Research Article

The role of mammals in local communities living in conservation areas in the Northeast of Brazil: an ethnozoological approach

Robson Soares de Melo[1], Olga Camila da Silva[1], Antonio Souto[2], Rômulo Romeu Nóbrega Alves[3], Nicola Schiel[1*]

[1]Departamento de Biologia, Universidade Federal Rural de Pernambuco, Rua Dom Manoel de Medeiros s/n, CP52171-900, Recife, Brasil. Email: robson-melo@hotmail.com; [2]Departamento de Zoologia, Universidade Federal de Pernambuco, Avenida Professor Moraes Rego 1235, CP50670-901, Recife, Brasil. Email: asouto.labet@gmail.com; [3]Departamento de Biologia, Universidade Estadual da Paraíba, Avenida das Baraúnas 351, CP58109-753, Campina Grande, Brasil. Email: romulo_nobrega@yahoo.com.br; *Present Address of Corresponding author: [1]Departamento de Biologia, Universidade Federal Rural de Pernambuco, Rua Dom Manoel de Medeiros s/n, CP52171-900, Recife, Brasil. Email: nschiel@yahoo.com

Abstract

Humans have used animals and their products since the beginning of their shared history. Animals are used for different purposes, including food, medicines and magical-religious practices. This study analyzes two communities that reside in a conservation area to determine the role of mammals by these communities, considering the influences of factors such as gender and age on the knowledge and use of the mammals by individuals. Data were obtained through semi-structured interviews in the two communities in the Chapada do Araripe Environmental Protection Area (APA/Araripe) in Brazil. All of the inhabited houses in the communities were visited, and at most, two people were interviewed per household. A total of 229 interviews were conducted with local residents. A total of 32 species of mammals was recorded, with 8 used for medicinal purposes, 17 species used as food resources, and 23 species related to superstition. Men knew and used more mammals as zootherapeutics and as a food resource than women, whereas for superstition, there was no significant difference between the genders. Regarding age, adults knew and used more mammals as zootherapeutics, and the elderly used more mammals as a food resource. This study demonstrates that the use of wild mammals still occurs in rural communities in Brazil, even in conservation units where the federal laws are stricter.

Keywords: Ethnozoology, Mammals, Conservation area, Brazil

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Introduction

The use of animals by humans for food [1-2], garments and tools manufacturing [3-4], production of medicines [5-6], and magical-religious practices [4, 7-8] dates to the early history of humanity [3, 9-10]. Such uses have caused impacts that often threaten the exploited species [11-12]. Some studies show that use of the surrounding fauna resources occurs mainly among populations within disadvantaged socioeconomic conditions [2-3, 13-15]. Such a situation exists in a large majority of populations occupying the semi-arid regions of northeastern Brazil [12, 16]. The extreme needs experienced by these communities often lead to hunting of wild fauna for food purposes [2-3, 17]. Many byproducts of these animals are used in the production of zootherapeutic medications and are sometimes used for magical-religious purposes [4, 6, 8, 18-20]. In these communities, mammals and birds are the preferred groups of animals selected by hunters for food [2].

In Brazil, subsistence hunting was legalized in 1998 by the Environmental Criminal Law (Law 9.605/1998). Such practice has been utilized mainly by indigenous and traditional populations living in the country [21]. It is expected that reduced threats to biodiversity exist in conserved natural areas. In Brazil, these areas are called Conservation Units (*Unidades de Conservação* - UC), and they use various management strategies to achieve maximal conservation of the ecosystem's diversity and existing species [22]. However, many of the conservation and management policies adopted in Brazil and in the world seem to be inefficient, especially because they ignore the human communities living in protected areas [23].

The study of popular knowledge regarding the use of animals is a crucial step in designing conservation strategies, because this knowledge reflects the values and attitudes adopted by a community or population regarding the local fauna [24-25]. For a better approach to this subject, the non-uniformity of knowledge among different genders and age groups should be considered [26-27]. In rural communities, for example, males usually have more contact with natural resources due to agriculture practices and hunting activities [28-30]. However, Almeida et al. [30] indicate that women have greater knowledge of the production of herbal medicines [31] and/or zootherapeutic products [32]. This difference most likely occurs because women are the main caretakers of children [30, 33]. In addition to gender, some studies show age as an important factor in knowledge regarding the use of wild animals [34-36]. Studies indicate that acquiring knowledge of natural resources occurs when individuals are still young [37-38], and there is a direct relationship between age and the knowledge obtained by the individual [39].

