

Humans and Jaguars in Five Brazilian Biomes: Same Country, Different Perceptions

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Human perceptions of and attitudes towards wildlife are important aspects of conservation as they indicate and reflect potential impacts on species populations. This study focused on identifying perceptions of the jaguar within local communities in five Brazilian biomes (Caatinga, Cerrado, Pantanal, Amazon and Atlantic Forest) using interviews for adolescents and adults, and thematic drawings for children. The majority of the public interviewed was in favor of jaguar conservation. In general, people presented positive perceptions and values of the jaguar, although there were differences between the biomes in perception of the species and values attributed towards it. Children's perceptions did not necessarily reflect that of the adults across the biomes. Results highlight the need for regionalized programs addressing the human aspect of jaguar conservation.

The relationship between humans and jaguars has several dimensions and has been documented in ancient and present times (Saunders 1998; Conforti & Azevedo 2003; Zimmermann *et al.* 2005; Palmeira & Barreira 2007). In general, it is acceptable to assume that many humans around the globe show admiration for large cats (Saunders 1998). They have been used as symbols since ancient cultures to today's modern society. In Pre-Columbian America, the jaguar was the most prominent symbol of power and strength (Benson 1998); today, its name stands for a luxury car brand. However, on a smaller scale, looking at communities that share space with them, perceptions change and are closely related to local culture and shaped by each area's religious history, ethical standards and conflicts with the species.

Brazil-wide demands for food production (crops and beef) combined with incentives for the expansion of agriculture and cattle ranching (Young 2005) have brought rapid conversion of jaguar habitat. At the same time, and based on the different local socio-economic circumstances, communities in each biome have developed distinct feelings towards native species like the jaguar, including fear, respect, and anger. These relations are commonly observed worldwide where humans live in close proximity to populations of wild animals (Manfredo & Dayer 2004).

Efforts to protect wildlife are often related to species that people admire for their beauty, power, charisma or exoticism (Sergio *et al.* 2006). On the other

hand, aggressive responses, such as efforts to eliminate species or retaliation (Fig. 1), are usually directed towards those species that are perceived as competitors to human activities or risk to human life (Fanshawe *et al.* 1997; Zimmerman *et al.* 2005). Considering that human perceptions and attitudes towards a species are determinant for its conservation (e.g. Marker *et al.* 2003; Lindsey *et al.* 2005), it is implicit that understanding these trends is key to guiding species conservation efforts.

In this study, we evaluated people's opinions about jaguars based on their perceptions and values attributed to the species across five biomes. We aimed to interpret perceptions while considering the distinct cultural aspects of the sampled communities. We also briefly discuss implications for jaguar conservation in the country's different biomes.

Material and Methods

Study area

We sampled one community site in each of five distinct regions of Brazil, located in different Brazilian biomes: Pantanal, Cerrado, Amazon, Caatinga, and Atlantic Forest. Although each area represents environmental, socio-economic and cultural characteristics typical for the biome, we do not consider that our data necessarily reflect the average perception of each biome as a whole. The study followed two major criteria for site selection: 1) that the area had confirmed past and present jaguar occurrence, and 2) that the traditions and socio-economics of the local community reflected the

general customs expected for most of the biome. The site locations and human populations (IBGE 2007) for these regions are as follows:

- Cerrado (CER): Surrounding Emas National Park (ENP), central Brazil, municipality of Mineiros and Chapadão do Céu, State of Goiás; Alto Taquari, State of Mato Grosso; and Costa Rica, State of Mato Grosso do Sul (between 18° 00' S / 52° 54' W and 18° 62' S / 53° 20' W), with an area of 18,369 km² and a human population of 74,813 inhabitants;
- Caatinga (CAA): Ecological Corridor that includes the Serra da Capivara National Park and the Serra das Confusões National Park (between 9° 00' S / 42° 48' W and 9° 28' S / 43° 34' W); Municipality of São Raimundo Nonato, Coronel José Dias and Caracol, State of Piauí, with an area of 4,699 km² and a population of 45,551 inhabitants;
- Amazon (AMA): Surrounding Cantão State Park (CSP) (between 09° 08' S / 50° 00' W and 09° 50' S / 49° 50' W); Municipality of Caseara and Marianópolis, State of Tocantins; and Santana do Araguaia, state of Pará, with an area of 15,374 km² and a population of 58,193 inhabitants;
- Pantanal (PAN): Municipalities of Miranda, Aquidauana and Bodoquena, State of Mato Grosso do Sul (between 20° 14' S / 55° 47' W and 20° 30' S / 56° 43' W); with an area of 24,945 km² and a population of 77,053 inhabitants;
- Atlantic Forest (ATF): Atlantic Forest Corridor, including the surroundings of Intervalos State Park, Alto Ribeira Tourist State Park, and Carlos Botel-



