Fecha de recepción: 26-julio-2022 Fecha de aceptación: 28-febrero-2023

GAME MAMMALS AND THEIR USES BY LOCAL HUNTERS IN AN ATLANTIC FOREST REGION OF NORTHEAST BRAZIL

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ABSTRACT

The present study records how hunters from the municipality of Santa Luzia do Itanhy (SLI) know and use game mammals. The municipality is located in the state of Sergipe, northeastern Brazil, and the study took place from May 2017 to July 2018. Information on the presence and use of mammals was sampled through semi-structured forms, complemented by the "snowball" method, free interviews, and non-formal conversations. We talk with 16 informants, indicating the presence of 27 game mammal species from 8 orders and 16 families, along with 35 citations of uses. Mammals are hunted for a variety of purposes, such as food (16 citations), zootherapy (6 citations), magic (6 citations), crafts (1 citation), religion (1 citation), besides targets of conflict (5 citations). The present records indicate that species with higher use-value can have higher hunting pressure locally. This, together with historical habitat loss due to land-use change subject species for population decrease, leading them to local extinction. This results highlight the immediate requirement of local management, preserve and conservation measures, with special attention to the threatened species. This set of measures must take into account the social-cultural aspects of the local communities. Besides, this contribution may enhances further ethnographical and ethnozoological studies for Sergipe.

KEYWORDS: cinegetic, ethnozoology, fauna, traditional knowledge.

MAMÍFEROS CAÇADOS E SEUS USOS POR CAÇADORES LOCAIS NUMA REGIÃO DE MATA ATLÂNTICA DO NORDESTE DO BRASIL

RESUMO

O presente estudo registrou como caçadores do município de Santa Luzia do Itanhy conhecem e usam os mamíferos alvos de caça. O município está localizado no estado de Sergipe, Nordeste do Brasil, e o estudo foi conduzido entre maio de 2017 e julho de 2018. Informações sobre a presença e uso de mamíferos foram obtidas através de

questionários semiestruturados, complementados pelos métodos *snowball*, entrevistas livres ou escuta livre, e conversas não formais. Nós conversamos com 16 informantes que indicaram a presença de 27 espécies de mamíferos alvos de caça, pertencentes a 8 ordens e 16 famílias, juntamente com 35 citações de usos. Essas espécies foram caçadas para uma variedade de propósitos, como alimentação (16 citações), zooterapia (6 citações), uso "mágico" (6 citações), artesanato (1 citação), religioso (1 citação), além de alvo de conflito (5 citações). Esses registros indicam que espécies com maiores valores de uso podem ter maior pressão de caça local. Isso, juntamente com a perda histórica de habitat devido à mudança no uso da terra, pressionam a diminuição das populações dessas espécies, levando-as à extinção local. Esses resultados destacam a imediata necessidade para um manejo local, e medidas locais de preservação e conservação, com especial atenção para as espécies ameaçadas de extinção. Esse conjunto de medidas deve levar em consideração os aspectos socioculturais das comunidades locais. Além disso, essa contribuição pode estimular estudos etnográficos e etnozoológicos continuados para Sergipe.

PALAVRAS-CHAVE: cinegético, conhecimento tradicional, etnozoologia, fauna.

INTRODUCTION

Human beings have developed varied interactions with animals during their evolutionary, biological, and cultural history (Alves *et al.*, 2011). In tropical countries, including Brazil, people use wild fauna for food, nutrition, medicinal and therapeutic use, cultural activities, mystic-religious practices, craft purposes, or even trade (live animals, parts of them, or by-products for various purposes), in addition to the vast combination of these uses (Bennett and Robinson, 1999; Alves and Rosa, 2006; Alves *et al.*, 2010; Barbosa *and* Aguiar, 2012). For example, some research shows that at least 300 species of animals are used in Brazil for therapeutic purposes, while about 100 species are used for magical-religious purposes (Alves and Rosa, 2007a; Alves *et al.*, 2009a; Ferreira *et al.*, 2013)

Among the various existing faunal resources, mammals stand out among the highest hunting interest groups (Silva Neto *et al.*, 2017; Chaves *et al.*, 2020). The interest arises because the species have a greater body volume and, consequently, a greater amount of meat in the cost-benefit ratio than the other taxa, mainly when the prey is used for food. Such characteristics increase the importance of mammals as hunting targets (Barrera-Bassols and Toledo, 2005; Barbosa *et al.*, 2011; Alves *et al.*, 2016). The high interest in mammal hunting highlights the need for specific protection measures and adequate or sustainable management.

