REVISTA BRASILEIRA DE CIÊNCIAS DA AMAZÔNIA

Article

RBCA 9 (3): 4–15 Ago. 2020
ISSN 2317-5729 (online edition)
Edição Especial: Biodiversidade e Conservação da Amazônia Sul-Ocidental

Hunting in a community of waste pickers of recyclable materials in Rondônia, Brazil

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Abstract

Hunting is an activity linked to the evolution of humans as a species. Hunting is the main source of protein for the Amazonian caboclo that guarantees the survival and subsistence of their population. Although there are several studies focusing on hunting in the Amazon, little is known about hunting in peri-urban regions. This work aimed to analyze the profile of hunters from the community of Vila Princesa, Porto Velho, Rondônia, which is located at km 10 of the BR-364 highway towards Rio Branco (AC). Data were collected by interviewing fourteen hunters through semi-structured questionnaires. Hunting was found to be a predominantly masculine activity, carried out for subsistence and taste, as well as for sport and trade. 19 game species were recorded, including mammals, birds and reptiles, with mammals being the most exploited group. The species of highest preference were *Cuniculus paca*, *Tayassu pecari* and *Mazama americana*, because of their palatability. In this study, it was also observed that animal by-products were used for medicinal purposes. The interviewees highlighted five hunting strategies: waiting game in fruit tree, waiting with barley, persistence hunting with canoe, persistence hunting with dog, and persistence hunting on foot; waiting game in fruit tree was the strategy with the highest number of records among the hunters of the community.

Keywords: Human ecology, Amazon, Tropical forest, Subsistence hunting, Hunting strategy.

Resumo

A caça é uma atividade ligada à evolução do humano como espécie, sendo a caça a principal fonte de proteínas para o caboclo amazônico que garante a sobrevivência e subsistência dessas populações. Embora existem diversos estudos enfocando a caça na Amazônia pouco se sabe sobre a caça em regiões periurbanas. O presente trabalho buscou avaliar o perfil dos caçadores da comunidade de Vila Princesa, zona rural de Porto Velho, Rondônia, que está localizada no km 10 da rodovia BR-364 sentido Rio Branco (AC). Os dados foram coletados através de questionários semi-estruturados. Foram entrevistados 14 pessoas do sexo masculino. A atividade de caça revelou-se predominantemente masculina, a maior parte da atividade de caça foi para subsistência sendo também registradas gosto, esporte e comércio. Foram registradas 19 espécies cinegéticas, entre mamíferos, aves e répteis, os mamíferos representam o grupo mais explorado pelos caçadores, sendo as espécies de maior preferência a *Cuniculus paca*, *Tayassu pecari* e o *Mazama americana*. A preferência por essas espécies está relacionada com a palatabilidade. O aproveitamento da caça também foi observado neste trabalho como a utilização dos subprodutos para fins medicinais. Os entrevistados destacaram cinco estratégias de caça sendo elas: espera em fruteira, espera com ceva, varrida com canoa, varrida com cão e varrida a pé, onde a espera em fruteira foi a estratégia com maior número de registros entre os caçadores da comunidade.

Palavras-chave: Ecologia humana, Amazônia, Floresta tropical, Caça de subsistência, Estratégias de caça.

Submetido em: 11 Jan.. 2020; aceito por P.V. Cruz em: 11 Abr. 2020.

Introduction

The exploitation of terrestrial and aquatic fauna has always been fundamental for the survival and subsistence of communities and is practiced in all tropical forests where hunters can use the great diversity of existing species (Valsecchi & Amaral, 2009). Historically, hunting was present in rural areas in various parts of the world, and it provides an important source of protein for the subsistence of local residents to this day (Alves *et al*., 2018). Hunting is an activity linked to the evolution of humans as a species, and for thousands of years humans have lived as hunters, fishermen, farmers, that is, extractors of natural resources (Ranzi *et al.*, 2018).

