SHORT COMMUNICATIONS
КРАТКИЕ СООБЩЕНИЯ

HUMAN-WILDLIFE CONFLICT IN THE SOUTHWESTERN AMAZON: POACHING AND ITS MOTIVATIONS

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The conflict between humans and wildlife in Brazil has both diversified and increased rapidly since 2005. These increases have been driven by the expansion of human economic activity and its associated infrastructure. The present article aims to describe and quantify the poaching of Brazilian wildlife and its link with livestock-keeping in the rural settlement project Joana D'Arc. Data were collected through semi-structured interviews of ranchers settled at the Joana D'Arc II and III, in Porto Velho municipality. The study revealed 20 instances of poaching and found that six species were poached. In 37.5% (n = 3) of the cases, poaching was performed with the help of dogs. In 25% (n = 2) of the cases, the settlement's owners offered their employees bonuses if they engaged in poaching. In 25% (n = 2) of the cases, people from outside the Joana D'Arc rural settlement were paid for poaching. In the remaining 12.5% (n = 1) of the cases the study found no details about the poaching event. The study found that the poachers were motivated to act preventing the predation of their livestock (n = 6, 30%), to reduce attacks on livestock (n = 5, 25%), owing to a personal aversion to wildlife (n = 4, 20%), the motivation of the poacher was not informed by the interviewed (n = 3, 15%), and to prevent attacks upon domestic animals and livestock in general (n = 2, 10%). However, this study showed that poaching was not entirely motivated by wildlife attacks. For instance, because it is difficult to confirm which predator is responsible for a given attack or is likely to attack in the future, people in these settlements are highly sensitive to the presence of wildlife – a condition that greatly increases the potential for the conflict between humans and wildlife. The study also found that wildlife hunting is common because predation can have a substantial economic impact on rural communities driven by agriculture. In short, the study found that the poaching of wild animals is not, in this context, directed to a single species of animal, and is a demonstrably multifaceted problem.

Key words: attack prevention, ethnozoology, hunting, interviews, predation, rural community

Introduction

In the last few years, conflicts between humans and wildlife in Brazil have rapidly intensified and increased. These conflicts have been driven by the expansion of human settlements and agricultural activity (Marchini & Crawshaw, 2015). Some of these conflicts are motivated by wildlife attacks and predation on livestock. Such attacks expose the activities of wild animals as matters of public concern within the community and thus render them more susceptible to human aggression. Such conflicts are usually resolved by the poaching of the wild animal implicated (Palmeira et al., 2007).

In other words, people living in rural settlements often poach the region's main predators not only out of their aversion to predators or some other fear or personal motivation. They do so in order to protect their means of subsistence and obtain meat and other hunting products (Cavalcanti et al., 2010; Marchini & Macdonald, 2012; Bashari et al., 2017; Guerisoli et al., 2017; Alves et al., 2018). Retaliatory attacks on wildlife can occur either before (Palmeira et al., 2007; Carvalho & Pezzuti, 2010) or after attacks on livestock (Azevedo, 2008). Among the groups most affected by poaching are representatives of the order Carnivora, especially felines (Palmeira et al., 2007; Palmeira & Barrella, 2007; Carvalho & Pezzuti, 2010; Cavalcanti et al., 2010; Ferreira et al., 2012; Torres et al., 2018).

In Brazil, human-wildlife conflicts have increased since 2005 (Marchini & Crawshaw, 2015). Since the beginning of the twentieth century, controlled hunting, subsistence hunting, and commercial hunting have all contributed to the steep decline in vulnerable animal populations, and most of these species have not been able to recover (Antunes et al., 2016). The recent expansion in almost fifteen years of the agricultural frontier in the Amazon has made this already concerning scenario even more critical (Marchini & Crawshaw, 2015). According

to Michalski et al. (2006), the rate of cattle depredation and human-wildlife conflicts has increased in locations far from urban centres and close to large forest blocks. As the agricultural frontier expands, there is an urgent need for better understanding of the causes of hunting and poaching and educate people living in these frontiers about the need to keep these vulnerable species alive.

In this context, ethnozoology has proven to be an important means of understanding human–wildlife conflicts (Torres et al., 2018). Instances of hunting or poaching cannot be properly measured via personal observation of researchers, and local residents become important sources of data (Schulz et al., 2014). The identification of key informants with experience recognised by the local population is of paramount importance, because such informants' knowledge is dynamically mutable insofar as it has the capacity to incorporate each new generation's experiences, understandings, and needs; thus, it can remain current and vital (Davis & Wagner, 2003).