However, mammals are also of fundamental importance in maintaining the balance of ecosystems. The countless species of mammals participate in different ecological processes, acting from population control of their prey to the constant regeneration of forests through pollination and seed dispersal (Robinson and Redford, 1986; Abreu Júnior and Köhler, 2009). Despite the importance of mammals in the functionality of ecosystems, the various interactions of human beings with nature currently imply the greatest threats to biodiversity, including mammals, mainly loss and fragmentation of habitat and hunting (Chiarello *et al.*, 2008).

The increasing exploitation and degradation of natural resources (Torres *et al.*, 2009) is resulted mainly by urban expansion (Elmqvist *et al.*, 2016) and replacement of forest remnants by agroforestry activities, or even by the indiscriminate use of their resources (Hempson *et al.*, 2017). These actions are main threats not only to biodiversity but also to human populations. Traditional or not, human populations depend on fauna to acquire food, economic resources, or ecosystem services (Barrera-Bassols and Toledo, 2005; Chiarello *et al.*, 2008). Therefore, knowledge of traditional and local human populations about local natural resources is useful for human well-being and management strategies.

The knowledge of traditional and local/rural people has been gaining increasing attention in ethnobiological

research (Ferreira *et al.*, 2016). Investigations on regional uses of animals also collaborate to value wild fauna properly from an ecological, economic, cultural, and social perspective (Cullen Jr. *et al.*, 2000). In addition, they provide a framework for implementing environmental management and species conservation based on social reality (Rocha-Mendes *et al.*, 2005). This study inventories the mammals' species used by residents of the municipality of Santa Luzia do Itanhy, describes the using forms and assesses the use-value of each of these species. Based on the results, we hope to contribute to the development of new ethnozoological studies in the state of Sergipe and encourage the development of conservation proposals for local species of mammals, especially those with higher use value and probably higher use value more impacted by hunting.

METHODS

Study site. The study was carried out in the municipality of Santa Luzia do Itanhy (Sergipe, Brazil), located on the southern coast of Sergipe, northeastern Brazil. The municipality currently has ca. 14,000 habitants (IBGE 2021). Santa Luzia do Itanhy has a *quilombola* community recognized in 2005 by the Palmares Foundation (Silva 2016) covering seven villages: Rua da Palha, Pedra Furada, Cajazeiras, Bode, Taboa, Pedra D'Água, and Crasto. Traditionally, *quilombo* is a community of descendants of runaway slaves (Leite, 2015). Rural settlements, based on land reform policies, composes other communities in the municipality, as the Bom Viver community.

We sampled four localities, the city headquarter (11°21'09"S, 37°26'54"W), and the villages Rua da Palha (11°18'48"S, 37°25'20"W), Pedra Furada (11°20'07"S, 37°24'19"W), and Bom Viver (11°20'53"S, 37°29'52"W) (Figure 1). The local social and ecological context of the study region can be seen in Figure 2. All sampled areas are located close to forest fragments, including the Private Natural Heritage Reserves (RPPN) Marinheiro (Forest 1 and 2; 88.3 ha and 62.8 ha respectively), Pedra da Urça (31.1 ha), Bom Jardim (167.9 ha), and Tapera (131.41 ha), which total 481.51 ha of protected areas, in addition to Mata do Crasto, with about 1,000 ha.

