Title: Attitudes towards the maned wolf amongst adolescents in the southeast of Brazil

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Abstract

The relationships between people and carnivores are a worldwide concern for the conservation of species and habitats. The maned wolf is an endangered, endemic canid inhabiting the southeast of Brazil - highly populated and rich in biodiversity and endemism. Strategies to conserve this key stone species may benefit the also declining Cerrado biome. The attitudes of teenagers towards wild carnivores are also of worldwide interest as future citizens and future decision makers. The present study investigates the attitudes of two age groups (12-13 and 16-17) towards the maned wolf. Questionnaires aimed to identify selected attitudes, beliefs and knowledge in relation to the maned wolf in urban areas of three locations in the São Paulo state. Responses were analysed according to age groups, gender, location and experiences concerning the maned wolf. Results suggest that positive attitudes declined with age; gender have very little effect on attitudes; zoos, as well as seeing the maned wolf in nature may increase support for the conservation of the species amongst the younger group; while identification with some maned wolf attributes amongst older teens may foster intentions to help the species. Conservation strategies and environmental education can help to provide early positive experiences of contact with the maned wolf and the Cerrado and be tailored to address attitudes in different age groups. This study can inform the planning of effective environmental educational strategies to foster long term support for the conservation of the maned wolf and the Cerrado.

Key words: maned wolf, wild carnivores, people/wildlife conflict, human dimensions, biodiversity conservation, Cerrado habitat.

1 Introduction

The relationship between people and wild animals is multifaceted and pervaded by feelings of both antagonism and attachment (Bjerke, Odegardstuen, & Kaltenborn, 1998b; Clayton & Myers, 2009). How people relate to wild carnivores is of particular interest to conservation due to their outstanding role in the dynamics of ecosystems and biodiversity (Sergio, Newton, Marchesi, & Pedrini, 2006). An understanding of this relationship, of how it develops from yearly years to adulthood and of the factors affecting it is necessary to inform effective decision making in wildlife conservation.

Maned wolf populations are in decline much due to anthropogenic actions. The population model created for Brazil by the Maned Wolf Action Plan identifies the main reason for this decline as habitat loss, and associated reduction of the carrying capacity, isolation of sub-populations, and loss of genetic variability (Rodrigues, 2002; Paula et al., 2008; Paula & Desbiez, 2014). Most of its favoured primary habitat, the Cerrado, has been heavily modified (between 50% and 92%), and only 2.2% is protected (Klink and Machado, 2005; Klink, 2014). Maned wolves are also subject to threats directly or indirectly related to human impact, such as road killing, feral dogs, climate change and retaliations due to alleged attacks on poultry, which are raised free (Dietz, 1984; Anic, 2002; Rodrigues, 2002; Rodrigues et al, 2014, 2012; Emmons, 2014; Muir & Emmons, 2012). Killing and mutilation of maned wolves due to popular beliefs may be added reasons for decline (Puglia, 1978; Silva, 2000; Silva and Nicola, 1999; Anic, 2002; Soler et al, 2006).

The present study aims to investigate the attitudes of two age groups (12-13 and 16-17) of students living in three urban areas within the maned wolf domain towards the species and its conservation, and how they may be affected by variables such as age, gender, location of residence and experiences in relation to the species in question.

Figure 1. The maned wolf (photo by Edu Fortes)

1.1. The research area and target group

São Paulo state is the most populated state in Brazil, of high political and economic importance in the national context and arguably over the whole of the maned wolf's distribution. In São Paulo state the highest concentration of people meet some of the largest remaining areas of Brazil's biodiversity and endemism.

Maned wolf habitat is mostly characterized by Cerrado, a biodiversity "hotspot", home to the most diverse savannah floras in the world (Juarez and Marinho-Filho, 2002; Klink and Moreira, 2002; Klink and Machado, 2005; Mittermeier et al., 2005). It also produces 50% of Brazil's soya beans and beef, mostly for export (Klink, 2014), hence remaining natural areas are highly fragmented, subject to pressures caused by anthropogenic action, such as the invasion of exotic animals and plants, hunting, and fire near urban areas (Rodrigues, 2002; Klink and Machado, 2005).

According to developmental psychology the transition from pre-adolescence to adolescence is a crucial time for the formation of attitudes towards wildlife conservation. Teenagers are future citizens and future decision makers, making them an important component in any community, going through a moment when their attitudes and values towards the environment and wildlife are being formed and consolidated (Bath and Farmer, 2000; Velsor and Nilon, 2006). Within

an educational context, this study could be instrumental in directing decisions about curriculum for these age groups and in the planning of environmental educational strategies.

2. Methodology

A total of 808 questionnaires on the attitudes of pre-selected interest groups in the local communities towards the maned wolf and its conservation, in the southeast of Brazil (for the full study see Consorte-McCrea, 2011) were distributed and collected during the months of August and September, 2007, and October 2008. Questionnaires aimed to identify selected attitudes, beliefs and knowledge of locals in relation to the maned wolf in urban and rural areas of the three locations in the São Paulo state. From this sample, data from all student respondents residing in urban areas, who were able to identify the maned wolf by looking at a photo, were selected for further investigation. The groups being investigated in the present study are students aged 12-13 (n=140) and students aged 16-17 (n=124) adding up to a total sample of 264 students (see table 1. below). The protocol for data collection was approved by the university's Ethics Committee.

Student age groups were chosen according to their 'readiness' in terms of developmental stage (following Jean Piaget Cognitive Theory; Lin 2002; Huitt and Hummel, 2003), where children aged 11-15 have already developed the ability to elaborate abstract concepts based on formal logic (Formal operational stage) though their cognitive development is not fully complete, and from 16 onwards they are already capable of reasoning as adults as their development matures.

		Research locations			Total
		Greater São Paulo	Low Mogiana region	São Carlos	
Target groups	students year 8	21	69	50	140
	students sixth-form	23	32	69	124
Total		44	101	119	264

Table 1. Target groups by research location

The three research sites selected for the study were:

Greater São Paulo (GSP): GSP covers an area of 7,943.818 km^2, including the cities of São Paulo and Franco da Rocha amongst other, and is inhabited by 19,616,060 people (IBGE, 2008). Questionnaires were administered to pre-booked visiting schools in São Paulo Zoo Park Foundation (which houses the maned wolf) and Juquery State Park, in Franco da Rocha, is the last remaining fragment of Cerrado in the metropolitan region of São Paulo city (maned wolves are absent).

São Carlos city (SC) has a total population of 220,425 inhabitants occupying an area of 1,132 km^2 (IBGE, 2009). The maned wolf in present in remnants of the local Cerrado, preserved within conservation units. Questionnaires were distributed to three different local schools. The main revenue is produced by services and industry followed by agriculture. Prestigious universities and research centres are based in SC (one PhD per 180 inhabitants, 30 times above the national average).

Low Mogiana region (LM) comprises the municipalities of Mogi Mirim (87,800 inhabitants occupy an area of 499 km2) and Mogi Guaçu (138,494 inhabitants over an area of 813 km^2) (IBGE, 2008). Questionnaires were distributed to two local schools. The maned wolf inhabits the local Cerrado. Services provide the largest revenue, followed by industry and agriculture.