Given the precarious living conditions of the communities in the semi-arid regions of northeastern Brazil [2, 11] and the prevalence of hunting practice by these communities [12, 16], we believe that they still hunt wild animals even in the conservation areas. Considering the needs of these communities, this use would be predominantly for food and zootherapeutic purposes, with some elements of superstition. We believe that the purposes for the use might vary according to gender and age of informants. Because males have more contact with the wild fauna [27-29], they would have more knowledge about the use of such fauna for food. Moreover, due to child care, we assume that females will present more knowledge about the use of fauna for zootherapeutic purposes. Considering the informant age [39-40], we expect that in general, elderly respondents will have more knowledge about the role of wild mammals. Because mammals are the group of animals most affected by hunting [2], we analyzed two communities in a conservation area regarding the role of wild mammals, particularly seeking the reasons why these communities use these animals and if there is an effect of the gender and age of the informant.

Methods

Study area

The data were collected in two communities situated near the National Araripe Forest (*Floresta Nacional do Araripe* - FLONA): the Sítio Betânia Community (07°27'45.4"S, 39°25'53.6"W) and Caldas Community (07°22'44.1"S, 39°20'59.5"W) (Figure 1). These communities are within the Chapada do Araripe Environmental Protection Area (*Área de Proteção Ambiental da Chapada do Araripe* - APA/Araripe), which is a Federal Conservation Unit created by law on August 4, 1997. The APA encompasses the Brazilian states of Ceará, Pernambuco and Piauí. The Caatinga biome is predominant in the APA/Araripe, which comprises an area of 972.590.45 ha (Chico Mendes Institute for Biodiversity Conservation [*Instituto Chico Mendes de Conservação da Biodiversidade* - ICMbio]). The communities belong to the municipality of Barbalha (Ceará state, Brazil). Barbalha has a population of 55,323 inhabitants [41], comprises an area of 479.184 km², and has a population density of 92.31 individuals/km^2. Of the total individuals, approximately 48.63% (26,904) are male, and 51.37% (28,419) are female [41].

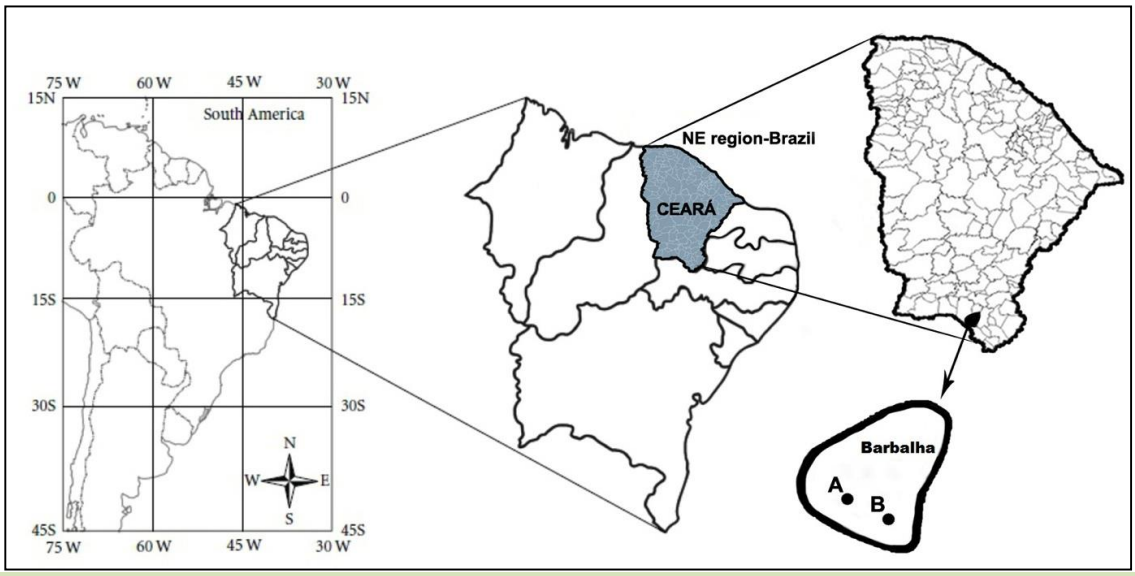

Fig 1. Study area: A – Caldas Community, B - Sítio Betânia Community. Municipality of Barbalha, state of Ceará, Northeast of Brazil.