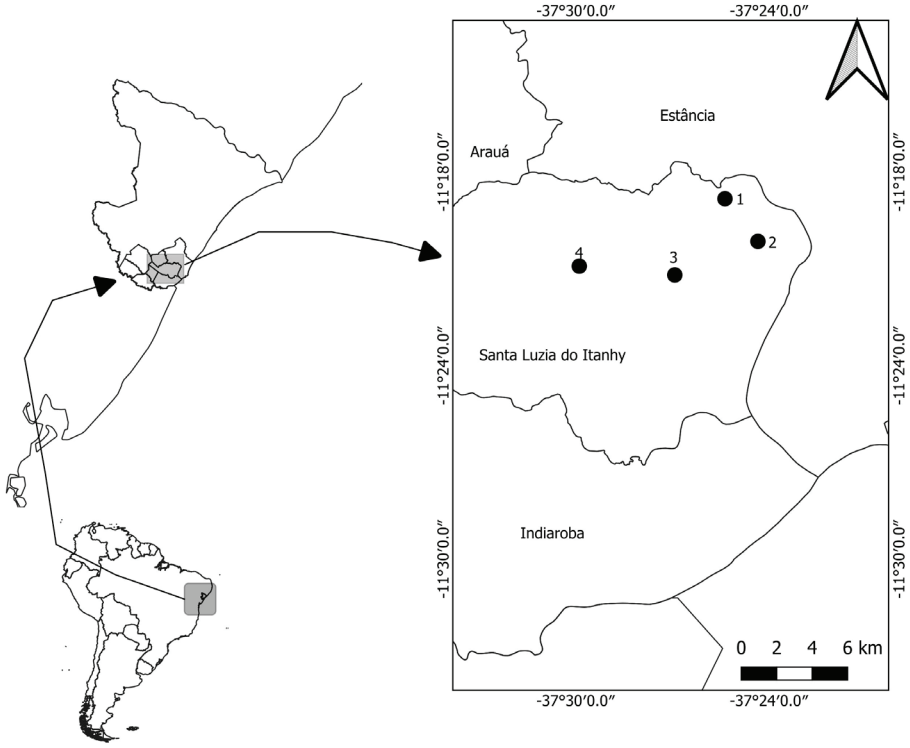

Figure 1. Sampled sites along the municipality of Santa Luzia do Itanhy, Sergipe state, northeastern Brazil. Numbers represent sites as follows: 1) Rua da Palha, 2) Pedra Furada, 3) Santa Luzia do Itanhy headquarter, and 4) Bom Viver.