Fig. 1. For subsistence farmers, any livestock loss due to jaguar predation may represent large economical damage, therefore retaliation over cattle killers or even preventive killing of jaguars is common (Photo Jaguar Conservation Fund/Instituto Onça-Pintada).

ho State Park (between 24° 17' S / 48° 37' W and 24° 84' S / 49° 00' W), municipality of Apiaí, Iporanga, Guapiara, Ribeirão Grande, and São Miguel Arcanjo, State of São Paulo, with an area of 3,799 km² and a population of 87,434 inhabitants.

Interviews

We distributed interviews equally among the five study areas and sampled a public comprised of adolescents (15 and 19 years of age), adults (20 to 59 years) and elderly people (60 years or older). Interviewees were chosen randomly from the local population. We used a semi-structured questionnaire with open and closed questions and opted for individual interviews without the presence of a third person. The questionnaires were divided in two sections: 1) Profile of the interviewee; and

2) Perception of the jaguar and values attributed to it.

We chose a qualitative approach for analysis of the open questions as this is a pioneer study that demands familiarization with the language of the studied public and the types of answers given. To analyze open questions we established two variables (e.g. Rey 2002): 1) perceptions of the jaguar, and 2) values attributed to the jaguar.

For the variable “*perceptions of the jaguar*,” we analyzed answers to the ques-

tions “*Have you ever seen a jaguar?*” indicating the person’s recognition of the species, followed by “*Where did you see a jaguar?*,” in order to identify how the person could identify the species (e.g. from television, seeing them at a zoo, etc.). Lastly, we asked “*What do you think of the jaguar?*” Based on the responses obtained to this question, we established levels of how the jaguar is perceived: dangerous (causes threats to human life), beautiful, or both (beautiful and dangerous). We recognize that with this approach re-sampling or sampling in other areas can result in more or different response categories from the ones we obtained in this study, however, this line of analysis allows general identification of the image of the species in the different regions.

For the variable “*values attributed to the jaguar*,” we analyzed answers to

the questions “*Do you think the jaguar should be eliminated from nature?*,” followed by “*Why?*” Answers to the latter question indicated values that justify positions of favoring the species’ elimination or favoring its protection. Results pointed to five classes of values attributed to the jaguar: (1) anthropocentric - those that show the necessity to conserve the jaguar so that future generations can enjoy its beauty, or condition its existence on the species not posing any risk to humans; (2) religious - those that consider the jaguar as sacred, a divine creature; (3) economical - those that condition the existence of the jaguar on the presence or absence of economical losses caused by it; (4) moral - those that condition the jaguar’s existence on it being protected by law; and (5) ecological - those that acknowledge the jaguar’s ecological importance, even if not explicitly stating its role in the food chain.

To be able to discuss results in a socio-cultural context, we also recorded length of residency in the particular region, literacy/education level, and knowledge of jaguar attacks in the region.

Drawings

Hand drawings were used to evaluate the perception of the jaguar by children between the ages of six and 15 years. For this exercise, children from public schools were first presented with pictures 24 x 30 cm in size of the typical vegetation of the biome they lived in. The children were then asked to draw three animals that, in their opinion, inhabit this environment. This exercise had the goal to evaluate the frequency at which the jaguar appeared among these three animals. Subsequently, we asked the children to draw a situation of them encountering a jaguar in the wild (Fig. 2). Lastly, children were asked individually to tell a short story about their drawing, to complement analysis of the encounter described by them. Using both pieces of information, we interpreted encounter situations as: a) positive (where there is interaction but the jaguar does not represent any danger to humans); b) negative (jaguar attacking human, or human attacking jaguar); or c) neutral (where there is no interaction between the jaguar and the human).

