were added. On the one hand, the number of visits to zoos in the last 12 months, on the other hand, the perspective on zoos. Both factors were significant and together explained another 1.4% of the variation of attitudes towards species conservation. Numerous studies have demonstrated the positive effect of environmental education programs in zoos on environmental attitudes (e.g. Counsell et al., 2020; Mellish, Pearson et al., 2019; Miller et al., 2013; Sponarski et al., 2016). Also the influence on conservation and environmental attitudes of visits to zoos without an additional environmental education program or visits to a zoo exhibition has been documented (e.g. Lukas & Ross, 2014; Pavitt & Moss, 2019; Pearson et al., 2014; Wagner et al., 2009; Yalowitz, 2004). Additionally, a study by Lukas and Ross (2005) showed that multiple visits to the zoo reinforce this positive

effect. Godinez and Fernandez (2019) came to a similar conclusion and Collins et al. (2020b) also identified previous experience with zoos as a positive influencing factor on learning outcomes in zoos. Falk et al. (2007) demonstrated that a visit to a zoo can have a positive influence on conservation attitudes, although some authors doubt the validity of the study (Malamud et al., 2010). These results are consistent with the results of our study. It could be shown that the number of zoo visits is positively related to the attitudes towards species conservation in particular and people who visit a zoo more regularly have a more positive attitude towards species conservation. The same applies to the perception of zoos. However, it should be noted that both effects are comparatively small.

Interest is used in a variety of fields to evaluate the success of educational programs. In biology education, questionnaires with single item questions are most commonly applied, but several items on one aspect of interest are also used. In the context of zoos and animals, methods are more versatile to measure interest: Borgi and Cirulli (2015) developed a computer program to determine which animals are most popular with children. Pictures of animals were shown and the children had to decide which animal they preferred. It was found that the young students preferred domestic animals over wild animals. To evaluate interest in a species, zoos often measure the number of people in front of an enclosure and the time people spend watching the animals (Davey, 2006; Margulis et al., 2003; Moss & Esson, 2010). It was found that especially the size, the activity of the animals (Margulis et al., 2003; Moss & Esson, 2010) and the way the enclosure is set up (Davey, 2006) have an influence on the interest of the visitors. In order to evaluate psychological constructs such as individual interest and environmental attitudes, questionnaires are usually used. Since the focus of this study was to measure and explore the relationship between these constructs, it was decided to use a questionnaire as well.

Interest in animals showed the greatest influence on the attitude towards species conservation in the analysis. This factor could explain 25.5% of the variation of attitudes towards species conservation. Until now, the investigation of the relationship between interest and attitudes has been rather neglected in environmental education research. Hofstein and Mamlok-Naaman (2011) postulated that there is a connection between interest in a topic and the attitudes towards it. In the field of environmental education, Le Hebel et al. (2014) found a link between attitudes and the level of interest in environmental topics among students. Uitto and Saloranta (2010) also demonstrated a correlation between attitudes and interest in the study of various environmental variables. From a theoretical perspective, this relationship makes perfect sense. It seems logical that the tendency to deal with an environmental topic [interest; Krapp (1992)] can develop into care and concern for this environmental topic [environmental attitudes; Gifford

and Sussman (2012)] and vice versa. The performed regression analysis confirms this relationship with empirical data. In the regression analysis, interest is the most important factor influencing attitudes towards species conservation (B = 0.422). Also the correlation between the two factors (r = 0.513) is high according to the common interpretation (Cohen, 1988), which is a clear indication for the strong connection between the two variables. Therefore, it is potentially possible to strengthen positive attitudes towards species conservation by increasing the interest in animals and thus leading to more positive environmental behavior. A direct enhancement in pro environmental attitudes could also have a positive effect on the interest in animals. From the point of view of zoological institutions, the effect of the frequency of zoo visits is of particular importance. Although the number of zoo visits has a significant, but only minor direct influence on attitudes to conservation (B = 0.047), the mediator analysis showed a clear indirect effect on the independent variable attitudes. Frequent visits to zoos have a significant effect on the interest in animals (B = 0.251), which is the strongest factor (B = 0.422) tested by us on attitudes towards species conservation. The combination of direct and indirect effects of the frequency of zoos visits results in a significant and high total effect (B = 0.153; Figure 1). This analysis is further evidence that zoos make an important contribution to environmental education. Regular zoo visitors have a higher interest in animals, which is a positive effect in itself. On the other hand, regular zoo visits lead to a strengthening of positive attitudes towards species conservation with interest as a reinforcing mediator.