Based on the Theory of Planned Behaviour attitudes, beliefs, and knowledge concerning the maned wolf and its conservation were measured in the questionnaire as they strongly influence behavioural choices (see Ajzen and Fishbein, 1980; Manstead, 1996). The questions of interest here were in a closed format to yield quantitative data for statistical analysis. Some items (for example, those assessing factual knowledge about the maned wolf) were in a binary-choice or multiple-response format. Responses to these items were coded as 0 (not selected) or 1 (selected). Other items used a semantic differential scale, where participants were invited to rate characteristics of the maned wolf on a seven-point scale between two semantic extremes (e.g. dangerous – harmless). These responses were coded by the position of the scale point selected by respondents (i.e., as 1-7).

Due to sample sizes we grouped experiences into first (*direct* and *indirect*)[1] and second hand (*vicarious*), but direct experiences seeing the maned wolf in nature have also been examined.

2.1. Data analysis

Three items were excluded from the analysis: one ("Wolves are dangerous beasts") because it did not specifically refer to the maned wolf, two others ("The maned wolf must be hunted" and "I don't like the maned wolf") because they did not provide sufficient variance in responses for further analysis (in both cases, one of the binary response options was selected by only three participants).

Knowledge about the maned wolf was coded in a single variable. Participants gained one point on this variable for each correct factual answer about the maned wolf, and lost one point for each incorrect answer. The result was a normally distributed variable on a scale ranging from -5 to +5.The attitude items were subjected to a principal components analysis, for the purposes of exploration and data reduction. Based on the point of inflection in the scree plot, four components were extracted. These were then rotated orthogonally (with the Varimax method) for ease of interpretation. (Alternative methods involving the extraction of more components and/or oblique rotation were also attempted, but the present solution was the most parsimonious and easier to interpret than others.) Table 3.1 shows the rotated components and the loadings of individual items on each of them (after rotation). Component scores for each participant were calculated according to the regression method. Semantic differential questions loaded particularly well (see Components 1 and 2), suggesting that this type of questions is well suited to attitudinal research.

To compare outcome variables by age groups, location, and gender, univariate analyses of variance (ANOVA) were performed. Where necessary, pairwise comparisons were adjusted using the conservative Bonferroni procedure. Multiple t-tests were used to explore the effect of socio-demographic variables (residence, gender) amongst interest groups across components, knowledge, exposure to, and intentions to help the maned wolf.

[1] Kellert (2002:118-119) classifies the experiences of contact between children and wildlife as direct (direct exposure, largely unplanned and in a natural setting, where wildlife function outside of human intervention), indirect (direct exposure but in "restricted, programmed, and managed contexts") and vicarious ("symbolic experience (…) in the absence of actual physical contact with the natural world").

Rotated Component Matrix[a]

	Component			
	1	2	3	4
ferocious or tame	.833	-.018	.070	.030
dangerous or harmless	.806	-.016	.049	-.156
aggressive or defensive	.795	.076	.014	-.004
good or bad	.608	.431	.118	-.192
The maned wolf does not harm anyone	.574	.171	.156	-.011
strong or weak	-.158	.726	.104	.193
brave or coward	.102	.673	.032	-.002
valuable or worthless	.184	.643	.127	.043
big or small	.056	.633	.037	.189
powerful or powerless	.014	.623	.030	-.079
beautiful or ugly	.390	.538	-.009	.106
The maned wolf needs to be protected	.153	.010	.739	.096
Preserving the maned helps to preserve the ecology	.115	.062	.739	-.163
The best place for the maned wolf is nature	-.042	.093	.615	-.082
The maned wolf helps my country's tourism and culture	.328	.224	.417	.312
The maned wolf scares and attacks people	-.292	.075	-.113	.714
The maned wolf is useless	.209	.038	-.094	.681
I don't care about the maned wolf	.014	.127	.182	.521
The maned wolf attacks chicken pens and livestock	-.270	-.005	-.148	.467

Table 3.1. Rotated Component Matrix of beliefs and attitudes towards the maned wolf. Attitudinal items loaded on each component.

3. Theoretical background

3.1. Relationships between the maned wolf and people

The maned wolf is a 'keystone' species and plays an important role in ecosystem dynamics (Sergio et al., 2006); contributes to the dispersal of various species of fruit in the Cerrado, and also feeds on insects and rats that are carriers of diseases such as *hantavirus and leptospirosis* (Dietz, 1984; Motta-Junior, 2000; Anic, 2002).

In the literature the maned wolf has been traditionally described as timid, cowardly and weak, except when defending pups (Magalhães, 1939; Ihering, 1968; Carvalho, 1976; Dietz, 1984; Ribeiro, 2003). Though predation on hen houses have been mentioned as a source of conflict, evidence from research on the feeding ecology of maned wolves suggest that poultry remains were only found in 0.3-1.5% of analysed scat samples (Bueno, Belentani and Motta-Junior, 2000; Motta-Junior 2000; Bueno and Motta-Junior, 2002; Anic, 2002; Rodrigues, 2002) or not at all (Aragona and Setz, 2001;

Juarez and Marinho-Filho, 2002; Santos, Setz and Gobi, 2002; see Motta-Junior, Queirolo and Bueno, 2014 for a review of the feeding ecology of the maned wolf). On the other hand, the association with the European wolf through its name, its large frame and stand out features (such as colour, black mane, eerie call, carnivore dentition and appearance) coupled with the rare but dramatic occurrence of attacks on chicken pens, may have helped to inspire negative attitudes and fear within minority groups (Mishra 1997, in Knight, 2000; Hill, 2004). Even when they seldom occur, events that may be frightening and disturbing and have been depicted vividly by the media or by peers tend to stick to people's minds (Clayton & Myers, 2009).

Remarkably, research into the attitudes of local people towards large carnivores (jaguar and cougars) in the south of Brazil indicates mostly positive perceptions towards them, even amongst people who had experienced predation incidents (Conforti & Azevedo, 2003). Similar results were found concerning the attitudes of local people towards the maned wolf in the state of São Paulo (Consorte-McCrea, 2011).

3.2. Developmental stages and relationships with wildlife

Although there are questions about the universality of the stages and sequence of cognitive development, it has been suggested that the development of active environmental concern may be influenced by early life experiences (Tanner, 1980, in Keliher, 1997; Bjerke, Odegardstuen, & Kaltenborn, 1998a and b). Kellert´s studies about children´s experiences of nature (et al 1996, 2002:129) suggest that some "inclinations to affiliate with natural processes and diversity" are inherited but also shaped by learning, culture and experience, emerging at different ages as the child grows.

According to Velsor and Nilon (2006) the development of appreciation and value towards wildlife in children and adolescents is mediated by frequent access to nature areas, in urban and rural settings; valuing messages from relevant adults about wildlife; and opportunities to take part in varied wildlife related activities in a safe and supportive environment. Misconceptions and negative messages about wildlife, on the other hand, can foster negative perceptions and limit their interest in relation to wildlife.

3.2.1. Pre-adolescents

Research suggests that during middle childhood, between the ages of 6 and 12 children face affective and emotional changes regarding their concern for animals. These combined with intellectual and cognitive changes in their understanding of animals between the ages of 10 and 13 provides unique opportunities for fostering an appreciation and an understanding of wildlife and nature amongst them (Westervelt and Llewellyn, 1985, in Wilkinson; Bjerke, Odegardstuen, & Kaltenborn, 1998a and b; Kellert, 2002). On the other hand, fear of predators is particularly common amongst 9 to 13 year olds (Heerwagen & Orians, 2002). Evolutionary studies indicate that *fear* may be an inherited mechanisms of predator avoidance in response to large carnivores, which remain in spite of more immediate dangers presented by modern life (Kellert, 2002; Kruuk, 2004).

