

PEOPLE AND JAGUARS COEXISTENCE PROJECT: UNDERSTANDING AND INCREASING TOLERANCE TO BIG CATS IN BRAZIL

Silvio Marchini*

Forest Science Department, Luiz de Queiroz College of Agriculture, University of São Paulo, P.O. Box 09, Piracicaba, SP 13418-900, Brazil

The jaguar (*Panthera onca*) and the puma (*Puma concolor*) are the largest terrestrial predators in the Neotropics (male mean weight in kg: 104.5 and 58.9, respectively) (Macdonald et al., 2010) and some of the most widely distributed (Fig. 1) and charismatic species of conservation concern in Central and South America. Nonetheless, these big cats are not always welcome in rural areas and their presence can be intolerable to many people. The resulting persecution by humans is a major threat to jaguars and pumas in Brazil (ICMBio, 2011, 2013). It is widely assumed that intolerant behaviour toward large predators is motivated by retaliation for real and perceived losses of livelihood (Treves and Bruskotter, 2014). The People and Jaguars Coexistence Project, however, proposes a human dimensions perspective for effectively understanding and resolving conflicts between people and big cats in Brazil; an approach that goes beyond the traditional ecological and economic considerations about reciprocal negative impacts, by addressing also the complexity of the causal relationship between jaguar and puma damage and human thoughts and actions toward these animals, and the disagreements between people over wildlife values and management objectives.



Fig. 1. Distribution maps of jaguar and puma. Maps from Panthera - www.panthera.org

*Corresponding author: silvio.marchini@usp.br



Ecology and economics of the conflict

The study and mitigation of the problems involving jaguars and pumas has focused on the negative aspects of the interactions, within the framework of human-wildlife conflicts (HWC). More specifically, it has given attention to the patterns and predictors of damage caused by jaguars and pumas; the description of the damage to livestock; the monetary costs associated with such damage; the implications of the situation for the conservation of these big cats; and the prevention of damage and mitigation of monetary losses.

Livestock losses to jaguars are generally small when averaged over time and space. Average losses attributed to jaguars in Brazil range from 0.2-2.3% of livestock holdings over 12 months in the Cerrado (Palmeira et al., 2008), the Atlantic Forest (Conforti and Azevedo, 2003), southern Amazonia (Michalski et al., 2006), southern Pantanal (Azevedo and Murray, 2007; Cavalcanti and Gese, 2010), two ranches in northern Pantanal (Dalponte, 2002), and a larger portion of the northern Pantanal (Zimmermann et al., 2005). Large cattle ranches (>1,500 head of cattle) were found to endure the highest monetary costs, reaching US\$1,770.80 in a 2-year period (Michalsky et al., 2006). Sometimes, a major factor predisposing a particular herd to jaguar predation is poor husbandry (Azevedo and Murray, 2007; Michalski et al., 2006). While the risk of predation is greater among cattle left unattended close to forest cover (Azevedo and Murray, 2007), documented losses of cattle to jaguar predation are generally much fewer than those attributable to accident, snake bite, dis-

ease, parturition problems, flood (Azevedo and Murray, 2007) and even theft. In the Pantanal, for instance, Azevedo and Murray (2007) found that of 169 cattle mortality incidents, 19% were due to predation by jaguars. These authors recommend that cattle ranchers in the Pantanal region concentrate on losses due to nonpredation causes that could be more easily controlled. Furthermore, on some ranches, livestock depredation by puma may be more common than predation by jaguars, but it may

be difficult for ranchers to distinguish predation by jaguars and pumas.

As for pumas, even though they can cause great losses to livestock (e.g. maximum losses in southern Brazil were 78% for goats, 84% for sheep, and 16% for cattle; Mazzolli et al., 2002), their impact has received less attention from wildlife professionals than that of jaguars, as they prey mostly upon sheep and goats in smaller properties instead of cattle in large ranches, and as their significance has most likely been overshadowed by the exceptional prominence of their spotted cousins (Marchini, 2010). Nonetheless, pumas have recently been brought to the forefront, through exposure in the press due to the apparent increases in the frequency of their appearances in unsuspected places and of their collisions with vehicles. Once restricted mostly to remote natural or rural areas, these incidents have been happening in populated places. There is evidence of high behavioural plasticity of pumas in using highly anthropogenic habitats (Magioli et al., 2014), but population trends are unknown and the species is still listed as endangered.