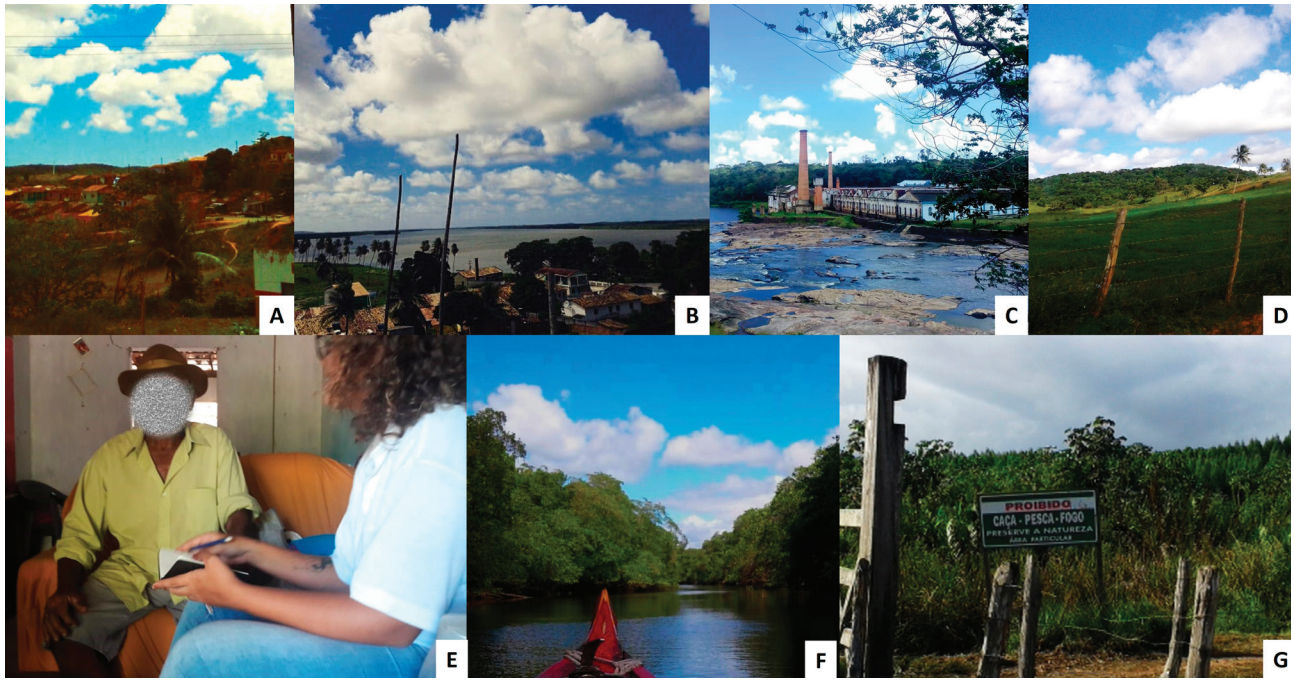

Figure 2. Local social and ecological context of the study region. A) Santa Luzia do Itanhy municipality headquarter; B) the village of Crasto; C) Piauitinga river and a colonial and deactivated sugarcane plant; D) RPPN Tapera forest fragment surrounded by pasture; E) a local resident during reporting of local mammal species and hunting; F) mangrove channel close to the village of Crasto; and G) the entrance of the RPPN Bom Jardim with an alert board of forbidden hunting.

Data sampling. Data have been sampled between May 2017 and July 2018. Informants were selected, prioritizing those who had already hunted or were still engaged in this activity at the survey. Sample selection was intentional and non-probabilistic using the "snowball" method (see Albuquerque *et al.*, 2010). This method is used to access local experts in certain knowledge, in this case, hunters. At each conversation, we asked the informant to recomend another expert. Thus we always sample data from hunters used to the local fauna in the study area.

The information was obtained through semi-structured forms (Bernard, 1988), complemented by free interviews, and informal conversations, performed individually (Albuquerque *et al.*, 2010). To access knowledge specifically about mammals, we asked respondents if they knew what mammals are, followed by popular terms such as "hair animals" and "sucking animals." We also presented identification guides containing images of mammals with actual and possible occurrences in the region (Emmons and Feer, 1997; Mittermeier *et al.*, 2007).

Through the forms applied, for each species mentioned, we asked: (i) popular name/place of the animal, (ii) used body parts, and (iii) purpose (described below). Furthermore, respecting intellectual property rights, we explained the objectives and nature of the research before each interview, accompanied by a Free and Informed Consent Form. The present study has been authorized by the Human Research Ethics Committee and possesses a Certificate of Presentation for Ethical Appreciation – CAAE nº 63170816.3.0000.5546, obtained through Plataforma Brasil.

Data analyses. Animals have been identified according to the characteristics mentioned by the interviewees. This technique is called taxonomic clue (Martins *et al.*, 2011) comparing the given description with the list of naturally occurring species in the region, together with indications made from identification guides. The obtained data on the interrelationships with the local fauna were categorized according to (Alves, 2012). The authors identified interactions between humans and natural resources for the following purposes: food, medicine, magic, religion, pets, and conflicting relationships. The conservation status of the registered species follows the Brazilian List of Mammals Endangered with Extinction (ICMBio, 2018) and the International Union for Nature Conservation (IUCN, 2022).

The use-value -adapted from Phillips and Gentry (1993a, 1993b), and Rossato *et al.* (1999)- was used to elucidate the relative importance of each reported species, calculated using the following formula: $UV_i=\sum Ui/n$; where UV_i is the use-value of species "i"; U is the total number of use citations of species "i"; and "i" is related to a specific species; while "n" represents the number of informants. Thus, the application of the use-value of each species is objectively based on the importance attributed by the informants and does not depend on the researcher's opinion. Thus, for the calculation, only the species that still occur in the region were considered. Usage values below 1 mean that the informants had only one or no usage type (UV=0). Use-values above 1 mean that informants cited more than one type of use for the species. Due to the prohibition of hunting in Brazil, we were not able to access any record of the hunted species made by the hunters.