In the neotropical region hunting is the main source of protein for rural and isolated populations. For Amazonian caboclo, the extractivism of wildlife makes fauna an important resource of the forest, generating regular income (Ribeiro *et al.*, 2007) which guarantees the survival and subsistence of their populations (Pezzuti & Chaves, 2009).

Several reasons influence the preference and consumption of game meat, for example, economic factors (Morsello *et al*., 2015), ethnic and cultural identity, practices of traditional medicine (Alves *et al.*, 2010), meat flavor, and hunting techniques (Silva Neto *et al.*, 2017). However, hunting is an activity that affects fauna, even when it is carried out at a small scale (Machado *et al*., 2013).

The main communities that practice hunting in the Amazon rainforest are: indigenous (Pereira & Schiavetti, 2010), riverside (Lopes *et al.*, 2012), extractives (Figueiredo & Barros, 2016) and settlers (Trinca & Ferrari, 2007). Each of these groups affects wildlife differently due to peculiarities in hunting techniques, hunted species, taboos, the purpose of hunting and the amount of hunting extracted (Trinca & Ferrari, 2007).

Hunting is an activity often related to low-income communities that use it as a source of food (Alves *et al*., 2012). Among the low-income populations that occur in Brazil, there are waste pickers of recyclable materials. The labor carried out by these workers consists of finding material in dumping ground and residential trash, transporting, separating, and conditioning that has market value and can be sold for reuse or recycling (Cavalcante & Franco, 1996; Ferreira & Cunha, 2019). They could be organized or not in cooperatives or associations (Ferreira & Cunha, 2019).

Although there are several studies focusing on hunting in the Amazon region (Fernandes-Ferreira & Alves, 2017), there are no investigations of hunting in regions near urban areas. As indicated above, this study aimed to evaluate the hunting profile of waste pickers of recyclable materials in the community of Vila Princesa in Porto Velho, Rondônia.

Material & Methods

The community of Vila Princesa is located at km 10 of the BR-364 highway towards Rio Branco – AC (8° 50.940'S - 63° 56.422'W). Approximately 400 families live in the locality living off the collection and recycling of solid waste collected in the dump that is located next to the community (Ferreira & Cunha, 2019). In addition to the collection, the community members have small shops (e.g. markets, ice cream parlors, and bars) and also passers-by who buy recycled material from waste pickers and resell to cooperatives.

Some residents report that the first people settled in Vila Princesa in the 1980s. These residents after the cycle of rubber and gold mining in the region were forced to explore the garbage dump in Porto Velho in search of recyclable materials, and then built the first shacks. Currently, in addition to shacks, the community has a few masonry buildings, three main streets, and some small alleys

between the buildings; however, there is no basic sanitation system, treated water, and asphalt paved streets (Figure 1).