By monitoring these conflicts, we can assess their causes and determine effective measures for the preservation of individual species through evidence-backed case studies, instead of proposing general measures for conflict resolution that often try to accommodate a diverse range of human motivations and thus are ineffective means of preservation (Azevedo, 2008). Case studies provide useful data for other professionals who face similar problems (Guerisoli et al., 2017). A growing body of evidence shows that the successful management of natural resources requires the mitigation and prevention of conflicts (Fisher et al., 2019). The adoption of participatory management reduces the damage caused by human-wildlife conflicts and enables the conservation of wildlife (Palmeira & Barrella, 2007; Carvalho & Morato, 2013). The present study aims to describe and quantify the poaching of wildlife by ranchers in the Joana D'Arc rural settlement project and describe the motivations that led them to poach.

Material and Methods

The Joana D'Arc rural settlement project was created and implemented by the federal government of Brazil in 2001. The settlement is located in Porto Velho municipality in the north-western corner of the state of Rondônia and in Canutama municipality in the south-eastern corner of the state of Amazonas. The settlement borders Mapinguari National Park to the north and Madeira River to the south and measures approximately 600 km^2. The settlement is divided into three sectors: Joana D'Arc I, II, and III (9.037518° S, 64.414454° W) (Fig.). The inhabitants of the settlement are small- and medium-scale agricultural producers, and their main income derives from the production of beef cattle. Since 2012, there has been a significant relocation of the local population because of flooding around the Santo Antônio hydroelectric plant.

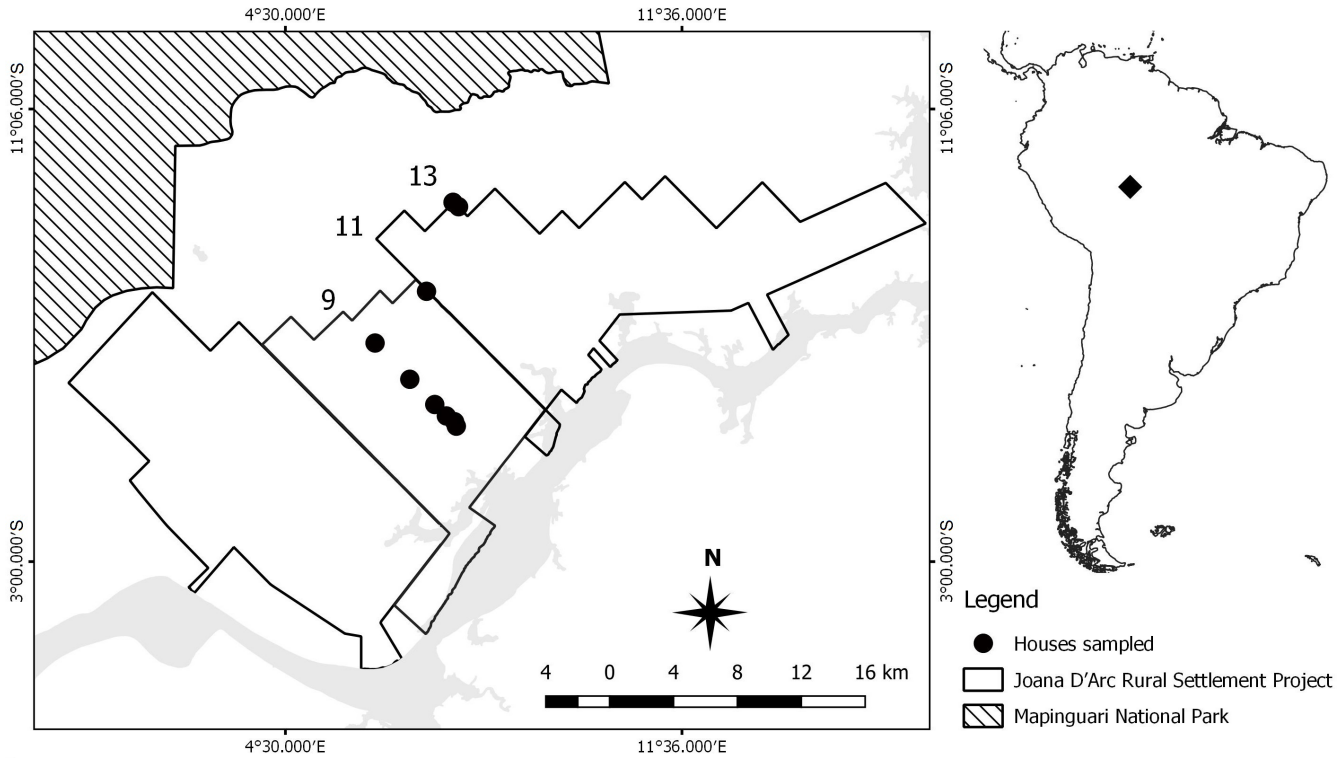

Fig. Localisation map and interview points at Joana D'Arc II and III, in the municipality of Porto Velho, Rondфnia, Brazil. Numbers indicate the plots examined.