The Sítio Betânia Community is in an area where agriculture is predominant. The community has one medical facility, one municipal school that offers early childhood education, and one church. The land for these public services was donated, and construction was by the residents of the community. The main activity of the population is subsistence agriculture with plantations of common bean, cassava and corn; small pastures for cattle and goats are maintained in some places. Firewood harvesting, for sale or for cooking food, is also very common. The community has approximately 50 families and a total of 258 inhabitants (personal communication from the M.S.P health agent).

The Caldas Community belongs to the municipality of Barbalha-Ceará state. Despite being a district away from the municipal center, Caldas is more urbanized than the previous community, having streets with sidewalks and a small local business. The community is next to the Araripe National Forest and has few public establishments, including only one medical facility, one kindergarten and elementary municipal school, one Catholic church, and some evangelical churches. The economy of the region is

traditionally based on the local business, and agricultural practice is less common. There is also economic activity linked with tourism, because the district is close to the Riacho do Meio Ecological Park, which includes the Geotope Arajara and is part of the Geopark Araripe; this is an area of geological and paleontological interest and is the only one of its kind found in the South and North Americas. The Caldas Bathing Resort (*Balneário do Caldas*) is also in the community, with water appropriate for balneotherapy, considered a rarity in the thermal mineral resorts of the northeast. Sítio Pinheiros "Eco" Pousada is also in the community and has a natural swimming pool, lake, and hiking trails. The community has approximately 155 families and 620 inhabitants (personal communication from the E.S.S. health agent).

Data collection

Information was obtained through the use of semi-structured interviews [42]. All the houses of the two communities were visited, and a maximum of two people were interviewed per household. Contact between each interviewee with the next one was avoided to prevent the possibility that one informant could influence the answers of the other. In case of such contact, the interviewed person was eliminated from the sample. The sample was divided by gender among three age groups, based on the classification criteria of the Brazilian Ministry of Health: adolescents (12 to 19 years old), adults (20 to 59 years old), and elderly (over 60 years old).

A total of 229 interviews were conducted between October and November 2012, with 124 of the interviews conducted in Caldas Community and 105 in the Sítio Betânia Community. Of the interviewees, 117 were males, and 112 were females. According to age group, a total of 42 adolescents, 146 adults and 41 elderly were interviewed.

To assess knowledge about mammals, interviewees were first asked if they knew what mammals are, and following their response, other popular terms were used, such as "animals with fur" and "animals that breastfeed." A photographic guide containing pictures of mammals of the region was also shown. The research focused on three types of use: food, zootherapeutic uses, and superstition. The questions were restricted to wild animals and addressed whether these animals are hunted and/or eaten not only by the interviewee but also by any acquaintance. Interviewees were also asked whether they use or have used mammals to produce zootherapeutic items. The diseases treated with zootherapeutic products were categorized according to the International Statistical Classification of Diseases and Related Health Problems [43]. With regard to superstition, the following subcategories were considered: animals that bring good luck; animals that bring bad luck; and sacred animals ("divine creatures" that cannot be killed or harmed).

Before each interview, the interviewees received a Free and Informed Consent Form providing information about the nature and objectives of the study. For the interviewees who were minors, a permission form was presented to their guardians. Signatures of the interviewee or the guardian of the minor were requested, for the record required by current legislation (Resolution No. 196, dated 10/10/1996, Brazilian National Health Council). This study was authorized by the Biodiversity Authorization and Information System (*Sistema de Autorização e Informação em Biodiversidade* – SISbio) No. 32668-1 and also by the National Ethics Committee for Research (Comissão Nacional de Ética em Pesquisa – CONEP) with Certificate of Presentation for Ethical Consideration (*Certificado de Apresentação para Apreciação Ética* CAAE) No. 01963212.0.0000.5052.

Statistical analysis

BioStat 5.0 software was used for the statistical analyses. The differences in knowledge and use of mammals between genders and age groups were compared with the Chi-squared test. A P value ≤ 0.05 was considered statistically significant. In cases of few answers (less than five) in a given category, the G-test was used. The tables were made with the spreadsheet application of Microsoft Excel© 2007.