RESULTS

Sixteen individuals were interviewed (two women and 14 men), aged between 23 and 91 years, distributed throughout the city headquarter (n=8), Rua da Palha (n=11), Pedra Furada (n=1), and Bom Viver (n=4). Among them, ten were former hunters, and six were still active as hunters. We obtained 265 citations for 27 species distributed in 8 orders and 16 families (Table 1). Rodentia was the order with the highest number of citations (25.7%), followed by Carnivora (24.8%), Cingulata (17.3%), Primates (8.7%), Artiodactyla (8.3%), Pilosa (7.4%), Didelphimorphia (5.9%), and Lagomorpha (1.5%).

Interviewees over 60 years of age (n=14) mentioned as currently extinct species that occurred in the past in the study area. They are the Collared Peccary (*Pecari tajacu*), the White-lipped Peccary (*Tayassu pecari*), and the jaguar (*Panthera onca*). In addition, the interviewees recognized species such as the Ring-tailed coati (*Nasua nasua*) and the Southern naked-tailed armadillo (*Cabassous unicinctus*). However, they reported that these species are rare, suggesting the difficulty of being spotted or possibly a recent recent local extinction.

All animals registered in this work are native. However, among the registered animals, seven are in some category of extinction risk, according to the Brazilian List of Endangered Mammals (2018) and the IUCN, as Near Threatened – NT: the Neotropical otter (*Lontra longicaudis*); Vulnerable – VU: the Maned sloth (*Bradypus torquatus*), the Bristle-spined porcupine (*Chaetomys subspinosus*), the Jaguarundi (*Herpailurus yagouaroundi*), the Cougar *(Puma concolor*); Endangered – EN: the Ocelot (*Leopardus emiliae*) and the Coimbra-Filho's Titi Monkey (*Callicebus coimbrai*).

Species use-values ranged from 0.06 to 1.50 (Table 1). Species cited for a single-use represented 63% of the citations, while species destined for multiple uses represented 37%. Among the species used for food consumption, the one that obtained the highest use value was the Bristled-spined porcupine *C. subspinosus* (UV=1.50), reflecting the cultural importance of this animal in the region. In addition to the Bristle-spined porcupine, the other most representative species, i.e. those with a use-value equal to or above one (1.0), were the Brazilian porcupine *Coendou prehensilis* (UV=1.19), the tailed armadillo *C. unicinctus* (UV=1.19), the Black-rumped agouti *Dasyprocta prymnolopha* (UV=1.13), the Nine-banded armadillo *Dasypus novemcinctus* (UV=1.06), and the Six-banded armadillo *Euphractus sexcinctus* (UV=1).

Despite reports that all armadillos species are highly appreciated for consumption, all informants declared that their meat of preference was the Paca (*Cuniculus paca*) (UV=0.94) due to its flavor. However, contradictorily, the species presented a use-value below 1.0. The further species with use-value below one (1.0; see Table 1) are reportedly less desirable for consumption, are captured when found opportunistically during hunting trips, and end up slaughtered for consumption.

According to the informants, marmoset (*Callithrix jacchus*) and Maned sloth (*B. torquatus*) are not consumed because they present anthropomorphized behavior. For the interviewees, killing monkeys and sloths would be like killing human beings because they have human-like features and movements. According to reports from

Table 1. Game mammals cited by informants from the communities of Santa Luzia do Itanhy, Sergipe state, northeastern Brazil.