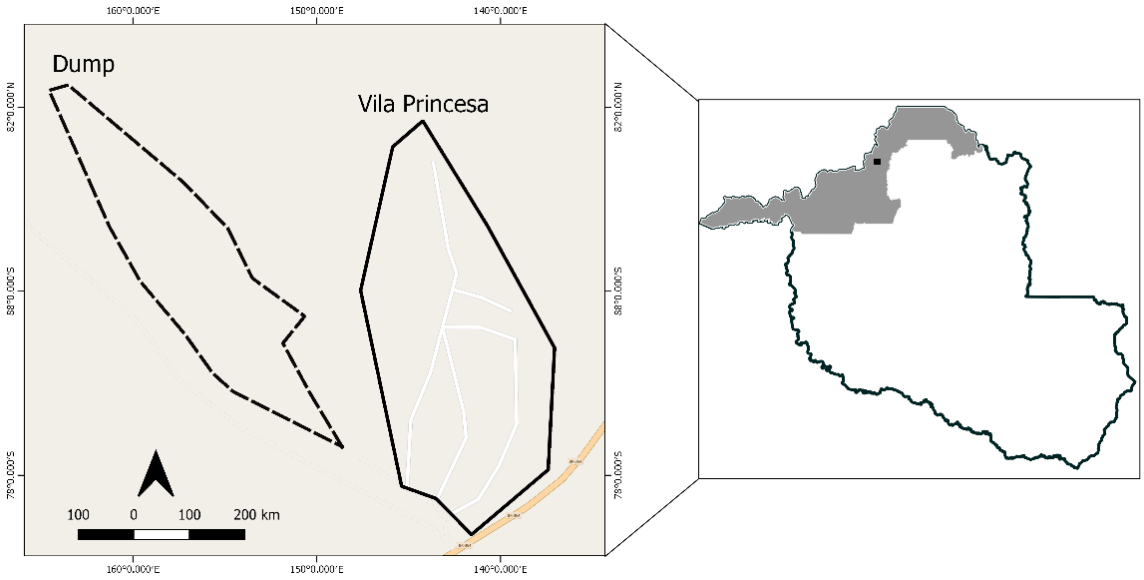

Figure 1 - Area of study, the community of Vila Princesa, Porto Velho, Rondônia.

The study was conducted between March and June 2019, by interviewing 14 hunters. In this study, the method of interviews with semi-structured questionnaires was used, as proposed by Albuquerque *et al.* (2010). The questionnaire was divided into two stages, the first with questions about the interviewee's profile and the second composed of questions about the hunting profile (Table 1).

Table 1 - Interview steps and variables used to survey the hunting profile.

Interview steps	**Variables**
Interviewee profile	Age Place of birth Education Origin Source of income Rural property
Hunting profile	Motivation Frequency Strategies Species Preference Local Taboo Zootherapics

This work was submitted to the Research Ethics Committee, which was approved under the number of opinions 2 661 332. All workers interviewed agreed to the research objectives and speak to the researcher in the condition of anonymity according to the requirements of the Ministry of Health norms (CNS 466/2012). Hunters who were residents of the community and who were over 18 years

old were included in the research. The selection of informants was performed using the "Snowball" method (Davis & Wagner, 2003).

Descriptive statistical analysis (mean and standard deviation) was used to characterize the socioeconomic profile, dynamics of the hunt, taboos, and zootherapics. For the definition of target hunting species and locally extinct, the ordering technique was used. To verify that there was a difference in the number of citations between mammals, birds, and hunted reptiles, the Kruskal-Wallis nonparametric test was used and the verification of difference within the groups was performed the Dunn test.

The food preference data were counted and presented in a matrix, where a value was assigned to each species, in the form of an inverted ranking (where the last item of each list received the value equal to 1, the penultimate equal to 2 and so on, until the first item in each list). The values obtained for each species were added, and the sum was divided by the total number of interviewees. Based on the mean obtained, the values were ordered by importance (Albuquerque *et al*., 2010). For all tests, the significance level of 5% was adopted and the analyses were performed in the PAST 3.25 program.

Results

The socioeconomic profile of the hunters of the community of Vila Princesa demonstrated that the interviewees were predominantly from the North region, the state of Rondônia (n=7), followed by Amazonas (n=4) and only one from each of the states of Acre, Pernambuco, and Pará. The age of the interviewed hunters ranged from 18 to 68 years (39 ± 18 years).

Hunting is predominantly masculine, with a starting age of 15 ± 9 years. Most hunters were introduced to the activity by the parents (n=6) and uncles (n=3), while grandfather, stepfather, and friends each represented only one citation. Only one hunter was introduced to hunting by both the father and uncle, and three claimed that they learned individually. Eleven hunters claimed to live in rural areas for an average of 11±9 years; and six claimed to own rural property. The predominant level of education was incomplete elementary school (71.4%, n =10), followed by illiterate (14.2%, n=2), completed elementary school (7.1%, n=1) and incomplete high school (7.1%, n=1). The main source of income of the interviewees was the collection of recyclable materials (64.2%, n=9), followed by retirement pension (21.4%, n=3), daily rate (7.1%, n=1) and trader (7.1%, n=1). The average monthly income was US$ 235.69±185.39.