Joana D'Arc II and III were sampled for this study. Plots 9 and 11 from Joana D'Arc II and plot 13 from Joana D'Arc III were examined. This study was approved by the Brazilian Research Ethics Committee (approval number 2.405.927).

The data were collected through semi-structured interviews (Albuquerque et al., 2010) based on the work of Palmeira & Barrella (2007). The distance between dwellings was at least one kilometre, and each interviewed family had a single plot in the settlement project. From August 2016 to October 2017, 23 interviews were carried out. Instances of hunting or poaching were recorded from December 2016 to October 2017. Of the 23 interviewees, 15 claimed to have resorted to poaching to resolve conflict with local wildlife.

Once a respondent claimed to have engaged in poaching, they were interviewed further in order to extract as much information as possible for this study. They were asked about the species killed, the date of the poaching, and their motivation for poaching. Motivations were grouped into four categories. The «attack prevention» category included the poaching of any species having the potential to attack domestic animals, even in the absence of proof of a recent attack or any previous record of attacking or violent behaviour. The «reduction» category was related to the poaching of potential predators in places with a history of conflicts. This category differs from the «attack prevention» category because poaching in this second category was motivated by records of wildlife attacks. The «natural aversion» category included poaching of species that residents feared or averred independently of the species' potential to attack livestock. Finally, the «predation of domestic animals» category included situations in which the wild animal was killed at the time of an attack of livestock or shortly thereafter, following a brief pursuit.

This study's analysis aims to determine the statistical differences in the records of poaching or hunting. Each animal that was reported as poached or hunted was depleted as a dependent variable and each recorded event as an independent variable. Regarding the motivations for poaching, each individual animal reported dead was withheld as a dependent variable, and the motivation related to each event as an independent variable. Each interview was determined as an independent sample, and the possibility of repetition of information was verified. All data were submitted to the Shapiro-Wilk normality test and the Bartlett test to test the equalities of variances, which showed that there is homogeneity between them (1.82 and 2.98). Therefore, the non-parametric Kruskal-Wallis test was adopted. PAST 3.5 was used for all statistical tests.

Results

This study recorded that six species of animal had been poached at the Joana D'Arc settlements in 20 total poachings. Felines represented 40% (n = 8) of these animal deaths. The common boa (*Boa constrictor* Linnaeus, 1758) had the most deaths by species, followed by the roadside hawk (*Rupornis magnirostris* (Gmelin, 1788)) (Table). In two cases, poachers ate the meat of the animal after poaching: the species involved in these poachings were a puma (*Puma concolor* (Linnaeus, 1771)) and a jaguar (*Panthera onca* (Linnaeus, 1758)). No statistically significant differences were found between the poaching of different species (H = 2.12, p = 0.29).

Table. Wildlife poaching, motivation, and number of poached individuals in Joana D'Arc II and III, Porto Velho, Rondônia

Species	Common name	Motivation	N
Boa constrictor	Jiboia	Predation of domestic animal	2
Boa constrictor	Jiboia	Natural aversion	4
Eira barbara	Tayara	Not informed	1
Leopardus pardalis	Ocelot	Predation of domestic animal	1
Panthera onca	Jaguar	Reducing attacks on domestic animal	3
Puma concolor	Puma	Reducing attacks on domestic animal	2
Puma concolor	Puma	Not informed	2
Rupornis magnirostris	Roadside hawk	Predation of domestic animal	3
Rupornis magnirostris	Roadside hawk	Prevent attacks	2