Results from such studies have provided the basis for a number of recommendations of prevention measures (e.g. fencing, guard dogs) and husbandry practices that have the potential to decrease livestock losses caused by jaguars (Hoogesteijn and Hoogesteijn, 2005; Marchini and Luciano, 2009). Recommendations include night corrals, maternity pastures in areas closer to the ranch headquarters and provision of drinking water to prevent cattle from excursions to forest streams (Michalski

et al., 2006; Azevedo and Murray, 2007). While data on the effectiveness of these prevention measures are still scarce, Cavalcanti et al. (2012) recognize that inherent characteristics of the Pantanal (e.g. large ranches averaging 12 thousand hectares in size, where cattle are raised extensively) make it difficult to effectively control the access of predators to cattle, and as long as this is an issue, it is likely that predation will occur to a certain extent. The authors suggest that, along with curtailing losses due to rudimentary herd management and poor husbandry practices, ranchers should focus on increasing their production potential (e.g. maintaining native prey populations).

Regarding the economic incentives that have been proposed to encourage tolerance, compensation and sport hunting have shown little promise due to operational, financial, legal and cultural constraints. Jaguar-based tourism, on the other hand, has boomed in the last decade, with several tour operations in place in the Pantanal and central Amazon. In 2008, a fisherman was killed by a jaguar while sleeping in his tent on a riverbank of the Paraguay River near Taiamã Ecological Station (Neto et al., 2011), a major destination in the Northern Pantanal for jaguar sighting tours. This was the first officially documented, unprovoked, fatal attack of a jaguar on a human in Brazil. In 2010, in the same region of the Pantanal, a tourist was seriously injured when a jaguar jumped out of a ravine onto his boat, biting him on the head and right shoulder and tipping him into the water (Neto et al., 2011). These two incidents fuelled controversies involving tour operators that were accused of baiting and habituating jaguars to increase sightings. In response, the government of Mato Grosso enacted, in 2011, regulations for jaguar viewing tours in that state (e.g. attracting jaguars with food or sound is prohibited, boats must keep a safe distance from the jaguar, avoiding being in its presence for more than 20 minutes).

The human dimension of coexistence

Ecology and economics provide a wide array of tools and techniques for understanding and managing wildlife-caused damage and conservation issues. These disciplines have contributed significantly to the control of pests and the conservation of endangered species. However, in the interactions between humans and charismatic animals like jaguars and pumas, the cause-effect relationship between wildlife damage and negativity toward wildlife is seldom simple and consistent. Besides, people often disagree – based on values other than ecological and economic ones – about management goals in HWC: while some people favour the control of damage to the detriment of wildlife, others favour wildlife for its positive impacts (Marchini, 2014).

In HWC, persecution (i.e. persistent killing, chasing, or other harassment of a species) is not always a simple function of wildlife damage. There may be a discrepancy between actual and perceived damage. What ultimately drives human behaviour is not reality itself, but how reality is perceived. In conflicts with high-profile predatory animals such as big cats, the perceived damage and risk often exceed the actual evidence (Marchini and Macdonald, 2012; Treves and Bruskotter, 2014). A feedback loop between notoriety and sensationalism may be behind the distorted perceptions. For



instance, we found that jaguar attacks on people have a prominent place in story-telling in rural Brazil and the attack reports provided by respondents may have been inflated by the self-reinforcing process in which a collective belief gains more plausibility through its increasing repetition in public discourse (colloquially: “repeat something often enough and it will become fact”) (Marchini, 2010).

Furthermore, factors not directly related to the impacts that wildlife have on human livelihoods may also be involved in the persecution of jaguars and pumas. Large carnivores elicit strong negative emotions, particularly fear, with people who are fearful of carnivores usually being more antagonistic to them. Also, we found that social motivations are important determinants of the intention to kill jaguars in the Pantanal, where 25% of ranchers justified their approval of jaguar killing on the grounds of tradition (Marchini, 2010). These ranchers often refer, with apparent pride, to the “Pantaneiro culture” and the conviction that jaguar hunting has been passed from generation to generation as an element of that culture.