Table 1. References of the jaguar stated by members of rural communities in five Brazilian biomes when asked “*What do you think of the jaguar?*” expressed in percent (n for each area ≈ 200).

Reference	Amazon	Cerrado	Caatinga	Atlantic Forest	Pantanal
Dangerous	21.0	15.4	28.5	37.8	15.0
Dangerous and beautiful	11.2	9.0	14.5	13.4	6.0
Beautiful	60.9	68.2	37.5	39.8	71
Nothing	1.5	1.0	6.0	4.0	3.5
Others	5.4	6.5	11	4.5	3.5
No answer	0.0	0.0	2.5	0.5	1.0

Table 2. Values attributed to the jaguar by members of rural communities in five Brazilian biomes, expressed in percent (n for each area ≈ 200).

Value	Amazon	Cerrado	Caatinga	Atlantic Forest	Pantanal
Anthropocentric	24.4	19.4	33.5	30.8	20.5
Ecological	20.5	22.4	6.0	15.4	38.5
Economic	24.9	6.0	3.0	6.0	5.5
Religious	29.8	44.8	45.5	30.3	34.5
Moral	0.0	3.5	2.5	5.5	0.0
Others	0.5	1.5	7.0	9.5	1.0
No answer	0.0	2.5	2.5	2.5	0.0

Statistics

To compare results within each biome we used a binomial test for questions answered with either “Yes” or “No,” and for the first drawings where the jaguar appeared or not. We used a Chi-square test to analyze questions responded with several categories of answers, interaction categories in the second drawing, and to compare results between biomes. Analyzes were processed using the software SPSS 13.0 for Windows (SPSS Inc., Chicago IL).

Results

Profile of the interviewees

We conducted 1,007 interviews. Age of the majority of the interviewees (74%) ranged from 20 to 59 years. Most interviewees were born in the sampled region in the Pantanal (84%), Caatinga (92%), and Atlantic Forest (94%), while in the Cerrado and Amazon area, rates of interviewees born there were distinctly lower (26% and 17%, respectively). Fundamental education, comprised by the first eight years of school, was the most frequent level of education in all study areas (PAN = 54%; AMA = 44.4%; CER = 42.8%; ATF = 39.8; CAA = 38.5%). In the Caatinga and Amazon areas, we observed the highest rate of illiteracy (30.5% and 21%, respectively).

Table 3. Interpretation of drawings from school children (age 6 to 15 years) in five Brazilian biomes when asked to draw an imaginary encounter between themselves and a jaguar; interaction of both characters was classified as positive, negative, or neutral.

Biome	Neutral (%)	Positive (%)	Negative (%)
Cerrado (n=21)	52.4	0.0	47.6
Pantanal (n=9)	11.1	11.1	77.8
Caatinga (n=12)	0.0	41.7	58.3
Amazon (n=13)	7.7	38.5	53.8
Atlantic Forest (n=15)	13.3	40.0	46.7

Perception of the jaguar

In all study areas, the majority of interviewees knew what a jaguar was. The Amazon study area showed the highest rate of interviewees that did not know (26.3%), followed by the Cerrado (15.9%), Caatinga (8.5%), Pantanal (7%) and Atlantic Forest (1%). In the Pantanal, 78% stated that they had seen a jaguar in its natural environment. For the other areas, this value ranged from 34.3% in the Cerrado, 18.5% in the Caatinga, and 17.4% in the Atlantic Forest to 0% in the Amazon. Television was the main source of information for recognizing jaguars in the Atlantic Forest (50.7%) and the Caatinga (54.5%), while in the Cerrado and Amazon sources of information varied, ranging from circus, zoos and photos to skins and skulls found in hands of locals.