3.2.2. Teenage years

After an outward trend of exploring nature during middle childhood, the value placed in nature and wildlife seems to decline in adolescence, in favour of a development of ties with the social environment (Kellert and Westervelt, 1984; Bjerke, Odegardstuen, & Kaltenborn, 1998b; Kaplan and Kaplan, 2002; McCleery et al., 2006; Clayton & Myers, 2009; Bornstein and Lerner, 2010). Between the ages of 13 and 17 the maturation of abstract thinking and ethical concerns facilitates an appreciation of the wider world and of its ecosystems, and of the interconnectedness and interdependence between people and wildlife. Feelings of moral and environmental stewardship can be further developed then. Although ready to contribute to the workings of the community, a sustained interest in wildlife will depend on the nature and quality of their early experiences (Kaplan and Kaplan, 2002; Velsor and Nilon, 2006). Attitudes of significant adults towards wildlife continue to play an important role in the development of teens' attitudes: positive reassurance from significant adults (parents, teachers), at a stage when a need for independence combines with a need just as strong for guidance, can make the difference in facilitating positive, happy experiences, which are strongly associated to teens´ commitment to helping others, be it society, ecosystems or wildlife (Kaplan and Kaplan, 2002; Velsor and Nilon, 2006).

Research found that in Norway younger adolescents had the most positive attitudes towards carnivores in general, though older teens displayed more positive attitudes towards wolves, while in the US younger teens showed more fear (Bjerk, Ødegardstuen, & Kaltenborn, 1998a and b). A general decline in the interest in wildlife and ecological awareness with increasing age seems to continue until the age of 18. A return of preference for the natural environment is expected after 18, as knowing about the environment should be an imperative of preparing for adulthood (Kaplan and Kaplan, 2002). Age differences were not significant in other studies (Driscoll, 1995;Torkar et al., 2010).

Because teens are more physically able and independent they can explore natural settings further afield and get closer to wilderness. This inclination to explore and test their limits provides opportunities for engagement with the conservation of native species. According to Thomashow (2002) adolescents can find parallels to their own changing state in a whole set of animals that embody ambiguity and shadows, "zones between categories" (Shepard, 1996, in Thomashow, 2002:262). Feelings of kinness with wolves fit well within this picture.

3.3. Other determinants of attitudes towards wildlife

Demographics and socioeconomic variables such as gender and place of residence influence attitudes towards animals (Kellert, 1996) and are investigated by this study.

3.3.1. Gender

Studies suggest that females may support the conservation of animals more than males, however they may display more fear of carnivores, while males may display more positive attitudes towards large carnivores, least popular and unfamiliar animals, often accompanied by greater knowledge about them (Kellert & Berry, 1987; Bjerk, Ødegardstuen, & Kaltenborn, 1998a; Bath and Farmer, 2000; Taylor and Signal, 2005; Roskaft et al., 2007; Prokkop and Tunnicliffe, 2008; Thornton and Quinn, 2009). However, no significant differences between attitudes of young males and females were found in studies carried out in Canada by Eagles and Muffitt (1990, in Bjerke, Odegardstuen, & Kaltenborn, 1998b).

3.3.2. Location, Experience and Knowledge

Research indicates that regional differences and variables related to place of residence may affect the development of attitudes towards carnivores. In the USA suburban residents (<50 000 inhabitants), who experience proximity and access to natural areas without the burdens of having to live and compete with wildlife show a significantly greater level of knowledge and interest in wildlife, while residents of large cities (over one million inhabitants), who may lack familiarity with nature and wildlife in their formative years, displayed less appreciation and knowledge about it as adults, or fear (Kellert, 1984; Thornton and Quinn, 2009). Meanwhile, residents of smaller cities and rural areas are often the most negative towards the existence of carnivores nearby associated with fear and concerns about own and family safety (Kellert, 1984; Roskaft et al, 2007). Yet, other studies show that children who reside in areas where carnivores are present tend to have more positive attitudes towards wild carnivores than children residing in more urban areas (Bath and Farmer, 2000; Bath, Olszanska, & Okarma, 2008). According to Siemer et al (2009:188) "personal experience reduces uncertainty about the consequences of living in proximity to a given species, which reduces concern level and risk perception." Karlsson and Sjostrom (2007) research indicate that rather than size of community, distance from the territory of wild carnivores affect attitudes not necessarily because of direct experiences of encounters or depredation, but as a result of a strong influence that family, friends and peers pose on people's attitudes.

However, having early life experiences of livestock predation can be decisive in forming long-lasting attitudes. In rural areas where livestock loss to predators is seem as a problem, rural people tend to have more negative attitudes towards carnivores when compared to urban residents (Bjerke, Odegardstuen, & Kaltenborn, 1998a,b; Bath, Olszanska, & Okarma, 2008). The same trend is found among children, and particularly amongst 9-10 year olds, suggesting that these attitudes also relate to the ability to identify with people who had negative experiences with predators (Bjerk, Ødegardstuen, & Kaltenborn, 1998a; Skogen and Thrane, 2008). Also in Norway, differences in rural/urban attitudes were reduced possibly because urban teenagers maintain contact with farms, and come from rural families that moved to urban areas, where these roots of concern may be passed on from adults to children in the same household or community (Roskaft et al, 2007). However, even in the areas of rural Norway where conflict between livestock and carnivores was more intense the majority of adolescents were protective towards carnivores, in contrast to Kellert findings in the USA (1994).

In fact, while negative attitudes towards carnivores in Norway were associated with the expectation that encounters with carnivores put themselves or their families in danger, and may result in financial loss, positive attitudes were associated to the expectations of seeing animals in the wild (and with the excitement derived from these encounters) (Roskaft, Handel, Bjerke, & Kaltenborn, 2007). Affective experiences are important entry points to learning about wildlife (Millar and Millar, 1996; Kellert, 2002). Research has connected a lack of interest in nature and commitment to biodiversity conservation to declining opportunities to engage with nature from childhood, be it in gardens, parks or wild places (Pyle, 1993, 2002; Kellert, 2002). According with social development research, experiences with live animals in a zoo may encourage empathy, through a sense of personal connection, which in turn facilitates greater concern towards their conservation and ultimately for their native ecosystem, having an effect in the formation of lasting values. (Myers and Saunders, 2002; Clayton & Myers, 2009; Clayton, Fraser, and Burgess 2011; Clayton, Luebke, Saunders, Matiasek, & Grajal, 2013).

Higher levels of knowledge about wild carnivores have been associated with high levels of positive attitudes towards them (Kellert & Berry, 1987; Kellert et al, 1996; Roskaft et al., 2007), while negative attitudes have been associated with

fear and lack of support towards conservation (Bath and Farmer, 2000; Bath, Olszanska, & Okarma, 2008; Torkar et al., 2010).

3.3.2.1. Students and exposure to information about the maned wolf and conservation

Bizerril (2004) has found a positive association between knowledge about the Cerrado biome and preferences for the biome in 12-17 year old students, where students who had positive experiences with the Cerrado were more likely to prefer Cerrado animals and plants.

On the other hand, lack of involvement, low affectivity, indifference and ignorance about local fauna have been associated to road killings and to attitudes that may develop into hunting, trapping or running over animals, or into the acceptance of these practices in adulthood (Rodrigues, 2002; Bizerril, 2004; Bizerril, Soares, & Santos, 2011; Consorte-McCrea, 2011; Consorte-McCrea, 2013).