In the fourth and last step of the analysis, the influence of the survey country on the attitudes towards species conservation with Germany as reference country was examined. The additional factor could explain another 6.1% of the variance. Thus, the survey country is the second strongest influencing factor in the conducted analysis. In the past there have been a number of studies that investigated environmental attitudes in relation to the country of origin. Schultz and Zelezny (1999), for example, found significant differences between environmental attitudes in 14 countries. When explaining differences in environmental attitudes between cultures, reference is often made to the approach of Inglehart (1995). In a large scale study in 46 countries he found that countries with predominantly post-materialist values (e.g. self-expression, quality of life) are more willing to protect the environment than countries with materialist values (e.g. economic, physical security). He could observe a change from materialist values to post-materialist values, especially in industrialized countries, but also in industrializing nations (Inglehart, 1995). Many studies confirm this result: Franzen and Vogl (2013), for example, found a close correlation between the wealth of a nation and the environmental concern when comparing 33 countries. People in richer countries tended to have a higher environmental

concern in this study. Other studies confirm this attitudes-wealth correlation (Franzen, 2003; Franzen & Meyer, 2010). However, there are also contradictory results. Boeve-de Pauw and van Petegem (2010), were unable to find a correlation between environmental attitudes and the level of development of a country in their examination of the 2006 PISA data from 56 countries. Other studies have found that people in the United States have less environmental friendly attitudes than people in countries with lower gross domestic product (GDP) per capita (Evans et al., 2007; Schultz, 2002). In the sample analyzed here, no effects could be found depending on the nation wealth. In this study, the greatest effect size is between Germany and Great Britain, two countries with very high GDP per capita. A possible explanation could be that in this study only people in countries with a comparatively high GDP per capita were surveyed. Five of the seven countries surveyed are classified by the World Bank as high income countries and the other two countries have upper middle income (The World Bank, 2020). This means that only the upper part of the spectrum is covered, so that a potential wealth effect is not shown. Even if the differences are small, Germany shows slightly stronger, while Great Britain shows slightly weaker positive attitudes towards species protection as the other countries. One possible explanation could be that in recent decades, public concern for environmental problems has declined slightly in the UK and people are becoming more skeptical about environmental problems (Park et al., 2012). Franzen and Vogl (2013) discovered that people in Germany have a higher environmental concern than people in France, Great Britain, Lithuania and Bulgaria. Other international studies, however, place both Germany and the UK in the middle of the field when it comes to environmental attitudes (Eurobarometer, 2013; Franzen, 2003; Franzen & Meyer, 2010). For the UK, the higher standard deviation than in other countries indicates greater variation between individuals. It can be concluded from this that the attitudes towards species conservation are more diverse in the UK than in the other countries studied. The results also indicate that the attitudes towards species conservation in all tested countries are high, and differences that occur have only a small effect strength, if any (Figure 2). The literature also often reflects that the country-specific differences between EU countries are rather small (Eurobarometer, 2013). This is a positive result because it shows that the important topic of species protection has a high relevance in all countries.

Limitations

Although the study was conducted with great care, some limitations need to be addressed. One methodological limitation is the test instruments used. Since persons in zoos or on the street

should be interviewed during their recreational time, the questionnaire had to be kept as short and compact as possible. In our experience, in this situation it should not take more than five minutes to complete the questionnaire, otherwise the motivation of the participants will decrease considerably and the questions will not be read and answered properly. In order to obtain an appropriate question instrument with high content validity and still keep the questionnaire as short as possible, the lowest possible number of items was selected. Such a procedure can potentially have a negative effect on the overall validity of the instrument. Another methodological limitation could be the time gap in data collection. Some of the data was collected in 2015/16 and the rest in early 2020. Further data acquisition was necessary because a larger data set improves the informative value of the multiple linear regression. Over this period of time, however, the public attitudes towards conservation may have changed. To limit this potential source of error, we compared the data collected in 2016 in Germany with those collected in 2020. The Mann Whitney-U test did not find a significant difference for interest in animals ($p = .905$), as well as for attitudes towards species conservation ($p = .051$). Nevertheless, it is possible that the time gap in the data collection had a small influence on the results, especially for the attitude towards species conservation, with a p-value relatively close to the significance level.