Among the observed levels of perception (dangerous, beautiful, or the combination of both) “beautiful” was predominant for all biomes (Table 1). Answers were not distributed equally between levels, and deviation from uniform distribution was significant ($20.025 < \text{Chi}^2 < 161.783$, $\text{df} = 2$, $p < 0.001$). Perceptions also differed significantly between the five biomes ($\text{Chi}^2 = 74.767$, $\text{df} = 8$, $p < 0.001$). In the Pantanal, Cerrado and Amazon, perception of beauty were represented more than in the Atlantic For-

est and the Caatinga, where perception of danger was found more often than in the other biomes (Table 1). Overall, the number of interviewees that had heard of an incidence of a jaguar attacking a human ranged from 29.5% in the Pantanal, followed by the Cerrado and Caatinga (27.4% and 27%, respectively), and considerably lower in the Atlantic Forest and Amazon (8% and 4.4%, respectively).

Values attributed to the jaguar

Throughout all study areas, a significant majority (85.5%) believes that the jaguar should not be eliminated ($p < 0.001$). The highest rate of answers in favor of elimination of the species were encountered



Fig. 2. Child drawing an imaginary encounter situation between herself and a jaguar (Photo Jaguar Conservation Fund/Instituto Onça-Pintada).

in the Amazon area (33.2%), followed by the Atlantic Forest (15.9%) and the Caatinga (11.5%) and a considerably lower rate in the Pantanal and Cerrado sites (3.5% both). Within biomes, the five classes of values (anthropocentric, economic, ecological, religious, and moral) were not attributed equally to the jaguar ($53.220 < \text{Chi}^2 < 177.425$, $\text{df} = 4$, $p < 0.001$). The predominating value in the Amazon, Cerrado and Caatinga was religious (Table 2), anthropocentric in the Atlantic Forest, and ecological in the Pantanal. Frequency of the five values differed significantly among biomes ($\text{Chi}^2 = 165.784$, $\text{df} = 16$, $p < 0.001$).

Perception of the jaguar by children

A total of 75 drawings (35 girls and 40 boys; average of 15 per biome) from students ranging in age between six and 15 years old were collected and analyzed.

In the Amazon, the jaguar appeared spontaneously among the three species in 50% of the first drawings. All other biomes showed a lower number of first drawings with a jaguar (ATF=40%, PAN=22%, CAA=13%, CER =9%), in the Cerrado and Caatinga the difference was significant ($p<0.001$ and $p=0.007$, respectively).

Regarding the second drawings, positive interaction was highest in the Caatinga, at 41.7%. Rates in the other biomes ranged from 40% in the Atlantic Forest to 0% in the Cerrado (Table 3). The Pantanal presented the highest incidence of negative interaction, at 77.8%, while in all other biomes negative interaction was present in about 50% of the drawings (Table 3). Twenty percent of these negative interactions in the Cerrado and 40% in the Caatinga and Amazon, involved humans attacking a jaguar. This was not observed in the other two biomes. Neutral interaction was represented in 52.4% of the drawings in the Cerrado, more than in any other study area (Table 3). Frequencies of the three types of interaction differed significantly between biomes ($\chi^2=21.259$, $df=8$; $p=0.006$). Drawings were generally coherent with the content of stories told.

Discussion

Considering that behavior is the result of interaction between perceptions, values and social rules integrated by an individual throughout his lifetime (Rodrigues *et al.* 1999), understanding people's perceptions can then be an essential tool to form favorable opinions about conservation of the jaguar. For example, in the Pantanal, extensive cattle ranching has been the major economic activity for over the past two centuries and consequently, the jaguar-rancher conflict has a long history. However, although jaguars are hunted in retaliation for cattle predation (Zimmermann *et al.* 2005), we observed in this study a clear desire to conserve the species, which is often highlighted as a regional flagship species. This is an important aspect for

the species' conservation and demonstrates how perception can differ from observable actions (Bandura 1973).