TAXON	VERNACULAR NAME (PORTUGUESE/ ENGLISH)	USE VALUE	USED PART	CATEGORIES	PURPOSE	PERCEPTION OF PRESENCE AT THE LOCATION
Order Didelphidae						
Family Didelphidae						
Didelphis albiventris Lund, 1840	Saruê-de-orelha-branca / White-eared opossum	0.50	-	Food	-	Present
Order Cingulata						
Family Chlamyphoridae						
Cabassous unicinctus (Linnaeus, 1758)	Tatu-rabo-de-couro / Southern naked-tailed armadillo	1.19	Tail	Zootherapy, Magic	Improve hearing, treat hearing problems, protection	Present (rare)
Euphractus sexcinctus (Linnaeus, 1758)	Tatu-peba / Six-banded armadillo	1.00	Fur	Magic	Protection in the forest	Present
Family Dasypodidae						
Dasypus novemcinctus (Linnaeus, 1758)	Tatu-verdadeiro / Nine-banded armadillo	1.06	Shell	Magic	Protection in the forest	Present
Dasypus septemcinctus (Linnaeus, 1758)	Tatuí / Seven-banded armadillo	0.63	Shell	Magic	Protection in the forest	Present
Order Pilosa						
Family Bradypodidae						
Bradypus torquatus Illiger, 1811	Preguiça-de-coleira / Maned three-toed sloth	0.25	Fur	Zootherapy	Syphilis treatment	Presente
Family Myrmecophagidae						
Tamandua tetradactyla (Linnaeus, 1758)	Tamanduá-mirim / Southern tamanduá	0.50	-	Food	-	Present
Order Lagomorpha						
Family Leporidae						
Sylvilagus brasiliensis (Linnaeus, 1758)	Tapiti / Brazilian tapeti	0.31	-	Food	-	Present
Order Primates						
Family Pitheciidae						
Callicebus coimbrai Kobayashi & Langguth, 1999	Guigó de Coimbra-Filho / Coimbra Filho's titi monkey	0.50	-	Food	-	Present
Family Callitrichidae						
Callithrix jacchus (Linnaeus, 1758)	Sagui de orelha branca / White tufted-ear marmoset	0.38	-	Pet	-	Present
Order Carnivora						
Family Felidae						
Leopardus emiliae (Thomas, 1914)	Gato-do-mato / Eastern tigrina	0.06	-	Targets of conflict	-	Present
Leopardus pardalis (Linnaeus, 1758)	Jaguatirica / Ocelot	0.13	-	Targets of conflict	-	Present
Herpailurus yagouaroundi (É. Geoffroy, 1803)	Gato-marisco / Jaguarundi	0.13	-	Targets of conflict	-	Present
Puma concolor (Linnaeus, 1771)	Suçuarana / Puma	0.19	-	Targets of conflict	-	Present
Family Canidae						
Cerdocyon thous (Linnaeus, 1766)	Raposa / Crab-eating fox	0.63	-	Food	-	Present

Table 1. Cont.

TAXON	VERNACULAR NAME (PORTUGUESE/ ENGLISH)	USE VALUE	USED PART	CATEGORIES	PURPOSE	PERCEPTION OF PRESENCE AT THE LOCATION
Family Mustelidae						
Lontra longicaudis (Olfers, 1818)	Lontra / Neotropical river otter	0.56	-	Food	-	Present
Eira barbara (Linnaeus, 1758)	Irara ou Papa-mel / Tayra	0.19	-	Food	-	Present
Galictis cuja (Molina, 1782)	Furão / Lesser grison	0.44	-	Food	-	Present
Family Procyonidae						
Procyon cancrivorus (G. Cuvier, 1798)	Guaxinim / Crab-eating raccoon	0.94	Skin	Religion, Crafts	Making of drumhead/ "Call Xangô"	Present
Nasua nasua (Linnaeus, 1766)	Quati / South American coati	0.50	-	Food	-	Present (rare)
Order Rodentia						
Family Cuniculidae						
Cuniculus paca (Linnaeus, 1766)	Paca / Lowland paca	0.94	Body fat	Food, Zootherapy		Present
Family Caviidae						
Hydrochoerus hydrochaeris (Linnaeus, 1766)	Capivara / Capybara	0.94	-	Food	-	Present
Galea spixii (Wagler, 1831)	Preá / Spix's yellow-toothed cavy	0.56	-	Food	-	Present
Family Dasyproctidae						
Dasyprocta prymnolopha Wagler, 1831	Cutia / Black-rumped agouti	1.13	Fur	Food, Zootherapy	Treatment for pain and swelling	Present
Family Erethizontidae						
Coendou prehensilis (Linnaeus, 1758)	Ouriço-cacheiro branco / Brazilian porcupine	1.19	Fur, Thorn	Food, Zootherapy, Magic	The hair are used to treat "air diseases or badwind", vernacular names to cerebral stroke. The spiny are used to treat pain and to gain protection, besides sharpens the dog sniff.	Present
Chaetomys subspinosus (Olfers, 1818)	Ouriço-preto / Bristle-spined rat	1.50	Fur, Thorn	Food, Zootherapy, Magic	The hair are used to treat joint pain, besides to gain protection and used also to sharpens the dog sniff. The spiny are used to treat skin diseases and "badwind".	Present

Table 1. Cont.