The main motivation for hunting was for food complementation (n = 9), followed by the taste of meat (n=7), sport (n=3) and for trading of game meat (n=2). In total six hunters cited more than one motivation for hunting: one for taste and trade, one for complementation and taste, two for sport and taste, one for sport and complementation, and one for complementation and trade.

A total of 19 game species (14 mammals, four birds, and one reptile) were recorded. The comparison between the most hunted classes showed that mammals obtained the highest number of citations, 59 out of 65, differing from the other animal classes (birds and reptiles) that were not different from each other ($H= 22.67$, $p > 0.05$). The species with the highest number of citations recorded was paca (Table 2).

Paca meat had the highest preference (n=6), followed by the white-lipped peccary (n=5), red brocket deer (n=4), tapir (n=2), tinamou (n=2), razor-billed curassow (n=2), primates (n=1) and collared peccary (n=1). Four interviewees preferred more than one kind of meat. In all cases, the justification for meat type preference was related to palatability. The average hunting frequency was 9.37±8 times per month.

The interviewees presented five hunting strategies, and waiting game in the fruit tree (n=9), persistence hunting on foot (n=6), persistence hunting canoe (n=2), persistence hunting with the dog (n=2) and waiting game with barley (n=1). Six respondents reported using more than one strategy and nine presented the waiting as a favorite strategy, five of the interviewees did not report any preference in the hunting strategy. Twelve of the interviewees preferred hunting by waiting in fruit tree, which is a common method to catch *C. paca, T. terrestris, T. pecari, M. americana* and *M. nemorivaga.*.

It was reported that persistence hunting in usually performed in small groups of two to four hunters and is carried out most often in the late afternoon or early evening. The hunters also presented two forms of meat preservation: eight used freezing, nine salted the meat, and three interviewees claim to use both forms of preservation.

Table 2 - Hunted species that occur in the Vila Princesa, Porto Velho, Rondônia; (n) number of citations; (r) Reversed ranking.

Class/Order	**Scientific Name**	**Vernacular name**	**n**	**r**
Aves Tinamiformes	Tinamidae Gray	**Tinamou**	2	6
Galliformes	*Pauxi tuberosa* (Spix)	**Razor-billed Curassow**	1	7
Piciformes	*Ramphastos* spp. Linnaeus	**Toucan**	1	7
Psitaciformes	*Ara* spp. (Linnaeus)	Macaw	1	7
Mammalia Cingulata	*Dasypus novemcinctus* Linnaeus	Nine-banded Armadillo	5	3
	Dasypus beniensis Lönnberg	Greater Long-nosed Armadillo	5	3
	Cabassous unicinctus (Linnaeus)	Southern Naked-tailed Armadillo	1	7
Perissodactyla	*Tapirus terrestris* (Linnaeus)	Tapir	4	4
Cetartiodactyla	*Tayassu pecari* (Link)	White-lipped Peccary	9	2
	Pecari tajacu (Linnaeus)	Collared Peccary	4	4
	Mazama americana (Erxleben)	Red Brocket Deer	4	4
	Mazama nemorivaga Cuvier	Amazonian brown brocket deer	2	6
Carnivora	*Puma concolor* (Linnaeus)	Puma	2	6
	Panthera onca (Linnaeus)	Jaguar	1	7
Primates	-	Primates	1	7

Rodentia	*Dasyprocta* spp Illiger	Agouti	3	5
	Cuniculus paca (Linnaeus)	Paca	12	1
	Hydrochoerus hydrochaeris (Linnaeus)	Capybara	2	6
Reptilia Alligatoridae	*Melanosuchus niger* (Spix) or *Caiman crocodilus* (Linnaeus)	Caiman	1	7

The presence of food taboos was cited by nine hunters. *Priodontes maximus* was the species with the highest number of citations (n=5), and the taboo was related to its generalist diet and associated with the consumption of carrion. The Primates class was the second most cited taboo (n=4) due to its similarity with humans. The group of sloths obtained a single citation, being related to meat palatability.

The use of wildlife for medicinal purposes was recorded for eight species, and four of these species were not consumed as food. A total of 18 citations of the use of zootherapics were recorded (Table 3).