Additionally, the survey was conducted by different people. The questionnaires were distributed by the zoo staff to the study participants in the individual zoos. It is therefore likely that there were differences in the procedure between the different zoos. In order to counteract this, all zoos were provided with an interview and behavior guide. Nevertheless, different approaches cannot be completely ruled out.

Conclusion & implications

The study identified a number of variables that affect attitudes towards species conservation (age, perception of zoos, frequency of zoo visits, interest in animals and country), but could not confirmed gender as an influencing factor (Eagles & Demare, 1999; Liefländer & Bogner, 2014). The results are consistent with previous studies on factors influencing environmental attitudes (e.g. Fransson & Gärling, 1999; Inglehart, 1995; Schultz, 2002). In this study we could confirm these relationships and connection for attitudes towards species conservation in particular. Especially important is the strong link between interest in animals and attitudes towards species conservation. Up to this point, there have been few studies on the relationship between interest and attitudes in environmental education research (e.g. Le Hebel et al., 2014). Our study can now empirically confirm this connection, which previously could only be assumed in theory. These findings are particularly interesting for zoos. The close relationship

between interest in animals and attitudes towards species conservation suggests that promoting interest in animals is an opportunity to increase attitudes towards species conservation. One way to increase individual interest in particular to help people recognize the value of what they have learned (Harackiewicz et al., 2016). Zoos could highlight the reasons why animals and their conservation are important and thus raise interest in animals and enhance positive environmental attitudes. Nevertheless, further research on the link between environmental interest and attitudes is strongly needed. A more general consideration of environmental attitudes and interest in the environment would be conceivable in this context. From the point of view of zoological educational institutions, the positive relationship between the number of visits to zoos, interest in animals and attitudes towards species conservation is particularly important. This connection emphasizes the positive influence of zoos directly and indirectly on attitudes towards species conservation. Thus, this study is a further proof that zoos are important actors in environmental education and make an educational contribution to species conservation. Since people who visit zoological institutions on a regular basis show stronger positive attitudes towards species conservation, more regular visits would be beneficial. For example, annual visits to such institutions could be included in school curriculums. But also regular private visits to zoos can help to increase a person's interest in animals and thus strengthen the attitudes towards species conservation.

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Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

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Appendix

Table A1: Results of the pairwise comparison of attitudes towards species conservation between the different countries.

	Significant values	Significant values with Bonferroni correction	Effect size (r)
Great Britain - France	p = 0.521	p = 1.000	-
Great Britain - Lithuania	**p < 0.001**	**p < 0.001**	**r = 0.155**
Great Britain - Greece	**p < 0.001**	**p < 0.001**	**r = 0.183**
Great Britain - Armenia	**p < 0.001**	**p < 0.001**	**r = 0.192**
Great Britain - Bulgaria	**p < 0.001**	**p < 0.001**	**r = 0.256**
Great Britain - Germany	**p < 0.001**	**p < 0.001**	**r = 0.271**
France - Lithuania	p = 0.022	p = 0.470	-
France - Greece	p = 0.006	p = 0.129	-
France - Armenia	p = 0.004	p = 0.079	-
France - Bulgaria	**p < 0.001**	**p < 0.001**	**r = 0.174**
France - Germany	**p < 0.001**	**p < 0.001**	**r = 0.152**
Lithuania - Greece	p = 0.351	p = 1.000	-
Lithuania - Armenia	p = 0.242	p = 1.000	-
Lithuania - Bulgaria	**p = 0.002**	**p = 0.033**	**r = 0.104**
Lithuania - Germany	**p < 0.001**	**p < 0.001**	**r = 0.208**
Greece - Armenia	p = 0.826	p = 1.000	-
Greece - Bulgaria	p = 0.118	p = 1.000	-
Greece - Germany	**p < 0.001**	**p = 0.006**	**r = 0.089**
Armenia - Bulgaria	p = 0.203	p = 1.000	-
Armenia - Germany	**p = 0.001**	**p = 0.023**	**r = 0.81**
Bulgaria - Germany	p = 0.006	p = 0.132	-

Table A2: Mean value and standard deviation (SD) of the attitudes towards species conservation of the different countries

Country	Mean value ± SD
Armenia	4.19 ± 0.91
Bulgaria	4.39 ± 0.67
France	4.18 ± 0.53
Germany	4.49 ± 0.60
Great Britain	3.92 ± 0.93
Greece	4.28 ± 0.77
Lithuania	4.29 ± 0.63

Figure A1: Comparison of attitudes toward species conservation among the countries tested. The significances and effect sizes between the individual countries are shown in Table A1.