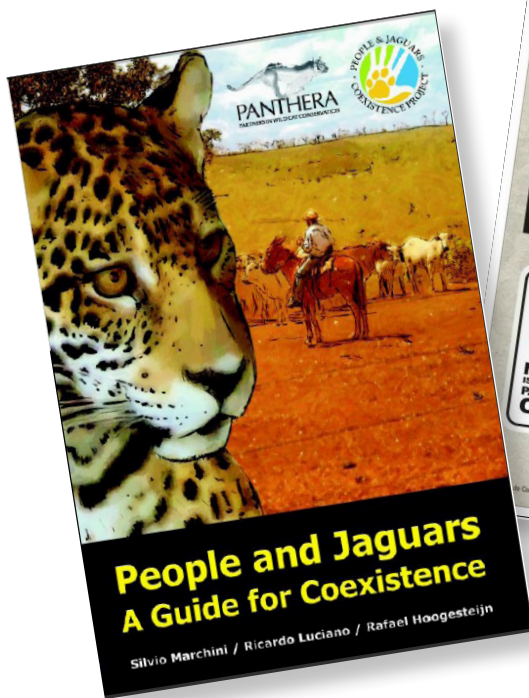
To make things worse, jaguars and pumas evoke strong, mixed opinions and feelings. Nobody opposes the extermination of mosquitos or gets offended by the non-consumptive use of birds in bird watching, but the management of iconic animals such as big cats divides opinions among broad sectors of society, which can result in social conflict. Damage alone can explain disagreements between groups of people when the impact of HWC is differentially distributed, with people more heavily affected expecting more stringent measures against wildlife than those who are not negatively affected. Social conflicts over wildlife, however, are often based on subjective factors. People can disagree over goals and management alternatives for affective, aesthetic, or ethical reasons, for example. Besides, charismatic wildlife often becomes a surrogate for deeply embedded cultural discords within and between social groups (Marchini, 2014). Ranchers and farmers are a minority group in Brazil, and their numbers are dwindling. As a result, they may associate wildlife conservation with urban values that are increasingly imposed on them and might view the continuation of wildlife killing as part of their resistance to this and their struggle to preserve their rural heritage (Marchini, 2010).

Hence, intolerance toward jaguars and pumas is not merely determined by any direct costs imposed, but is rather the product of a dynamic and complex web of individual (e.g. perception of risk and fear), societal (e.g., peer pressure and social conflict), and cultural (e.g. identity) factors (Dickman et al., 2013). The conventional approach to wildlife management and conservation, with its emphasis on animals and their habitats, is inadequate to deal with the psychological and social nature of our problems with these felids. A more promising approach is one that incorporates a “human dimensions” perspective. The emerging field of Human Dimensions of Wildlife addresses the system human-wildlife-habitat, instead of wildlife and habitat separately, with an emphasis on describing, understanding, predicting, and affecting human thought and action toward wildlife (Manfredo et al., 1996). As humans are the common thread in the highly variable realm of human-wildlife conflicts, and the course and resolution of conflict are determined by the thoughts and behaviours of the people involved, understanding the human dimensions is the most crucial prerequisite for developing effective mitigation (Manfredo and Dayer, 2004).

People and Jaguars Coexistence Project

Our project is hosted by the Laboratory of Wildlife Ecology, Management and Conservation (LEMaC) of the University of Sao Paulo, led by Prof. Katia Ferraz, and aims to understand and improve the relationship between people and wildlife in Brazil, with a focus on jaguars and pumas. A key feature of this pursuit is the articulation of a model of wildlife management that integrates human and biological dimensions in wildlife





management, conservation planning, and policy-making. We work to develop fundamental understandings of human behaviour associated with controversial wildlife and to apply concepts and empirical findings to real-world problems of conflict management.

More specifically, we have been doing: i) Research with focus on the individual level, to understand people's behaviour toward big cats and obtain clues about how to influence that behaviour for the benefit of jaguar and puma conservation, and research looking at the socio-cultural level, to understand how tolerance varies in space, the similarities and differences among human-big cats conflict situations in different regions of Brazil (including Amazonia and Pantanal) and evaluate whether interventions found successful in one context are likely to work in another; ii) Education and communication based upon the results from the above research and built upon 12 years of experience in education for conservation of the Escola da Amazônia Project¹, to increase tolerance to jaguars and pumas and decrease persecution; iii) Conservation conflict transformation, in collaboration with Prof. Alistair Bath (Memorial University in Newfoundland, Canada), by the engagement of interest groups such as farmers and parks authorities, gaining trust and building management plans through true consensus processes; iv) Incorporation of human dimensions into conservation

planning and public policy, more specifically through the collaborative work in the design of two National Action Plans, led by the Ministry of Environment – one for the jaguar and one for the puma; and v) Capacity building in human dimensions among wildlife professionals and graduate students.