The study found that the poachers were motivated to act preventing the predation of their livestock (n = 6, 30%), reduce attacks on livestock (n = 5, 25%), because of their own natural aversion to wildlife (n = 4, 20%), the motivation of the poacher was not informed by the interviewed (n = 3, 15%), and to prevent attacks domestic animals and livestock in general (n = 2, 10%). In poaching falling under the «predation of domestic animals» category, the animals were poached during the attack. The remaining poaching occurred without the confirmation of a predation event and were caused by opportunistic encounters between humans and wildlife. In these cases, interviewees revealed that a lack of identifying information regarding which predator was responsible for a given attack on livestock increased the potential for violent conflict. In 37.5% (n = 3) of the cases, poaching was performed with the help of dogs. In 25% (n = 2) of cases, the settlement's owners offered their employees bonuses if they engaged in poaching. In 25% (n = 2) of cases, people from outside the Joana D'Arc rural settlement were paid to poach. In the remaining 12.5% (n = 1) of the cases, the study found no details about the poaching event. The statistical analysis showed that poaching was not directly motivated by attacks on livestock ($H = 0.802$, $p = 0.69$).

Discussion

The variety of motivations for wildlife poaching revealed by this study indicates that this is a multifaceted and complex conflict. Therefore, it is not possible to design a single effective strategy to protect vulnerable species at the Amazon's frontiers. However, strategies that consider all the motivations underlying wildlife poaching – including economic, psychological, and cultural motivations – are likely to be more effective (Cavalcanti et al., 2010; Marchini & Macdonald, 2012). The possibility of new attacks based on previous events was the most relevant factor influencing the poaching of wild felines. The absence of significant differences in poachers' motivations and the number of poaching cases per species may be related to this study's small sample size. However, a lack of differences between motivation and poaching may also represent real data: the literature shows that there is a historical concentration of studies involving conflicts between humans and carnivorous animals (Torres et al., 2018).

Regarding poaching methods, we highlight the use of dogs (*Canis lupus familiaris* Linnaeus, 1758). Hunting with dogs is a common practice in the Amazon, and dogs are used for feline hunting to increase the likelihood and efficiency of wild feline capture (Trinca & Ferrari, 2007; Carvalho & Pezzuti, 2010; Ferreira et al., 2012; Valsecchi, 2012). Dog hunting is a recognised problem: for instance, in environmentally protected areas, dog hunting has been banned to reduce conflicts (Carvalho & Pezzuti, 2010). We also highlight poaching profits as a motivation for poaching. These profits represent a considerable amount of extra income for settlement residents – especially those whose incomes are in jeopardy after attacks on their livestock. Thus, low agricultural incomes may lead to poaching, and higher wages for agricultural workers, improved working conditions, and education may help preserve the Brazilian wildlife.

Given that the predators responsible for attacks on livestock are often not identified, other possible causes of economic loss, such as animal disease or cattle theft, may potentiate these conflicts. In addition, although interviews were a useful method for recording and estimating data about infrequently hunted animals such as felines in this study, in general, data that lack confirmation of which species are responsible for attacks on livestock may generate inaccurate estimates of predator poaching (Valsecchi, 2012).

In rural areas, the primary source of residents' income is livestock breeding. Attacks on livestock by wild species can therefore result in serious economic harm (Palmeira & Barrella, 2007; Guerisoli et al., 2017). This study found that the number of felines poached and the motivations for poaching were similar to those found by Carvalho & Pezzuti (2010). However, these figures may be underreported by our interviewees owing to fear of reprisal. In most cases, poaching was motivated by third party reports about previous attacks in the area and was perceived as the only way to prevent future attacks.

The most studied conflict-makers are wild felines (Cavalcanti et al., 2010). However, our study showed wild felines represent only a small proportion of all poached predators. Given that poaching has been practised to prevent predation of livestock for centuries (Woodroffe et al., 2005), and has been documented in other Brazilian localities (Palmeira & Barrella, 2007; Trinca & Ferrari, 2007; Melo et al., 2015), we think, like Melo et al. (2015), that preventative poaching is deeply rooted in the local culture. People's natural aver-

sion to some animals combined with their fear of potential attacks was determining factors in this study. This confirms the result of other studies (e.g. Palmeira et al., 2007; Marchini & Macdonald, 2012). This behaviour may result in unnecessary poaching, putting the conservation of large predators at risk (Verdade & Campos, 2004).

Conclusions

To sum up, this study showed that the poaching of wild animals is not directed at a single species and stems from a variety of motivations. Poaching is not restricted to the loss of livestock and is a demonstrably multifaceted problem with no single solution.

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References

Albuquerque U.P., Lucena R.F.P., Alencar N.L. 2010. Métodos e técnicas para a coleta de dados etnobiológicos. In: U.P. Albuquerque, R.F.P. Lucena, L.V.F.C. Cunha (Eds.): *Métodos e Técnicas na Pesquisa Etnobiológica e Etnoecológica.* Recife: NUPEEA (Brazil). P. 39–64.