As in many parts of the world, visits to zoos in São Paulo state are often part of the school year. Amongst urban populations, zoos offer unique opportunities to reconnect people with wildlife, a key element in support towards biodiversity conservation (Consorte-McCrea 1994; Almeida 1997; Myers & Saunders, 2002; Bowkett 2009; Clayton & Myers, 2009; Vanstreels and Pessutti 2010; Clayton, Luebke, Saunders, Matiasek, & Grajal, 2013). However, zoos commitment to public education can only be fulfilled if there is an investment in understanding their public.

4. Results

4.1. Attitudinal components

As shown in Table 3.1, Component I collates positive beliefs related to sympathy and feelings that the maned wolf is unthreatening; Component II corresponds to a charismatic, even heroic, image of the maned wolf; Component III to positive attitudes towards the conservation of the maned wolf; and component IV to negative beliefs, fear and potential conflict with the species. Attitudes of the 12-13 and 16-17 age groups were compared across gender and research locations to explore the influence of variables such as the size of the city and the presence of the maned wolf on attitudes towards the species.

4.1.1. Sympathy and feelings that the maned wolf is unthreatening

The between-groups ANOVA indicates significant effects of some of the predictor variables upon Component I scores. A significant main effect of location ($F(2, 174) = 8.30$, $p < .001$) suggests that respondents in São Carlos found the maned wolf significantly more unthreatening and likable than Lower Mogiana residents. The interaction between age group and location was also significant, with $F(2, 174) = 6.98$, $p < .01$. In Low Mogiana ($t(85) = 2.57$, $p < .05$) and São Carlos ($t(74) = 5.11$, $p < .001$) the positive beliefs about the maned wolf decline as children grow older (table 4.1.1.). This is not the

case for Greater São Paulo residents, where the trend appears to be reversed ($t(21) = -2.16$, $p < .05$), although this difference is not significant after application of the Bonferroni adjustment (figure 4.1.1.).

Dependent variable	df	F	Sig.
Research location	2	8.298	<0.001
Target groups by locations	2	6.977	.001
-Greater Sao Paulo	1	3.920	.049
-Low Mogiana region	1	7.361	.007
-Sao Carlos	1	23.706	<0.001

Table 4.1.1. Univariate tests for Component I

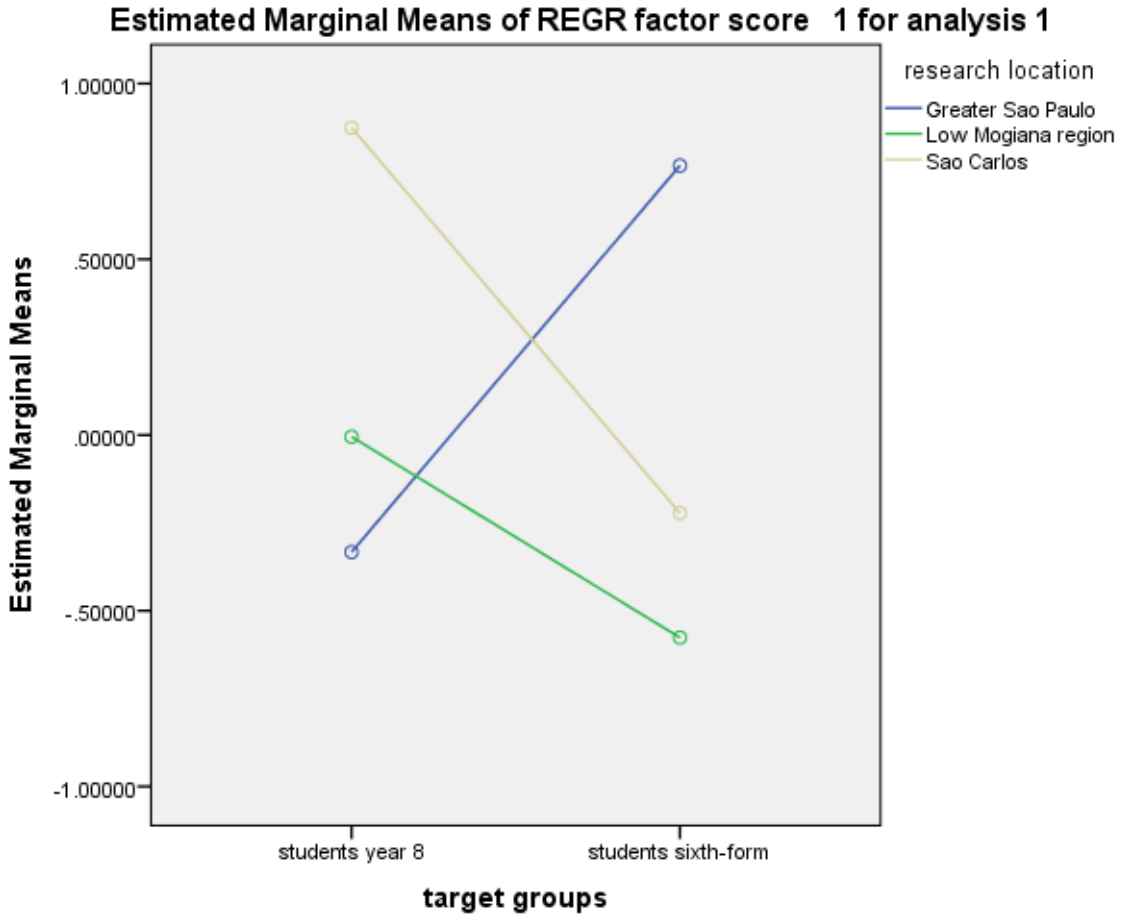


Figure 4.1.1. Profile plot for Component I by target groups, by research location.