A use-value for each species used as food or in zootherapeutic and magical-religious practices was calculated (adapted from Phillips' proposal [44]). This index shows the importance of the locally known species. This value is calculated using the following formula:

$UV=\sum U/n$

(UV = use-value of the species, U = number of citations per species, and n = number of informants).

Results

A total of 32 mammal species (distributed in 19 families) was recorded through the interviews, which described their medicinal, food, or superstition uses. Of the total number of species recorded, 24 are wild species. According to the national [45] and international [46] lists of threatened species, four species of the mammals mentioned are vulnerable or near threatened with extinction: *Tolypeutes tricinctus* (brazilian three-banded armadillo), *Leopardus tigrinus* (oncilla), *Puma concolor* (puma), and *Panthera onca* (jaguar).

The role of mammals as food resource

Based on the information from the forms, 126 (55%) interviewees stated that they have eaten meat from wild mammals. A total of 17 species of mammals used as food was recorded in both of the communities. The three species that showed the highest use-values were *Mazama gouazoubira* (gray brocket deer) (UV = 0.682), *Dasyprocta prymnolopha* (black-rumped agouti) (UV = 0.634), and *Dasypus novemcinctus* (nine-banded armadillo) (UV = 0.611) (Appendix 1).

When the interviewees were asked if they had ever consumed wild mammals, there was a significant difference between genders (X^2 = 7.971; gl = 1; P = 0.005), with 64% of the men saying yes compared to 46% of the women. Likewise, a significant difference was found among the age groups (X^2 = 36.600; gl = 2; P < 0.0001), with 81% of the elderly responding that they had consumed wild mammals compared to 59% of the adults and 17% of the adolescents.

A total of 21 interviewees (9%) responded that they still consume wild mammals. There was no significant difference between genders (X^2 = 0.339; gl = 1; P = 0.56). There was a significant difference among age groups (G = 8.2025; gl = 2; P = 0.02), with 22% of the elderly responding that they still consume wild mammals compared to 7% of the adults and 5% of the adolescents.

Of the interviewees, 80% said they had consumed mammals' meat for more than one year. When asked why they use wild mammals as a food, the following answers were obtained: because they do not have the resources to buy another type of meat (40%), because these animals are tasty (20%), because it is a regional tradition (18%), because these animals are easily caught (12%) and because these animals are abundant (10%). More than half of the interviewees (71%) stated that the wild mammals used as food are hunted, 26% stated that they receive the animals from friends or acquaintances, 2% stated that they ask someone else to get them, and 1% stated that they buy the animals in street markets or from hunters of the community.

The role of mammals as zootherapeutic sources

A total of eight mammalian species (divided into six families) were recorded as used for medicinal purposes. From these species, six species are wild mammals, and two are domestic. The most important species mentioned were *Ovis aries* (sheep/lamb) with 17 citations and *M. gouazoubira* (gray brocket deer) with 16 citations, with use-values (UV) of 0.425 and 0.400, respectively (for more details, see Appendix 2). According to the interviewees, the hard parts, such as shell, cartilage and horn, are usually dried or roasted, grated and crushed to obtain a powder that is then administered as a tea or consumed with food. The soft tissues, such as fat, feces, liver and urine, are consumed or used as ointment. The species were cited to cure approximately 18 diseases, which were grouped into 11 categories according to the International Statistical Classification of Diseases and Related Health Problems [43]. Two diseases were classified in the "undefined" category because they were not in any of the categories of this international classification, according to Alves and Rosa [47] (Appendix 2).

The majority of interviewees answered negatively when asked if they use or have used mammals for zootherapeutic purposes. Of the 229 interviewees, 40 (17%) responded they use or have used some mammal or parts of the mammal to treat some illness. The chi-squared test showed no significant differences between men and women regarding the use of mammals for zootherapeutic purposes (X^2 = 2.524; gl = 1; P = 0.11). The G-test showed a significant difference among the age groups (G = 7.6235, gl = 2, P = 0.02), with 17% of the total elderly answering that they use or have used mammals for zootherapeutic purposes compared to 21% of the adults and 5% of the adolescents.

All the interviewees stated that they learned about the use of folk medicines derived from mammals from older individuals. When asked why mammals were used to produce some medicines, the following answers were obtained: because these animals are easily obtained (20%), because these folk medicines are better than the allopathic medicines (25%), and because they do not have the financial resources to buy allopathic medicine or do not have access to such medicines (55%).