Our results were also, besides the real economic loss, the subjectivity of feelings and perceptions may also be behind the killing of jaguars. Specifically among farmers on the frontier of deforestation of the Amazon, the fear of jaguars and the belief that killing them is a common practice among neighbours are main motivations for persecution (Cavalcanti et al., 2010; Marchini and Macdonald, 2012). It was with these farmers and their children that we conducted an experiment that evaluated the effectiveness of different approaches of education and communication – within and outside the classroom – to improve the feelings and perceptions of jaguars and consequently, discourage the behaviour of killing them (Marchini, 2010).

The experiment involved six rural schools and 150 students, averaging 12 years old. The students asked, with the support of an official letter from the school, that their parents review parts of the book used in the activities in the classroom and sign the homework. In addition, parents received information through “People and Jaguars: a Guide for Coexisting”² (Marchini and Luciano, 2009), an illustrated, colourful book, attractive and easy to understand even for those who

¹ More detail at <http://whitleyaward.org/winners/education-conservation-amazon-brazil/>

² Free download at <http://www.amazonium.com.br/docs/peopleandjaguarcomplete.pdf>



cannot read. Another group of adults, in the same rural community, received the book from the project researchers, identified as representatives of an environmental organization. The impact was greater among parents who received the book through the school, from the hands of their son or daughter: at the end of the experiment, they were less convinced that killing jaguars is as common or socially acceptable. This result suggests that parents' perceptions can be influenced not only by the information explicitly conveyed in the content of books and their children's homework, but also by the implicit message that a community institution (and therefore other community members) supports jaguar conservation more than they had realised. The use of role models, case studies, and examples of coexistence with jaguars, could conceivably enhance the power of school-based communication campaigns to create or redefine social norms concerning conservation-orientated behaviours.

Our project shows that conservation efforts considered as emanating from outside the social group can be poorly accepted. Conservation educators and communicators should therefore explore the benefit of the social domino effect and find ways to make their messages appear to originate from within the community; messages that arrive through other community mem-

bers (e.g. friends, neighbours and relatives) can be more easily accepted than those that appear to come from the top down, imposed by "outside" people or institutions. We have also shown that school-based education and communication interventions can have a powerful impact on students' perceptions of jaguars, and on those of their fathers; this process could be used to positive conservation effect. The finding that students can influence their fathers' perceptions of jaguars suggests that conservationists can use rural schools to reach at once tens of students in a classroom, or hundreds on the school's soccer pitch, who will in turn transfer the conservation message to their fathers. Given the logistical challenge of visiting landowners one-by-one at home in rural Amazonia, this strategy might be relatively cost-effective. The exceptionally strong prominence of the jaguar in people's hearts and minds, combined with the relatively high rate of primary school enrolment in Brazil (97.5%) and the willingness of public school directors and teachers to cooperate with conservationists, renders school-based intergenerational learning a particularly promising approach for big cat conservation.