TAXON	VERNACULAR NAME (PORTUGUESE/ ENGLISH)	USE VALUE	USED PART	CATEGORIES	PURPOSE	PERCEPTION OF PRESENCE AT THE LOCATION
Order Artiodactyla						
Family Cervidae						
Mazama gouazoubira (G. Fisher, 1814)	Veado catingueiro / Gray brocket deer	0.75	-	Food	-	Present

some interviewees, sloths reach the place where the projectile hit them. This "human-like" death behavior causes fear to hunters. Notwithstanding, marmosets are commonly captured and raised as pet.

Among the other species mentioned (see Table 1), some are less desirable due to specific meat characteristics and thus also had low use-values. The hunters consume few of some species, deeming them as "cold meat animals" (without flavor), or because they have a bad taste, as is the case of Capybara (*Hydrochoerus hydrochaeris*), and of the Southern Tamandua or anteater (*Tamandua tetradactyla*) (ant taste), and of the White-eared Opossum (*Didelphis albiventris*) that gives off a strong odor.

We recorded six species of mammals used for medicinal purposes (Table 1). The most representative (UV>1.0) were *C. subspinosus, C. prehensilis, C. unicinctus, and D. prymnolopha*. According to respondents, commonly used parts include thorn, tail, fur, and by-products such as body fat to treat skin diseases, "bad wind" (brain aneurysm), syphilis, bronchitis, and joint pain. The tail's tip of the *C. unicinctus* armadillo, for example, is used to scratch the ear of a person who is affected by hearing problems.

Six species of mammals with magical uses were also recorded (Table 1). Among the most representative are C. *subspinosus* fur providing protection, *C. prehensilis, D. prymnolopha*, and *D. novemcinctus* fur and thorns sharpen dogs' nostrils in search of prey, and provide protection to hunters. Despite their low UV, the Seven-banded armadillo *(D. septemcinctus*) (UV=0.63), and the Crab-eating Raccoon (*P. cancrivorus*) (UV=0.94) draw attention due to their citations of religious and artisanal use. The raccoon's skin, for example, is used to make drums, a sacred percussive instrument present in Candomblé yard cults in the region.

Species that are targets of conflicts such as the felines mentioned, the Eastern Tigrina *L. emiliae* (UV=0.06), the Ocelot *L. pardalis* (UV=0.13), the Jaguarundi *H. yagouaroundi* (UV=0.13), and the Cougar *P. concolor* (UV=0.19) have mostly low usage values. However, the conflicting relationships with residents, because they attack domestic animals, pose risks to people's lives, or even represent a risk to hunters during their expeditions, guarantee special attention to this group of species.

DISCUSSION

Multiple uses, conflicting relationships, and food taboos. Humans' knowledge and use of wildlife are everyday practices in many traditional communities, and hunting represents one of the most common activities exploiting these resources (Alves *et al.*, 2012; Chaves *et al.*, 2020). The mammals mentioned by the informants revealed an expressive richness of species and their uses for different purposes. Most species are pretty common in ethnographic studies, recorded in previous ethnozoological studies (Alves *et al.*, 2009b; Hanazaki *et al.*, 2009; Pereira and Schiavetti, 2010; Barbosa *and* Aguiar, 2012).

Most species had UV less than 1, ranging between 0.06 and 1.50. Among these, six had UV above one, reflecting the importance of these locally known species. The UV indicates which species have greater cultural importance, suggesting that the best-known resources are also the most used (Rossato *et al.*, 1999). Studies about hunting in

Brazilian Northeast did not test the relation between UV and hunting pressure. Nonetheless, species with higher hunting frequency are among those with the highest UV (see Souto *et al.*, 2018; Souza *et al.*, 2022). Thus, a high UV suggest more significant hunting pressure, increasing their local exploitation, which may drive the local extinction of these animals in the region. Further studies can verify whether a possible local decline is occurring and whether it is linked (directly or indirectly) to their use or other factors so that it is possible to design conservation strategies for these animals, even if locally.