The role of mammals in superstition

A total of 23 mammalian species related to superstition were recorded, comprising 15 wild species and eight domestic species. The most cited mammals for bringing good luck to humans were *Sylvilagus brasiliensis* (tapeti) and *M. gouazoubira* (gray brocket deer), and those that would bring bad luck were *Felis catus* (black domestic cat) followed by *Callithrix jacchus* (common marmoset) and *Cerdocyon thous* (crab-eating fox). The most cited mammals considered sacred animals were *M. gouazoubira* (gray brocket deer), *Bos taurus* (bull/cow) and *Equus asinus* (donkey) (Appendix 3).

No significant difference was observed between men and women in any of the questions related to superstitions involving mammals: "Do you consider any mammal as a sacred animal?" (X^2 = 0.421; gl = 1; P = 0.51); "Do you believe that some mammals can bring good luck?" (X^2 = 1.096; gl = 1; P = 0.29); "Do you believe that some mammals can bring bad luck?" (X^2 = 0.022; gl = 1; P = 0.88).

Analyzing the answers of the age groups, there was no significant difference when the respondents were asked if they consider any mammal to be a sacred animal (G = 0.5798, gl = 2, P = 0.74) or if they believe that some mammals can bring good luck (G = 0.5323, gl = 2, P = 0.76). When asked if they believe that some mammals can bring bad luck, there was a significant difference among age groups (G = 7.29, df = 2, P = 0.026), with 15% of the elderly answering yes compared to 21% of the adults and 5% of the adolescents.

Discussion

The apparent role of wild mammals in the communities studied here reflects the hunting importance of this animal group [3, 12, 48-56]. The factors that lead these communities to use wild mammals are similar to those indicated in the literature [2-3, 13-15]. Even when residing in a conservation unit in which any use of wild animals is prohibited, poverty associated with lack of inspection in such locations [3, 16] is most likely the reason these communities use wild mammals for both food and zootherapeutic purposes.

The role of mammals as food resources was controversial. On the one hand, the current use of mammals for food purposes proved to be low. On the other hand, this practice is still high when fitted into a time corresponding to less than one year. When interviewees were asked whether they have consumed wild mammals, the answer was positive for over 50% of them, mostly the elderly. This age group most likely experienced a period of time when subsistence hunting was more common. Such habits would also be associated with reduced inspection, greater geographic isolation, and lower family income [18] at that time. In general, mammals are the group of animals with the greatest hunting interest [15, 50-51] because some mammals have greater body volume [16, 49, 52-53] and are recognized for their flavorful meat [54]. In fact, many interviewees reported that they enjoy the meat of *D. novemcinctus* (nine-banded armadillo), *M. gouazoubira* (gray brocket deer), *D. prymnolopha* (black-rumped agouti) and *E. sexcinctus* (yellow armadillo). Most of the hunted species cited in this study match those reported in other ethnozoological studies [12, 16, 49].

Consumption of wild mammals was more common among males. This difference follows the trend observed by other authors [3, 28-29], who indicate that hunting activities are often performed by men in most societies. This difference most likely occurs because males have more contact with available natural resources than females [26-27].

In addition to the use of mammals for food purposes, our results showed that mammals also play a role in folk medicine. Studies show that in Brazil, the majority of animals used for medicinal purposes are wild animals [33, 55-57], which is similar to the situation in the current study. Alves et al. [58] reported in a study conducted in the semi-arid region of northeastern Brazil that 78% of the species with medicinal properties were wild animals. However, domestic animal species are also used for zootherapeutic purposes in the northeast region [57]. Animals such as sheep, recognized as an important medical resource in the surveyed area, are also cited in other regions of the Northeast and in several other places in Brazil [33, 56-57].