References

- Azevedo FCC, Murray DL (2007) Evaluation of Potential Factors Predisposing Livestock to Predation by Jaguars. *Journal of Wildlife Management* 71, 2379–2386.
- Cavalcanti SMC, Gese EM (2010) Kill rates and predation patterns of jaguars (*Panthera onca*) preying on livestock and native prey in the southern Pantanal, Brazil. *Journal of Mammalogy* 91(3), 722–736.
- Cavalcanti SMC, Crawshaw Jr PG, Tortato FR (2012) Use of Electric Fencing and Associated Measures as Deterrents to Jaguar Predation on Cattle in the Pantanal of Brazil. In: Somers MJ, Hayward MW, editors. *Fencing for conservation – restriction of evolutionary potential or a riposte to threatening processes?* Springer, Berlin, Germany, pp. 295–308.
- Cavalcanti SM, Marchini S, Zimmermann A, Gese EM, Macdonald DW (2010) Jaguars, livestock and people: reality and perceptions behind the conflicts in Brazil. In: Macdonald DW, Loveridge A, editors. *The Biology and Conservation of Wild Felids*. Oxford University Press, Oxford, UK, pp. 383–402.
- Conforti VA, Azevedo FCC (2003) Local perceptions of Jaguars (*Panthera onca*) and pumas (*Puma concolor*) in the Iguacu National Park area, south Brazil. *Biological Conservation* 111, 215–221.
- Dalponete JC (2002) Dieta del jaguar y depredación de ganado en el norte del Pantanal, Brasil. In: Medellín RA et al., editors. *El jaguar en el nuevo milenio*. Ediciones Científicas Universitarias, Mexico City, Mexico, pp. 209–221.
- Dickman AJ, Marchini S, Manfredo M (2013) The importance of the human dimension in addressing conflict with large carnivores. In: Macdonald DW, Willis KJ, editors. *Key topics in conservation biology*, vol 2. Wiley-Blackwell, Oxford, pp. 110–126.
- Hoogesteijn R, Hoogesteijn A (2005) *Manual sobre problemas de depredación causados por grandes felinos en hatos ganaderos*. Wildlife Conservation Society, Campo Grande, Brazil, 48 p.
- Instituto Chico Mendes de Biodiversidade (2011) Plano de Ação Nacional para a Conservação da Onça-Parda. ICMBio, Brasília, Brazil. Available at <http://www.icmbio.gov.br/portal/images/stories/docs-plano-de-acao/pan-onca-parda/sumario-on%C3%A7aparda-icmbio-web.pdf>
- Instituto Chico Mendes de Biodiversidade (2013) Plano de Ação Nacional para a Conservação da Onça-Pintada. ICMBio, Brasília, Brazil. Available at <http://www.icmbio.gov.br/portal/images/stories/docs-plano-de-acao/pan-onca-pintada/livro-onca-pintada.pdf>
- Macdonald DW, Loveridge A, Nowell K (2010) *Dramatis personae: an introduction to the wild felids*. In: Macdonald DW, Loveridge A, editors. *The Biology and Conservation of Wild Felids*. Oxford University Press, Oxford, UK, pp. 3–58.
- Magioli M, Moreira MZ, Ferraz KMPMB, Miotto RA, Camargo PB, Rodrigues MG, Silva C, MC, Setz EF (2014), Stable isotope evidence of *Puma concolor* (Felidae) feeding patterns in agricultural landscapes in Southeastern Brazil. *Biotropica* 46, 451–460. doi: 10.1111/btp.12115
- Manfredo MJ, Dayer A (2004) Concepts for exploring the social aspects of human–wildlife conflict in a global context. *Human Dimensions of Wildlife* 9(4), 1–20.
- Manfredo MJ, Vaske JJ, Sikorowski L (1996) Human dimensions of wildlife management. In: Ewert AW, editor. *Natural resource management: the human dimension*. Westview Press, Boulder, USA, pp. 53–72.
- Marchini S (2010) Human dimensions of the conflicts between people and jaguars (*Panthera onca*) in Brazil. Department of Zoology, University of Oxford, Oxford.
- Marchini S (2014) Who's in conflict with whom? The human dimensions of the conflicts involving wildlife. In: Verdade LM, Lyra-Jorge MC, Piña CI, editors. *Applied ecology and human dimensions in biological conservation*. Springer, Berlin, pp. 189–210.
- Marchini S, Luciano R (2009) *People and jaguars: a guide for coexistence*. Panthera, New York, USA, 52 p.
- Marchini S, Macdonald DW (2012) Predicting ranchers' intention to kill jaguars: case studies in Amazonia and Pantanal. *Biological Conservation* 147, 213–221.
- Mazzolli M, Graipel ME, Dunstone N (2002) Mountain lion depredation in southern Brazil, *Biological Conservation* 105, 43–51.
- Michalski F, Boulhosa RLP, Faria A, Peres CA (2006) Human–wildlife conflicts in a fragmented Amazonian forest landscape: determinants of large felid depredation on livestock. *Animal Conservation* 9, 179–188.
- Neto MF, Neto DG, Haddad Jr V (2011). Attacks by Jaguars (*Panthera onca*) on humans in central Brazil: report of three cases, with observation of a death. *Wilderness Environ. Med.* 22, 130–135.
- Palmeira FBL, Crawshaw PG, Haddad CM, Ferraz KMPMB, Verdade LM (2008). Cattle depredation by puma (*Puma concolor*) and jaguar (*Panthera onca*) in central–western Brazil. *Biological Conservation* 141(1), 118–125. doi:10.1016/j.biocon.2007.09.015
- Treves A, Bruskotter J (2014) Tolerance for Predatory Wildlife. *Science* 344 (6183), 476–477. doi:10.1126/science.1252690
- Zimmermann A, Walpole MJ, Leader-Williamns N (2005) Cattle ranchers' attitudes to conflicts with jaguar *Panthera onca* in the Pantanal of Brazil. *Oryx* 39, 406–412.