4.1.2. Charismatic image of the maned wolf

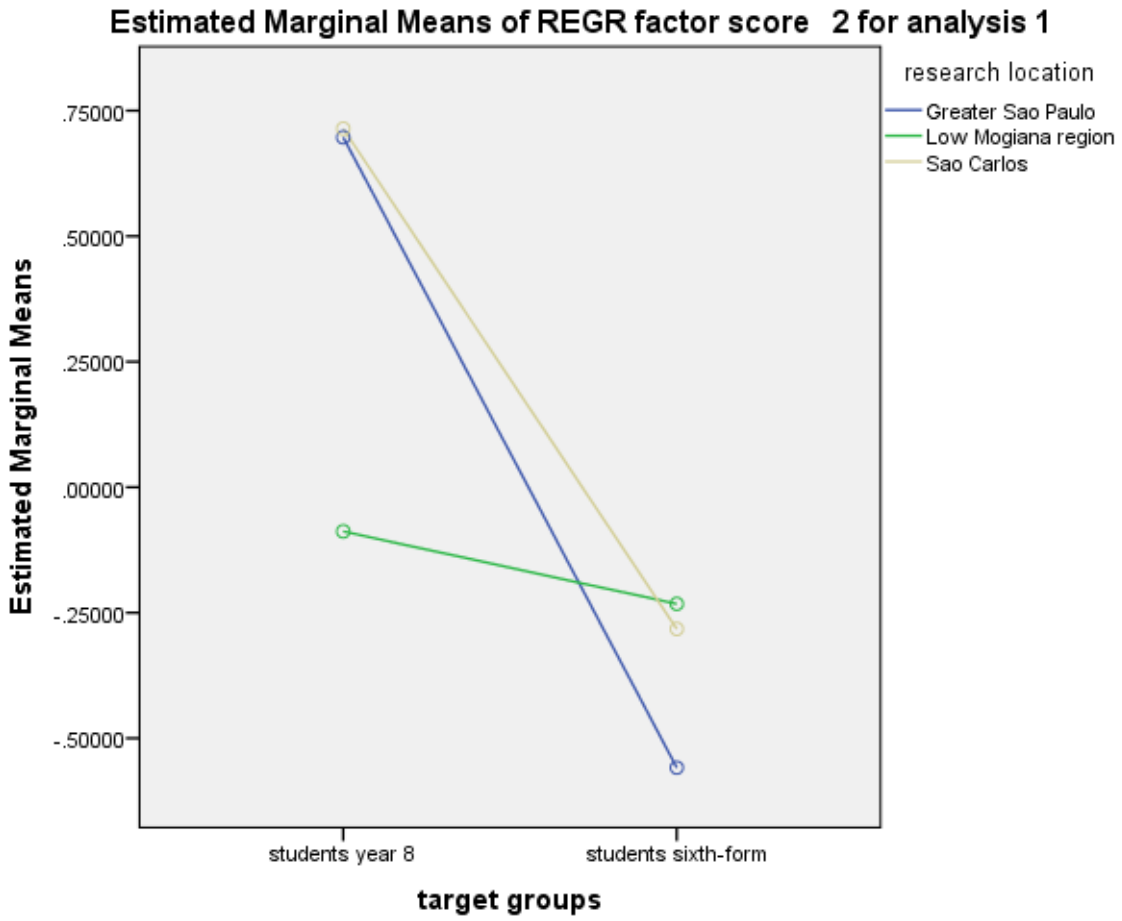


Figure 4.1.2a. Profile plot for Component II by research locations and age group

The ANOVA on Component 2 scores revealed a significant main effect of age group, a marginal main effect of location, and significant interactions between location and age group, and between location and gender. Younger teens are positively impressed by the maned wolf's image. Such beliefs, as in Component I, seem to decline with age, $F(1, 174) = 13.76$, $p < 0.001$. Residents of the Lower Mogiana region find the maned wolf marginally less charismatic than residents of the other two locations, $F(2, 174) = 2.90$, $p = 0.058$). Further investigation of the interaction between age group and location, $F(2, 174) = 4.43$, $p < .05$, shows that although the belief that the maned wolf is charismatic declines significantly with age, this trend is only significant in São Carlos ($t(74) = 4.15$, $p < .001$). In Greater São Paulo the effect becomes non-significant when applying the Bonferroni correction to the significance criterion ($t(21) = 2.49$, $p < .05$), and it is not significant amongst Lower Mogiana teens, $t(85) = .71$, $p = .48$ (figure 4.1.2a.).

A strong association between gender, location and Component II is also evident, $F(2, 174) = 3.48$, $p < .05$. Simple main effects analysis suggests that boys found the maned wolf significantly less charismatic than girls only in São Carlos ($t(74) = -2.77$, $p < .01$), while no gender differences were significant in the other locations (figure 4.1.2b.).

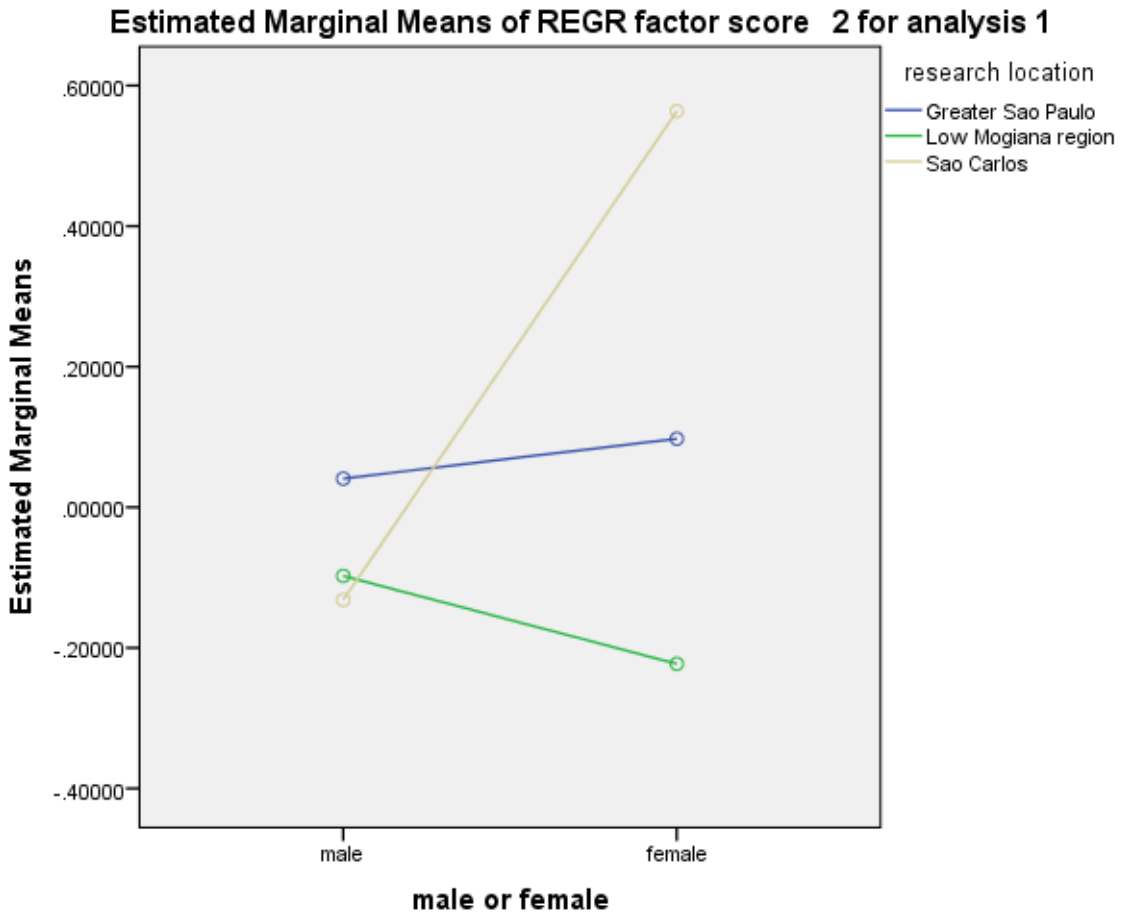


Figure 4.1.2b. Profile plot for Component II by research locations and gender

Dependent Variable	df	F	Sig.
Target groups	1	13.760	<0.001
Target groups by location	2	4.43	0.013
-students year 8	2	9.580	<0.001
Location by gender	2	3.48	0.033
-São Carlos	1	9.225	<0.001

Table 4.1.2. Univariate tests for Component II

4.1.3. Positive attitudes towards the conservation of the maned wolf

Attitudes towards maned wolf conservation do not seem to be associated to age group, location or gender (all *p* values were .25 or greater).

4.1.4. Negative beliefs, fear and potential conflict with the maned wolf

The ANOVA indicates strong associations between Component IV and age groups, $F(1, 174) = 7.74$, $p < .01$. The three-way interaction between age group, location and gender was marginal, $F(2, 174) = 2.97$, $p = .054$.

Some strong associations were found for some of the variables in component IV when looking within each age group, which deserve particular attention (table 4.1.4.). The belief that the maned wolf scares and attacks people and attacks chickens and livestock was found mostly amongst young students from Greater São Paulo, when compared to the other locations. Significantly only older students from the Low Mogiana region believed the maned wolf scares and attacks people, when compared to no students from the other locations.