Lack of resources and difficult access to other medicines are cited as the main reasons for use of wild mammals as zootherapeutic agents. Today, however, adolescents and most of the adults live in a different scenario, where the source of income is not only agriculture [59]. Currently, there are several social welfare programs offered by the Brazilian government, such as family allowance (*Bolsa família*), dry season assistance (*Auxílio estiagem*), gas assistance (*Auxílio gás*) and school allowance (*Bolsa escola*), among others (Brazil without Poverty Program of the Federal Government, [60]). Nevertheless, Alves and Rosa [56] indicate that home remedies derived from plants and animals are very common in folk medicine in regions of the Northeast due to the same factors reported in the current study. As in other studies conducted in communities with socio-cultural conditions similar to ours [33, 47, 56], we found that part of the community still believes that zootherapeutic agents are more effective. All the interviewees stated that they learned about the use of zootherapeutics from the elderly. Several studies address the transmission of knowledge from older to younger individuals [37, 61-63]. The elderly lived in a period when access to medicines from pharmacies was even more

difficult than in the present; thus, there was a greater need to prepare and use medicines from plants and animals [64]. Regardless of age, there was no difference between the genders, likely because of the intense participation of women in preparing home remedies [30] and the men's contact with animals through hunting [65].

All the home remedies mentioned in our study were prepared from mammalian byproducts. Moura and Marques [57] stated that many of the animals or their byproducts are used as zootherapeutic agents because they are useless for other purposes. The same fact had already been observed by Holanda [66] in the twentieth century and by Alves et al. [58], who mentioned the use of amulets and medicines obtained from parts of wild animals that are considered inappropriate for food or leather manufacturing, stating that medicinal use of these byproducts was very widespread at the time. The author cites horns, teeth, nails, bones, hooves, skin and fat among the parts that can be used, which were similar to the byproducts that were cited in our work for zootherapeutic practice. Interestingly, in some cases, the same byproduct is used to treat different diseases.

The role of mammals in superstition proved to be unusual in both of the surveyed communities. Men and women seem to share the same beliefs. Adults referred more often to superstition and mentioned two wild animal species as animals that bring bad luck. Local beliefs should not be underestimated, because they may have a negative impact on the associated species. Some interviewees demonstrated repugnance of species believed to bring bad luck. Thus, these animals were unwanted in these communities. In a study of the use of fauna for mystical-religious purposes conducted in the semi-arid region of Paraiba state, Brazil, Barbosa and Aguiar [19] found results similar to ours for *C. thous* (crab-eating fox). The authors found that the population of the surveyed community rejected this species, believing that it is a diabolical animal.

However, some species are associated with divine creatures. The veneration of some animals is also observed in other cultures [67-68]. Some cultures demonstrate a close integration and connections with totemic, mythological (imaginary) or god animals, as noted by Allaby [68]. In a study conducted in the agreste region of the Brazilian state of Paraíba, Barbosa and Aguiar [20] observed that animals such as birds and insects are considered sacred by residents of one community of this region. According to the interviewees, *E. asinus* (donkey) is considered sacred because it helps humans to carry loads and it carried Jesus Christ when he entered Jerusalem (Gospel, Matthew 21; 5-7). Although *M. gouazoubira* (gray brocket deer) and *B. taurus* (bull/cow) are considered sacred, these mammals are consumed. This situation is different from other places where sacred animals are not consumed [68-69]. When asked why they consider these animals sacred, the majority of the interviewees could not define a real reason. The animals were associated with a divine creation. Some interviewees said: "It is because we must respect God's creation" (E.S.S.); "It is because all God's creation is divine" (M.G.A); "It is because animals are God's creation, so we have to respect them a lot" (H.A).

Implications for conservation

Our study showed that the use of wild mammals in the surveyed communities is still a common practice and that current conservation strategies adopted throughout Brazil (i.e. establishing certain areas as conservation units) have not been effective. Unfortunately hunting practice and the use of products of wild animals are still widespread in the country, regardless of the region and protectionist status. This suggests that current conservation strategies need to be rethought. Most likely, what drives hunting in such communities are poverty, cultural traditions, and especially the lack of legal enforcement. However, it is very hard to assign conservation policies in communities where wild animals have always been seen as critical resources. To avoid ethical conflicts between human needs

and wildlife conservation, these policies should take into account the social and cultural aspects of local communities in addressing the use and management of wild animals. The development of environmental education programs is of paramount importance. With the influence of these measures, the anthropogenic impacts on endangered species will most likely be reduced.

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Appendix 1. Wild mammals used as food resource by locals from the communities of Caldas and Sítio Betânia (APA/Araripe, Ceará, Brazil).