Table 3 - Wild animals used to treat diseases by respondents from the Vila Princesa community, Porto Velho, Rondônia; (n) number of citations.

Species	**Part used**	**Form of preparation**	**Disease**	**N**
Paca	Gall	Dried and added to drink or injury	Malaria	3
			Injuries	1
			Asthma	1
			Liver disease	1
Anaconda	Fat	Melted and stored	Asthma	1
			Pain	1
			Injuries	1
Tapir	Mane	Unknown form of preparation	Psychological disorders	1
	Fat	Melted and stored	Bronchitis	1
Capibara	Fat	Melted and stored	Bronchitis	1
	Bones	Roasted and crushed	Rheumatism	1
Boa	Fat	Melted and stored	Pain	1
			Injuries	1
Caiman	Dermal plate	Roasted and crushed	Verminosis	1
Common Opossum	Gall	Melted and stored	Asthma	1
American Black Vulture	Gall	Dried and added to drink	Cancer	1

Discussion

This study presents an important contribution to the understanding of peri-urban practice of hunting in community of waste pickers of recycled materials. Consistent with existing literature, hunting is predominantly a male activity in which men socialize and obtain food resources from wildlife (Terra & Rebêlo, 2005). Figueiredo and Barros (2016) point out that although hunting is a male activity, their participation in hunting may be limited by: i) physical conditions; ii) forms of access and belonging to a given territory; iii) knowledge of animal habits and behaviors, and iv) hunting strategies.

According to Valsecchi and Amaral (2009) the hunters start hunting before the age of 15, usually accompany their parents. This study presents the same pattern, reinforcing hunting as a practice linked to the male domain and as a tool for strengthening family bonds. It was observed that in low education and low income groups, hunting is an alternative option to increase their income.

Most respondents originated from the North region, although a study by Cajaiba *et al.* (2015) observed that most hunters in the state of Pará originated from other states, and migrated north in search of productive land. This difference may be associated with the time of migratory processes in the regions studied in the states of Rondônia and Pará, and Rondônia received migrants in previous periods.

The income source profile in this community differs from the rest of Amazon's hunter communities because it is a peri-urban community founded from the installation of the dump. On the other hand, hunters from traditional Amazonian communities earn from agriculture and extractivism (Ramos *et al.*, 2008; Ferreira *et al.,* 2012). The motivation of hunting is related to food complementation and acquisition of animal protein, similarly observed by Pezzuti and Chaves (2009).

Waiting game in fruit tree was the most preferred technique among the hunters of Vila Princesa. The game waiting is extremely selective and sustainable hunting, which consists of choosing a place in which the hunter waits for game, preferably in the nighttime (Alves *et al*., 2018). The hunter waits for the animal mainly in the feeding areas, mowing, trees with fruits or river ravines, where they seek mineral salts (Oliveira & Calouro, 2019). The relations of hunting strategy and game species presented by Ferreira *et al.* (2012), demonstrate that hunting strategy based on the ecology of game species is widely used in the Amazon.

One of the most contradicting strategies in relation to sustainability is the persistence hunting of dogs, although this is a common practice in the Amazon (Pezzuti *et al*., 2004), it was less reported in this study. Dogs are mainly used for the hunting of gregarious and semi-fossorial species (Fragoso, 1998, Reis *et al.,* 2006). Persistence hunting of dogs, is a hunting strategy that results in the non-selective slaughter of species, as reported by Lemos *et al.* (2018) in the Serra do Divisor National Park, Acre. The presence of these dogs is very serious given the possibility of declining natural populations of various animals, as well as being a gateway to many contagious diseases for wild species (Vilela & Guedes, 2017). On the other hand, a study evaluating the impact of hunting dogs on indigenous lands in the southwestern Brazilian Amazon concluded that, in terms of conservation, there is no reason to ban hunting with dogs (Constantino, 2018).