Alves R.R.N., Souto W.M.S., Fernandes-Ferreira H., Bezerra D.M.M., Barboza R.R.D., Vieira W.L.S. 2018. The Importance of Hunting in Human Societies. In: R.R.N. Alves, U.P. Alburquerque (Eds.): *Ethnozoology: animals in our Lives*. Cambridge: Academic Press. P. 95–118.

Antunes A.P., Fewster R.M., Venticinique E.M., Peres C.A., Levi T., Rohe F., Shepard G.H. 2016. Empty forest or empty rivers? A century of commercial hunting in Amazonia. *Science Advances* 2: e1600936. DOI: 10.1126/sciadv.1600936

Azevedo F.C.C. 2008. Food habits and livestock depredation of sympatric jaguars and pumas in the Iguaçu National Park area, south Brazil. *Biotropica* 40(4): 494–500. DOI: 10.1111/j.1744-7429.2008.00404.x

Bashari M., Sills E., Peterson M.N., Cubbage F. 2017. Hunting in Afghanistan: variation in motivations across species. *Oryx* 52(3): 526–536. DOI: 10.1017/S0030605316001174

Carvalho E.A.R., Morato R.G. 2013. Factors affecting big cat hunting in Brazilian protected areas. *Tropical Conservation Science* 6(2): 303–310. DOI: 10.1177/194008291300600210

Carvalho E.A.R., Pezzuti J.C.B. 2010. Hunting of jaguars and pumas in the Tapajós-Arapiuns Extractive Reserve, Brazilian Amazonia. *Oryx* 44(4): 610–612. DOI: 10.1017/S003060531000075X

Cavalcanti S.M.C., Marchini S., Zimmermann A., Gese E.M., Macdonald D.W. 2010. Jaguars, livestock, and people in Brazil: realities and perceptions behind the conflict. In: W. David, D.W. Macdonald, A. Loveridge (Eds.): *Biology and conservation of wild felids*. Oxford: Oxford University Press. P. 383–402.

Davis A., Wagner J.R. 2003. Who Knows? On the importance of identifying "experts" when researching Local Ecological Knowledge. *Human Ecology* 31(3): 463–489. DOI: 10.1023/A:1025075923297

Ferreira D.S.S., Campos C.E.C., Araújo A.S. 2012. Aspectos da atividade de caça no Assentamento Rural Nova Canaã, Município de Porto Grande, estado do Amapá. *Biota Amazônica* 2(1): 22–31. DOI: 10.18561/2179-5746/biotaamazonia.v2n1p22-31

Fisher J., Stutzman H., Vedoveto M., Delgado D., Rivero R., Dariquebe W.Q., Contreras L.S., Souto T., Harden A., Rhee S. 2019. Collaborative governance and conflict management: lessons learned and good practices from a case study in the Amazon Basin. *Society and Natural Resources* 2019: 1–16. DOI: 10.1080/08941920.2019.1620389

Guerisoli M.M., Luengos V.E., Franchini M., Caruso N., Casanave B.B., Lucherini M. 2017. Characterization of puma-livestock conflicts in rangelands of central Argentina. *Royal Society Open Science* 6(12): 170852. DOI: 10.1098/rsos.170852

Marchini S., Crawshaw P.G.Jr. 2015. Human-wildlife conflicts in Brazil: a fast-growing issue. *Human Dimensions of Wildlife* 24(4): 323–328. DOI: 10.1080/10871209.2015.1004145

Marchini S., Macdonald D.W. 2012. Predicting ranchers' intention to kill jaguars: Case studies in Amazonia and Pantanal. *Biological Conservation* 147(1): 213–221. DOI: 10.1016/j.biocon.2012.01.002

Melo E.R.A., Gadelha J.R., Silva M.N.D., Silva A.P., Pontes A.R.M. 2015. Diversity, abundance and the impact of hunting on large mammals in two contrasting forest sites in northern Amazon. *Wildlife Biology* 21(5): 234–245. DOI: 10.2981/wlb.00095

Michalski F., Boulhosa R.L.P., Faria A., Peres C.A. 2006. Human-wildlife conflicts in a fragmented Amazonian forest landscape: determinants of large felid depredation on livestock. *Animal Conservation* 9(2006): 179–188. DOI: 10.1111/j.1469-1795.2006.00025.x