Aspect	Result	Chi -squared statistics
12-13 year olds		
the maned wolf scares and attacks people	Greater São Paulo > other locations (São Carlos = 0)	F=14.5, df=2, *p*<0.001
maned wolf attacks chickens and livestock	Greater São Paulo > other locations	F=10.3, df=2, *p*<0.001
16-17 year olds		
the maned wolf scares and attacks people	Low Mogiana region > other locations (=0)	F=4.64, df=2, *p*=0.011

Table 4.1.4. Component IV by individual age groups

It is possible that the statement “scares and attacks” may not necessarily convey fear and harm, but surprise (“O lobo guará assusta e ataca gente” in Portugese). It is interesting to note that the statement “the maned wolf does not harm anyone” does not load into Comp IV, but loads into Comp I.

4.2. Knowledge about the maned wolf

The Knowledge score corresponds to correct answers to questions about the maned wolf’s feeding habits, declining number trend and social organization (questions 3, 4, 6 and 12).

4.2.1. By socio-demographics and research location

ANOVA indicates a strong association between Knowledge and research locations, $F(2, 251) = 30.29$, $p < .001$). Girls and boys of both age groups knew more about the maned wolf in São Carlos, followed by Greater São Paulo, with residents of Low Mogiana displaying significantly lower levels of knowledge. The main effects of age group ($F(1, 251) = 0.23$, $p = .63$) and gender ($F(1, 251) = 0.06$, $p = .80$) were not significant.

4.2.2. By Components

Analysis of correlations between knowledge scores and Component I show that the more respondents knew about the maned wolf the higher they believed the maned wolf to be unthreatening and likable ($r = .36$, $p < .001$). No correlations were found between knowledge scores and Component II ($r = .05$, $p = .47$).

Analysis indicates that the more students knew about the maned wolf the most positive were their attitudes towards its conservation ($r = .25$, $p = .001$). No evidence was found of correlation between Component IV and Knowledge ($r = .05$, $p = .47$).

4.3. Previous experience and sources of information

4.3.1. First and second hand experience of seeing the maned wolf

Respondents were asked about their exposure to the maned wolf, and if they have seen the maned wolf first hand live in nature, in a zoo, museum or conservation unit; or had a second hand contact with the species via papers, books, magazines; school, environmental education; information from parents, family or friends; or the internet.

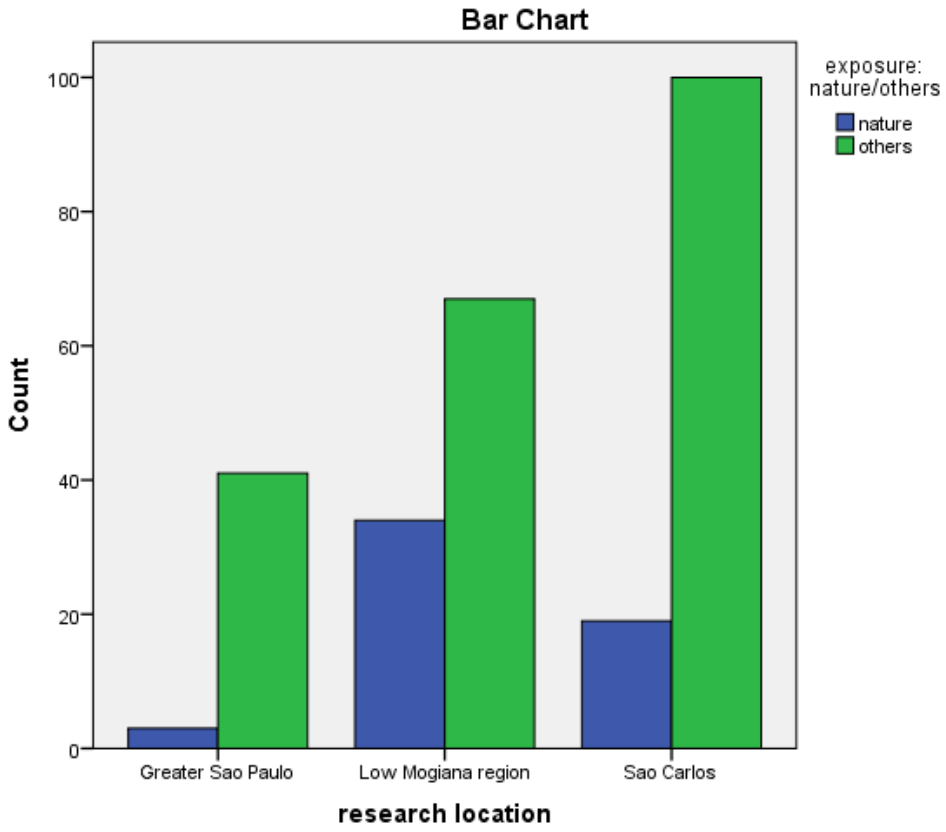
Chi-squared test indicate a significant association between exposure and research locations. Residents of Lower Mogiana have seen the maned wolf live in nature more than teens in other locations (fig 4.4.4.1., $\chi^2(2) = 16.78$, $p < .001$). Second hand exposure is similar in all locations, while first hand (live, zoos, museum, CU) is higher in São Carlos, due to the influence of an active local zoo (PESC). This can be inferred as statistical evidence shows that less São Carlos respondents are not familiar with the local zoo than respondents from both Low Mogiana and Greater São Paulo ($p<0.001$), and less São Carlos respondents are familiar with local conservation unit than respondents from other locations (particularly Greater São Paulo, $p<0.001$) . In fact 92.4% of SC respondents were familiar with the local zoo, while only 16% knew of the local CU.

4.3.1.1. By Components

Independent Samples t Tests indicate that teens who have seen the maned wolf first hand in nature or in the zoo rather than second-hand through the media or others ($t(184) = 2.73$, $p < .01$) were more supportive of maned wolf

conservation. This effect held when exposure to the maned wolf was differentiated between those who had seen the animal live in nature and those who had experienced it by any other means, $t(184) = 2.17$, $p < .05$.

A marginal effect that only appeared when exposure was differentiated between first- and second-hand was that participants with first-hand experience of the maned wolf more strongly endorsed attitude component IV (negative beliefs, fear, and potential conflict), $t(184) = 1.73$, $p = .085$. All other effects relating exposure to attitude components were non-significant.