The variety of cinegetetic species intended for consumption offers a certain diversity of choices and, consequently, preferences (Figueiredo & Barros, 2016). In this study, the most preferred species were mammals, the same pattern observed in the Amazon. Generally, hunters capture more species of mammals, followed by birds and finally reptiles (Redford & Robinson, 1987; Valsecchi & Amaral,

2009; Lemos *et al.*, 2018). The preference of game species, as declared, is related to palatability and not with the size, as pointed out by Guimarães *et al.* (2019).

The preference of a specific game meat could possibly lead to over-exploitation. For example, hunting contributed to the increased risks of local extinction of species and decreased their populations, even in vast areas of continuous forest (Ferreira *et al.*, 2012). The species with higher longevity and low reproduction rates are more vulnerable and at a higher risk of extinction. These vulnerable species are usually the ones with the largest size (Chiarello, 2000), and the super-exploitation of medium and large mammals can pronounce biological and mechanical effects on the structure and dynamics of tropical forests, produced by the scarcity or extinction of these animals (Roldán & Simonetti, 2001). According to Benítez-López *et al.* (2017), hunting areas have a greater reduction in the abundance of mammals (83%) than birds (58%), probably due to the preference of hunters for larger animals, which are more sensitive to the effects of hunting (Nunes *et al.*, 2018).

The use of zootherapeutics related to by-products of hunting is widely disseminated in the tropics (Alves & Policarpo, 2018), with fat being the most used raw material for the treatment of various diseases (Ribeiro *et al*., 2007). According to Silva (2008), large mammals have a wide variety of medicinal properties: riverside communities use tapir and capybara fat for the treatment of respiratory diseases (e.g. asthma, influenza, pneumonia) and injuries. This pattern of use was also observed in this study, but we suggest that some species were slaughtered exclusively for their therapeutic properties.

The highest number of citations of zootherapeutic use of paca observed in the present study is observed in other locations in the Amazon. This pattern can be explained due to paca being the most hunted species in the region, due to the taste of its meat and, secondarily, to the medicinal purposes attributed to its by-products, such as fat and bile (Pereira & Schiavetti, 2010). According to Ferreira *et al.* (2016) in the Brazilian North and Northeast, about 86% of the animals used as zootherapeutics originate from the wild. Kahn (2006) points out that the use of animals for disease treatment can be a pathway to the transmission of diseases from animals to humans. Moreover, the use of zootherapeutic drugs is closely linked with low-income populations (Rodrigues & Dantas, 2018), as recorded in this study. Comparatively, an ethnobotanical study carried out in the same location by Silva *et al*. (2011) showed the medicinal use of 47 species in order to treat a large variety of diseases. The use of plants for the treatment of diseases related to the respiratory system had a higher number of citations, which is similar to that found for zootherapeutic uses.

The presence of food taboos and cultural practices contribute to the conservation of fauna since they limit hunting of certain species (Pezzuti *et al*., 2004; Gomes, 2017). Consequently, this could positively affect the population size of these animal species (Iwamura *et al*., 2016), and also lead to hunting restrictions. Although the primate similarity with humans is a taboo (Figueiredo & Barros, 2016) reducing the hunting pressure on the group, the group is largely consumed by people in the Amazon region, both indigenous as riverines and rubber tapcaps (Peres, 2000).

Conclusion

This study traced the profile of hunting strategies and hunters living in the community. In the peri-urban community of Vila Princesa, the target species of hunting, food preference, dynamics of hunting, taboos and the use of zootherapics presented similar patterns to those already reported in the literature for the Amazon. We highlight the need to deepen studies regarding some aspects of hunting as local livelihoods, such as: i) the hunting pattern based on the analysis of the territory used and the

slaughter rate; ii) the aspects related to the zootherapics, expanding the application of the interviews to the rest of the community; iii) the food consumption of game meat-based on food frequency questionnaires and other similar methodologies applied to the whole community; iv) understanding of the operation of the game meat trade and its by-products and v) analysis of the potential for disease transmission related to the game products and by-products.

Acknowledgements

We would like to thank the residents of the Vila Princesa. We also thank the anonymous reviewer for the valuable corrections and suggestions made to our manuscript.

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