Family/specie	Popular name in the region	Nº of citations	UV
Canidae			
Cerdocyon thous (Linnaeus, 1766)	Raposa / goro (crab-eating fox)	1	0.007
Caviidae			
Galea spixii (Wagler, 1831)	Preá (spix's yellow-toothed cavy)	21	0.166
Kerodon rupestris (Wied-Neuwied, 1820)	Mocó (rock cavy)	1	0.007
Cervidae			
Mazama gouazoubira (Fisher, 1814)	Veado (gray brocket deer)	86	0.682
Dasypodidae			
Cabassous unicinctus (Linnaeus, 1758)	Tatu china (southern naked-tailed armadillo)	2	0.015
Dasypus novemcinctus (Linnaeus, 1758)	Tatu verdadeiro (nine-banded armadillo)	77	0.611
Euphractus sexcinctus (Linnaeus, 1758)	Tatu peba (yellow armadillo)	51	0.404
Tolypeutes tricinctus (Linnaeus, 1758)	Tatu bola (brazilian three-banded armadillo)	1	0.007
Dasyproctidae			
Dasyprocta prymnolopha (Wagler, 1831)	Cutia (black-rumped agouti)	80	0.634
Didelphidae			
Didelphis albiventris (Lund, 1840)	Cassaco / saruê / timbú (white-eared opossum)	3	0.023
Echimyidae			
Trichomys apereoides (Lund, 1839)	Punaré / rato do mato (common punaré)	5	0.039
Felidae			
Leopardus tigrinus (Schereber, 1775)	Gato do mato / lagartixeiro (oncilla)	5	0.039
Puma concolor (Linnaeus, 1771)	Onça vermelha / bodeira (puma)	16	0.126
Panthera onca (Linnaeus, 1758)	Onça pintada (jaguar)	1	0.007
Mustelidae			
Conepatus semistriatus (Boddaert, 1785)	Gambá (striped hog-nosed skunk)	8	0.063
Myrmecophagidae			
Tamandua tetradactyla (Linnaeus, 1758)	Tamanduá (southern tamandua)	15	0.119
Tayassuidae			
Tayassu tajacu (Linnaeus, 1758)	Porco do mato (collared peccary)	1	0.007

UV = use value.

Appendix 2. Wild mammals used as zootherapeutics by locals from the communities of Caldas and Sítio Betânia (APA/Araripe, Ceará, Brazil).

Family / Specie	Popular name in the region	NC	UV	Used part	Disease(s)	Category of the disease
Bovidae						
Bos taurus (Linnaeus, 1758)*	Boi / vaca (bull/cow)	1	0,025	Calves' foot (1)	Nerve problems	Nervous system
Ovis aries (Linnaeus, 1758)*	Carneiro / ovelha (sheep/ lamb)	17	0,425	Fat/lard (2,3)	Flu (stuffy nose)	Respiratory system
				Tallow (2,3)	Cracked feet	Undefined disease
					Rheumatism and pain in the feet	Musculoskeletal system and connective tissue
					Swelling and luxation	Injury, poisoning and other consequences of external causes
					Tooth pain	Specific teeth disorders and supporting structures
					Joint inflammation	Other joint disorders
					Strokes	External causes of morbidity and mortality
Canidae						
Cerdocyon thous (Linnaeus, 1766)	Raposa / goro (crab-eating fox)	3	0.075	Fat/lard (2,3)	Back pain and rheumatism	Musculoskeletal system and connective tissue
					Hemorrhoids	Circulatory system
				Liver (4)	Cough	Respiratory system
Cervidae						
Mazama gouazoubira (Fisher, 1814)	Veado (gray brocket deer)	16	0.400	Faeces (5)	Headache	Neurological disorders (headache)
					Cough	Respiratory system
				Horn (6,7,8,9,10)	Irritation during the birth of teeth in children	Undefined disease
					Toothache	Specific teeth disorders and supporting structures
					Earache	Ear and mastoid apophysis

					Snakebite	External causes of morbidity and mortality
				Calves' foot (11)	Wound	Injury, poisoning and other consequences of external causes
					Cracked feet	Undefined diseases
Dasypodidae						
Euphractus sexcinctus (Linnaeus, 1758)	Tatu peba (yellow armadillo)	1	0.025	Tail (9)	Earache	Ear and mastoid apophysis
Tolypeutes tricinctus (Linnaeus, 1758)	Tatu bola (brazilian three-banded armadillo)	1	0,025	Carapace (12)	Cough	Respiratory system
Dasyproctidae						
Dasyprocta prymnolopha (Wagler, 1831)	Cutia (black-rumped agouti)	1	0,025	Tail (9)	Earache	Ear and mastoid apophysis
Mustelidae						
Conepatus semistriatus (Boddaert, 1785)	Gambá (striped hog-nosed skunk)	4	0.100	Urine (13)	Back pain	Musculoskeletal system and connective tissue
					Earache	Ear and mastoid apophysis
					Rheumatism	Musculoskeletal system and connective tissue
				Liver (5)	Rheumatism	Musculoskeletal system and connective tissue