The Caatinga and Atlantic Forest biomes presented strongest perception of the jaguar as dangerous. Generally, this perception occurs as a result of folklore and traditions (Wilson 2004, East & Hofer 1998) and a response to attacks on humans (Saberwal *et al.* 1994; Wilson 2004; Palmeira & Barreira 2007). In the Caatinga, 27% of the interviewees claimed to know of attacks by jaguars on humans. An interesting analogy to this perception can be observed in cave paintings of the region, dated back to at least 5000 b.c. (N. Guidon, personal communication), showing what seems to be a large cat attacking a human (Fig. 3). In the Atlantic Forest, although few interviewees (8%) claimed to know about jaguar attacks, fear of the jaguar was an important reference, a tendency also observed in the surrounding area of Iguazu National Park (Conforti & Azevedo 2003).

Of all biomes, the Pantanal showed the highest percentage of ecological value attributed to the jaguar (Table 2). The long coexistence of cattle ranchers and jaguars in this biome could have led to a better understanding of the species' ecological role. The second highest incidence of interviewees recognizing the ecological value of the jaguar was observed in the Cerrado, although the local population does not have a history of coexistence with the species, as large scale agricultural occupation of the landscape was initiated in the early seventies and accompanied by immigration into this region (Ribeiro *et al.* 2005). However, this could be explained by the sampled area being located in the surroundings of Emas National Park, a locally well known reserve that protects jaguars. The Park may have brought public awareness about biodiversity related issues. Also, this region is dominated by agricultural activities with virtually no jaguar-rancher conflict, favoring, in turn, tolerance of the species.

At the Amazon study site, located in the so-called arc of deforestation and characterized by a strong jaguar-live-stock rancher conflict, the number of interviewees attributing an economical value to the jaguar was three to six times higher than in any other biome.

Also, one third of the interviewed public thought that the jaguar should be eradicated. The progressive expansion of the agricultural frontier in this region has brought in immigrants from other parts of Brazil (Young 2005), which could be causing a lack of identification with the local wildlife. Independent to the value attributed, most interviewees throughout all biomes agreed that the jaguar should not be eliminated from nature.

The perceptions and values discussed here are also present in the children's minds, with the prominent attitude being fear. Fear of animals among children is common and diminishes or is replaced by other fears with increasing age (Ferrari 1986; Bleichmar 1991; Roazzi *et al.* 2001). The negative interaction characterizing the jaguar as a threat to human life is common in all biomes (Table 3), while the figure of the brave human (attacking the jaguar) occurred only in the Cerrado, Amazon and Caatinga.

Human-jaguar interactions presented in the second drawing did not necessarily reflect the predominating perception or value attributed to the jaguar by adults. For example, the Atlantic Forest presented a high score of neutral interaction, although the reference of the jaguar as dangerous corresponded to 37.8% of the adults' answers. On the other hand, for the Amazon, the larger proportion of adults in favor of eliminating jaguars seemed to have influenced the children as they showed the highest incidence of drawings presenting a human attacking a jaguar.

Conserving a wide-ranging species with high conflict potential and a wide distribution like the jaguar has to incorporate the human dimension and recognize its uniqueness in different environmental, cultural and socio-economical settings. Several studies have proposed environmental education as a tool for mitigating conflicts between humans and wildlife (Conforti & Azevedo 2003; Zimmermann *et al.* 2005; Palmeira & Barreira 2007). While educational activities could strengthen positive tendencies observed in the Cerrado and Pantanal study areas, they can also lay the groundwork for understanding the ecological importance of the jaguar and demystify it where it is predominantly seen as a threat to human lives,

like in the Atlantic Forest and Caatinga. Considering that children have not yet completely internalized locally typical perceptions and values, environmental education should preferentially be directed towards this age class (Conforti & Azevedo 2003; present study). Their fear of the jaguar should be considered in such activities.

This study can be seen as a starting point to investigate how different local perceptions of the jaguar influence people's behavior and how this knowledge can complement political and ecological conservation efforts for the species in Brazil.

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Fig. 3. Cave painting from the Serra da Capivara National Park, Caatinga of Northeastern Brazil representing a jaguar attacking a human, dated back to approximately 5000 BC (Photo Jaguar Conservation Fund/Instituto Onça-Pintada).

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