Palmeira F.B.L., Crawshaw P.G., Haddad C.M., Maria K., Ferraz P.M.B., Verdade L.M. 2007. 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

Palmeira L.B.F., Barrella W. 2007. Conflitos causados predação de rebanhos domésticos por grandes felinos em comunidades quilombolas na Mata Atlântica. *Biota Neotropica* 7(1): 119–128. DOI: 10.1590/S1676-06032007000100017

Schulz F., Printes R.C., Oliveira L.R. 2014. Depredation of domestic herds by pumas based on farmer's information in Southern Brazil. *Journal of Ethnobiology and Ethnomedicine* 10(73): 1–11. DOI: 10.1186/1746-4269-10-73

Torres D.F, Oliveira E.S., Alves R.R.N. 2018. Understanding human–wildlife conflicts and their implications. In: R.R.N Alves, U.P. Alburquerque (Eds.): *Ethnozoology: animals in our Lives*. Cambridge: Academic Press. P. 421–445.

Trinca C.T., Ferrari S.F. 2007. Game populations and hunting pressure on a rural frontier in southern Brazilian Amazonia. *Biologia Geral e Experimental* 7(2): 5–16.

Valsecchi J. 2012. *Caça de animais silvestres nas Reservas de Desenvolvimento Sustentável Mamirauá e Amanã.* Belo Horizonte, Brazil: Universidade Federal de Minas Gerais. 142 p.

Verdade L.M., Campos C.B. 2004. How much is a puma worth? Economic compensation as an alternative for the conflict between wildlife conservation and livestock production in Brazil. *Biota Neotropica* 4(2): 2–5. DOI: 10.1590/S1676-06032004000200014

Woodroffe R., Thirgood S., Rabinowitz A. 2005. The impact of human-wildlife conflict on natural systems. In: R. Woodroffe, S. Thrigood, A. Rabinowitz (Eds.): *People and Wildlife: Conflict or Coexistence?* Cambridge: Academic Press. P. 1–12.

КОНФЛИКТ ЧЕЛОВЕКА И ДИКОЙ ПРИРОДЫ НА ЮГО-ЗАПАДЕ АМАЗОНИИ: БРАКОНЬЕРСТВО И ЕГО МОТИВЫ

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С 2005 г. конфликты между людьми и дикой природой в Бразилии быстро распространились и участились. Это было вызвано расширением экономической активности человека и связанной с ней инфраструктуры. Целью настоящей статьи является описание и количественная оценка браконьерства в дикой природе Бразилии и его связи с животноводством в проекте по созданию сельского поселения Жанны д'Арк. Данные были собраны с помощью полуструктурированных интервью с владельцами ранчо, поселившимися в поселениях Жанны д'Арк II и III, в муниципалитете Порту-Велью. Исследование выявило 20 случаев браконьерства и показало, что оно коснулось шести видов животных. В 37.5% (n = 3) случаев браконьерство было проведено с помощью собак. В 25% (n = 2) случаев владельцы поселка предлагали своим работникам вознаграждение, если они занимались браконьерством. В 25% (n=2) случаев людям из-за пределов сельского поселения Жанны д'Арк платили за браконьерство. В оставшихся 12.5% (n = 1) случаев исследование не выявило деталей о случае браконьерства. Исследование показало, что браконьеры были мотивированы действовать по следующим причинам: 1) чтобы предотвратить хищничество их домашнего скота (n = 6, 30%); 2) чтобы уменьшить нападения на домашний скот (n = 5, 25%); 3) из-за личного отвращения к дикой природе (n = 4, 20%); 4) мотивация браконьера не была выявлена в результате опроса (n = 3, 15%); 5) для предотвращения нападений на домашних животных и скот в целом (n = 2, 10%). Тем не менее, это исследование показало, что браконьерство не было полностью мотивировано нападениями диких животных. Например, поскольку трудно определить, какой хищник несет ответственность за данное нападение или возможность напасть в будущем, люди в этих поселениях очень восприимчивы к присутствию живой природы – условию, которое значительно увеличивает вероятность конфликта между людьми и дикой природы. Исследование также показало, что охота на диких животных является распространенным явлением, поскольку хищничество может оказать существенное экономическое влияние на сельские общины, управляемые сельским хозяйством. Вкратце, исследование показало, что браконьерство диких животных в этом контексте не направлено на один определенный вид животных и является явно многогранной проблемой.

Ключевые слова: интервью, предотвращение нападения, сельская община, хищничество, этнозоология, охота