*Domestic animal; NC = Number of Citations; UV = Use-value; Preparation and use: (1) = Cook the calves' foot (*mocoto*) with fennel, cinnamon and sugar until it becomes a paste; (2) = Melt in fire; (3) = Place it on the affected area or rub the ointment on the area; (4) Consume the roasted and unsalted part; (5) = Consume the raw part; (6) = Shave the horn and add it to porridge; (7) = Shave the horn, toast it in the fire, put it on cotton and place in the tooth or ear; (8) = Shave the horn, make a cigarette and smoke; (9) = Scratch the ear; (10) = Burn the horn, shave, wet in milk and place on top of the bite; (11) = Heat the calves' foot (*mocoto*) and rub on top of the wound; (12) = Toast the shell, step on it, and make a tea with the powder; (13) = Consume the urine.

Appendix 3. The role of mammals in superstition by the communities of Caldas and Sítio Betânia (APA/Araripe, Ceará, Brazil).

		Nº of citations		
Family/Specie	**Popular name in the region**	**GL**	**BL**	**SA**
Bovidae				
Bos taurus (Linnaeus, 1758)*	Boi / vaca (bull/cow)	3	-	5
Ovis aries (Linnaeus, 1758)*	Carneiro / ovelha (sheep / lamb)	-	-	3
Callitrichidae				
Callithrix jacchus (Linnaeus, 1758)	Macaco / Soin (common marmoset)	2	9	2
Canidae				
Canis lupus familiaris (Linnaeus, 1758)*	Cachorro (domestic dog)	1	-	-
Cerdocyon thous (Linnaeus, 1766)	Raposa / goró (crab-eating fox)	1	9	-
Caviidae				
Galea spixii (Erxleben, 1777)	Preá (spix's yellow-toothed cavy)	2	-	1
Cervidae				
Mazama gouazoubira (Fisher, 1814)	Veado (gray brocket deer)	6	1	8
Dasypodidae				
Euphractus sexcinctus (Linnaeus, 1758)	Tatu peba (yellow armadillo)	1	-	2
Dasyproctidae				
Dasyprocta prymnolopha (Wagler, 1831)	Cutia (black-rumped agouti)	4	-	3
Didelphidae				
Didelphis albiventris (Lund, 1840)	Cassaco / timbú (white-eared opossum)	-	1	-
Elephantidae				
Loxodonta spp.	Elefante (elephant)	1	-	-
Equidae				
Equus caballus (Linnaeus, 1758)	Cavalo (horse)	-	-	2
Equus asinus (Linnaeus, 1758)*	Jumento (donkey)	-	-	4
Felidae				
Felis catus (Linnaeus, 1758)*	Gato doméstico (domestic cat)	2	14	3
Leopardus tigrinus (Schereber, 1775)*	Gato do mato / Lagartixeiro (oncilla)	1	1	1
Panthera leo (Linnaeus, 1758)	Leão (lion)	-	-	2
Panthera onca (Linnaeus, 1758)	Onça pintada (jaguar)	2	1	2
Leporidae				

Sylvilagus brasiliensis (Linnaeus, 1758)	Coelho (tapeti)	12	-	-
Muridae				
Rattus spp.	Rato (rat)	-	1	-
Mustelidae				
Conepatus semistriatus (Boddaert, 1785)	Gambá (striped hog-nosed skunk)	1	-	-
Myrmecophagidae				
Tamandua tetradactyla (Linnaeus, 1758)	Tamanduá (southern tamandua)	-	-	1
Suidae				
Sus scrofa domesticus (Linnaeus, 1758)*	Porco doméstico (domestic pig)	-	-	1
Chiroptera**	Morcego (bat)	-	1	-

*Domestic animal; ** Unidentified animal species; GL = Good luck; BL = Bad luck; SA = Sacred animal.