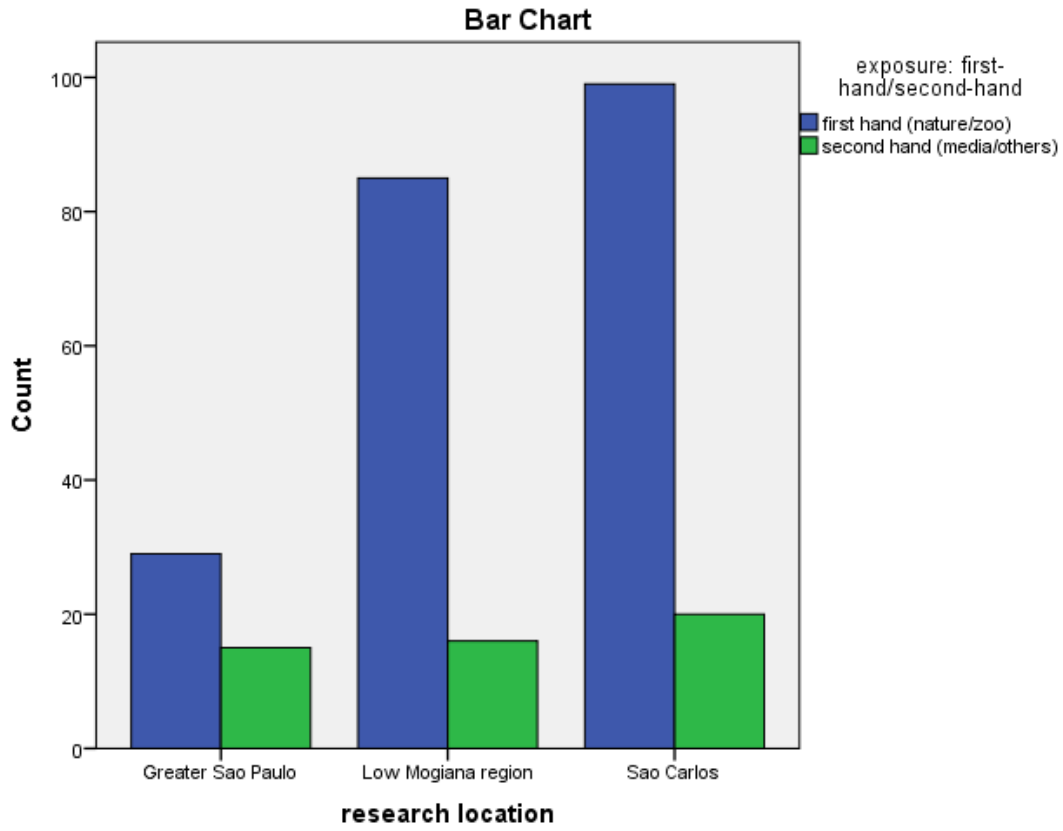


Figure 4.3.1.1. Exposure to nature/others, and exposure to first/second hand sources of information about the maned wolf, by location

4.3.1.2. By Knowledge

Coding exposure to the maned wolf as exposure in nature versus exposure by other means did not yield any substantial relationship with knowledge scores, $t(262) = 0.38$, $p = .71$. However, a significant effect exists when exposure is coded as first-hand versus second-hand, $t(262) = 1.97$, $p < .05$. Participants with first-hand experience of the maned wolf ($M = 1.54$, $s = 1.81$) displayed greater knowledge of the animal than those with only second-hand experience ($M = 0.98$, $s = 1.95$).

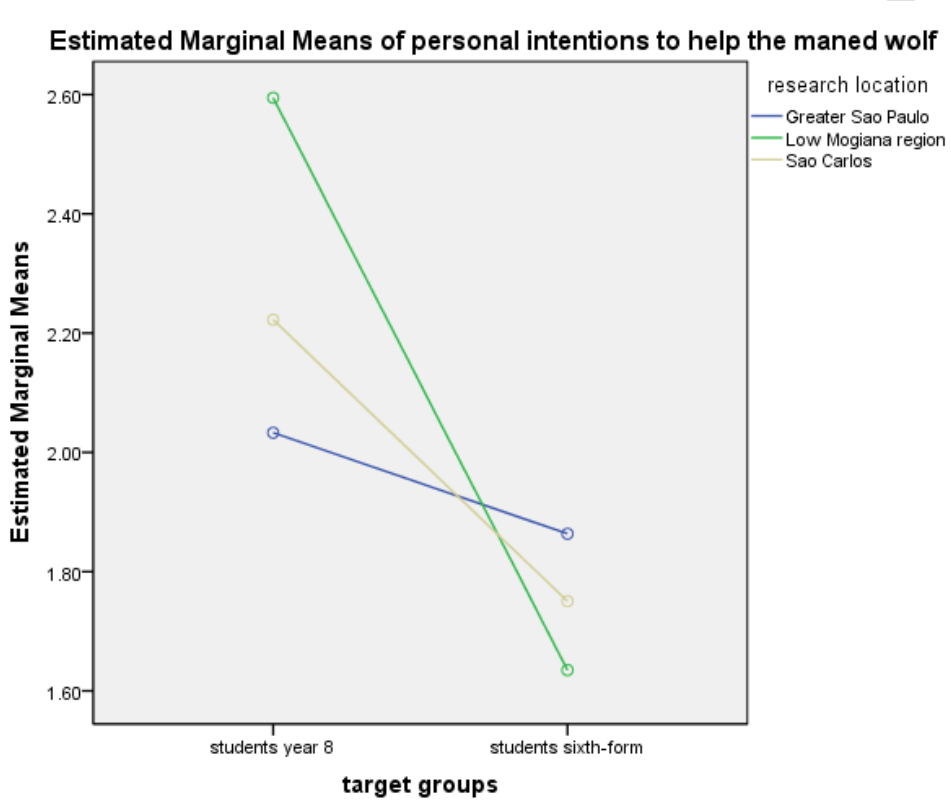
4.4. Intentions

4.4.1. By age group, location, gender

UNIANOVA indicates strong associations between intentions to help the maned wolf, age groups and research locations, and no considerable association between intentions and gender. Younger boys and girls demonstrated more intention to help maned wolf conservation than the older group ($F=19.81$, $df=1$, $p<0.001$). The strong association between age groups and locations (Graph 4.4.1.) ($F=3.59$; $df=2$; $p=0.029$) was investigated further. Bonferroni shows that intentions to help the maned wolf were higher in Lower Mogiana than São Carlos ($p=0.014$), and marginally higher than Greater

São Paulo (*p=0.075*) though differences between locations were not confirmed by Homogenous Subsets. Looking at each research location separately using Univariate tests, the decline with age in intentions to help the maned wolf is significant in both Low Mogiana (F=24.49, df=1, *p< 0,001*) and São Carlos (F=10.33, F=1, *p=0.002*), but not in Greater São Paulo.

Looking at age groups individually, ANOVA shows that these intentions were significantly higher amongst younger respondents in the Lower Mogiana region than Greater São Paulo (F=5.24, df=2, *p*= 0.006), but no significant differences were found in the older group.



Graph 4.4.1. Intentions to help the maned wolf by research locations and age groups.

4.4.2. By components

ANOVA indicates strong associations between Components II (F=5.48; df=4; *p*<0.001), III (F=5.34; df=4; *p*<0.001) and intentions to help the maned wolf.

Examining each age group separately, ANOVA shows that intentions to help the maned wolf are related to positive attitudes towards its conservation amongst younger respondents (F=7.6; df=4; *p*<0.001), while such intentions are related to feelings that the maned wolf is charismatic amongst older teens (F=3.97; df=4; *p*=0.006), confirmed by post-hoc tests. No significant associations were found between intentions and knowledge.

4.4.3. By exposure

UNIANOVA suggests a strong association between intentions to help the maned wolf and exposure. Respondents who have been exposed to maned wolf first hand displayed more intention to help the species ($F= 7.92$; $df=1$; $p=0.005$), regardless of age and location. T-tests, however were not significant.

5. Discussion

5.1. Attitudes and variables

Overall attitudes were positive towards the maned wolf, however some variables had a negative influence on attitudes. The results from our research shed some light onto when attitudes towards the maned wolf are formed, and about the influence of variables in their development.

5.1.1. Age

Attitudes towards the maned wolf were highly influenced by developmental changes taking place between the ages of 12 and 17. Younger teens (12-13) were more positive towards the maned wolf and displayed more intention to help the species, though they also believed the maned wolf was more of a threat to people and livestock, as it is expected from this age group possibly as an innate response to predators.

As in other studies about attitudes towards wild carnivores, there was a decline in positive attitudes towards the maned wolf with age in areas where the maned wolf is present, which may be the result of an overall decline in interest for interactions with nature, in favour of social interactions, but may also reflect negative values associated with the maned wolf in the vicinity of rural areas. Where the maned wolf is not present, however, older teenagers were more sympathetic and less fearful of the maned wolf, in a similar way that European teens relate to the image and symbolism attached to the *Canis lupus* (Bjerk, Ødegardstuen, & Kaltenborn, 1998a). This older group, less familiar with the maned wolf *per se*, may identify with the wild appeal that resonates with the changes they are going through as they approach adulthood. Such identification should be useful informing conservation strategies

Sustaining any level of interest towards maned wolf conservation amongst older teens may depend on combining conservation with a chance for them to interact with peers, within a stimulating context. It is precisely between the ages of 13 and 17 that the maturation of abstract thinking and ethical concerns facilitates an appreciation of the wider world and its ecosystems and of the interconnectedness and interdependence between people and wildlife. Feelings of moral and environmental stewardship can be fostered at this point in time, while an inclination to explore and test their limits provides opportunities for engagement. Such opportunities can be maximized by environmental education and awareness campaigns within zoos and conservation units, where the animals are present.

5.1.2. Gender

There were no pronounced differences between girls' and boys' attitudes towards the maned wolf, knowledge or intention to help the species, suggesting that the relationship between gender and attitudes towards the maned wolf differ from the one found in studies of other large carnivores (Kellert & Berry, 1987; Bath & Farmer, 2000; Roskaft, Handel, Bjerke, & Kaltenborn, 2007; Bath, Olszanska, & Okarma, 2008; Prokkop & Tunnicliffe, 2008; Thornton & Quinn, 2009).

5.1.3. Location, Experience and knowledge

Location of residence accounted for most variability in attitudes towards the maned wolf amongst respondents. Findings suggest that attitudes are affected by proximity to maned wolves territories as a result of livelihoods and related influences posed by family, friends and peers.

Positive attitudes in São Carlos may be associated with familiarity with wildlife combined with a stronger urban cultural heritage and economy. São Carlos enjoys proximity to natural areas but has an economy where competition with wildlife has been replaced by services and industries and a thriving academic life, more so than LM.

On the other hand, Low Mogiana respondents displayed overall less positive attitudes towards and knowledge about the maned wolf, though they were the most exposed to the maned wolf in nature. However, their familiarity with the maned wolf still translated into intentions to help the species, and positive attitudes amongst the younger teens. As suggested by Thornton and Quin (2009) the proximity to experiences of conflict and depredation may bring increasing awareness of conservation issues particularly amongst younger Low Mogiana residents. The negative attitudes amongst younger children here may relate to misconceptions about the feeding ecology of the maned wolf and alleged threat to henhouses, possibly passed down from parents with a rural background. Notwithstanding, the attitudes of the younger children here, where maned wolves are present, were less negative than the attitudes of children residing in GSP, were they are not, in accordance with other research (Bath and Farmer,2000; Bath, Olszanska, & Okarma, 2008).

Residents of the most urban, Greater São Paulo displayed less intention to help the maned wolf and less positive attitudes towards the species, though general attitudes towards the maned wolf improved with age. The sympathy towards the species amongst older GSP teens is not based on knowledge or protectionism but on identification with heroic-related attributes of the maned wolf, and other wolf-related attributes which have been associated with age-linked changes (values, affective).

Although not rural residents themselves, teens in the Low Mogiana may be highly influenced by the local rural economy and family connections, which may affect their attitudes towards the maned wolf. This cultural heritage may also prejudice their trust on information from institutional sources, in favour of local informal sources, which deserve consideration when planning interventions (Skogen & Thrane, 2008).

Knowledge about the maned wolf was directly associated with positive attitudes towards the species and its conservation, highlighting the importance of the cognitive element of attitude formation and justifying the need for investment in devising and disseminating accurate information as a means to raise support for the conservation of the maned wolf.

On the other hand, findings also suggest that seeing the maned wolf in nature or in a zoo may facilitate learning about the species. Other zoos (and conservation units) may wish to explore this potential to combine the development of both cognitive and affective messages through information and the use of positive models of contact with the maned wolf (Tunnicliffe, Lucas, & Osborne, 1997; Myers & Saunders, 2002; Clayton & Myers, 2009; Clayton, Luebke, Saunders, Matiasek, & Grajal, 2013). Furthermore, zoos can influence children's experiences from an early age when attitudes towards wildlife are being formed, and help to develop active environmental concerns for life (Keliher, 1997; Wilkinson, no date; Biaggio, Vargas, Monteiro, de Souza, & Tesche, 1999). While the conservation of wild habitats benefits the maned wolf and the local people, the development of connections between the maned wolf and people in the zoo is also important to promote concern for the species and the natural environment as a whole.

Nevertheless our finding that younger children's attitudes were affected by seeing the maned wolf live in nature support suggestions that the expectation as well as the experience of encounters may relate to an awareness of conservation issues, interest in wild animals, reduction of fear and beliefs that their presence enhances the quality of life (Bath & Farmer, 2000; Roskaft, Handel, Bjerke, & Kaltenborn, 2007; Bath, Olszanska, & Okarma, 2008; Thornton & Quinn, 2009; Torkar et al, 2010). The emergence of positive attitudes may result from the fact that the experience provides an opportunity to combine affective and cognitive elements, when the excitement of seeing the maned wolf is supported by the accompanying adults and followed up by finding out more about the species. (Millar & Millar, 1996; Clayton & Myers, 2009; Clayton, Luebke, Saunders, Matiasek, & Grajal, 2013).

6. Conclusions

The development of values regarding wildlife conservation, parallel to children's emotional and intellectual development, is particularly sensitive during middle childhood and early adolescence when it can benefit greatly from stimulation provided by nature and wildlife, from a mixture of direct, indirect and symbolic experiences.

It is possible that in the most rural areas, teens between the ages of 13 and 16 become more aware of negative attitudes towards the maned wolves amongst their family and peers, identify themselves more with them, or begin to associate the maned wolf more with financial loss and danger for themselves and their family as they prepare to take on their adult role in society. Many of these negative attitudes, though, may relate to misconceptions about the feeding ecology of the maned wolf and alleged threat to henhouses and require investments in knowledge. However, as negative attitudes based on cultural heritage may predispose local people against institutional sources of information it becomes even more important to involve local conservationists in conservation strategies, who may inspire trust and be adopted as role models by the teens.

It has been pointed out that consistent exposure to positive experiences in nature from an early age should help to shape values and affect the persistence of positive attitudes towards wildlife throughout life. In urban centres, positive personal experiences with maned wolves in captivity and in the wild can be managed to promote and strength positive values, to benefit its conservation and that of its habitat. Near rural areas, even if children are influenced by negative attitudes towards maned wolf eventual predation events, children's innate affinity with biodiversity and care for animal species before the age of 13 can be reinforced by the social environment, positive experiences and by quality

information. Early investment seems crucial to help promote long term support for the conservation of the maned wolf and its environment.

It is important to consider that attitudes may decline as maned wolf populations recover and experiences of conflict and predation move closer to their place of residence. Efforts towards recovery must be accompanied by monitoring human attitudes so that potential problems may be addressed.

The charismatic maned wolf has a role to fulfil in raising awareness for the conservation of the Cerrado habitat, in which it depends to survive, throughout local communities and further afield in urban centres. The present research suggests that, the maned wolf generates curiosity and intention to help conserve them among teenagers, future decision makers. The maned wolf affords an entry point to discuss ecological interactions with the Cerrado habitat, and values related to the conservation of its biodiversity that should be explored for the benefit of generations to come.

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