Species with UV over 1 serve as food and have other artisanal, medicinal, or magical uses. These functional and multiple roles of fauna demonstrate detailed traditional knowledge of the ecology of exploited animals and other environmental aspects such as feeding, reproduction, habitat, and predation. According to Alves *et al.* (2012), the ecological knowledge of local populations is closely connected to their needs, as natural resources meet their needs. The meat of wild animals is present in families' diet, playing a relevant role for their subsistence at some point in their lives or that of older relatives. The history of the Santa Luzia do Itanhy inhabitants relies on performing subsistence activities and obtaining more basic animal protein, including hunting and fishing. According to (IBGE, 2013), 56.6% of the municipality's population has an income of up to half the minimum wage. The withdraw of wild fauna for food needs is one of the main categories of use in hunting studies and the primary motivating factor for the advent and permanence of hunting activities (Torres *et al.*, 2009; Brooks *et al.*, 2010; Pereira and Schiavetti, 2010; Fernandes-Ferreira *et al.*, 2013).

The fact that paca and armadillos are food preferences in this study shows a greater relationship of greed for slaughter. On the other hand, the greatest desire to consume paca is not directly related to the hunter's ability to find and kill the desired animal. Furthermore, a higher Use-Value does not necessarily correlate well/positively with the ability of some species to resist higher hunting pressure, serving only as an indication of the choice that each species is exposed to during this practice. The trend of preference for certain species for food purposes was also observed by Alves *et al.* (2009b) and Mendonça *et al.* (2011) in the municipality of Pocinhos, Paraíba. While the tendency towards high Use-Value was observed by Santos *et al.* (2019) only for Seven-tailed armadillo in the rural community Capivara, also in Paraíba, with food and magic uses being recorded.

The Bristle-spined porcupine had the highest use value (VU=1.50), representing the multiplicity of uses that the species has, highlighting how the animal's widespread knowledge among informants. The Bristle-spined porcupine (*C. subspinosus*), has protein intended for food use and hairs and spines for medicinal and magical use, respectively. According to Pasa (2007), the category of use of each species can be cumulative. It can belong to several categories, and it can have alimentary, medicinal, and magical purposes. The cultural relevance of species also directly relates to their multiplicity of uses since the intensified connection of some residents with wildlife resources makes certain species more notable for this population. According to Tardío and Pardo-de-Santayana (2008), the number of uses attributed to a resource is intrinsic to people's knowledge. Considering culture as a shared system of knowledge and skills among a group of people, its members will widely share the most central aspects of culture (Wan *et al.*, 2007). Therefore, the multiplicity of uses within a cultural system can materially express itself in different ways, such as staple food, crucial emergency food, sacred item, or medicine.

All respondents quoted the Bristle-back porcupine (*C. subspinosus*). The relevance of the species may be related to this animal's availability in the local forest remnants and to the benefits brought, as it is used both as food and as a medicinal and magical resource (providing material for the preparation of remedies). The Ecological Appearance Hypothesis suggests that species more apparent in nature, easier to be found in the forest, are more likely to be used by people (Phillips and Gentry, 1993a, 1993b). According to this hypothesis, *C. subspinosus* is the most apparent from an ecological point of view for the specific culture of the studied community. Thus, the availability of the species may

have expanded the local opportunities for collecting it, leading to a greater accumulation of knowledge about its uses, consequently increasing the interest of collectors in this resource. However, this contradicts what is known about the species, as the bristle-back porcupine is an animal with essentially nocturnal habits, arboreal and restricted folivorous (see Chiarello *et al.*, 1997; Giné *et al.*, 2010; Oliveira *et al.*, 2012), depending exclusively on forested environments. These features associated with the species' behavior results in an intrinsic difficulty in observing them relatively often. Thus, the search and multiple uses of this animal directly reflect a real predilection. This real predilection can imply a decrease in its population, increasing the degree of local extinction threat for a species already considered vulnerable to extinction (Catzeflis *et al.*, 2017).

As discussed above, the multiplicity of uses is a factor that may cause more significant hunting pressure on species, and the ease of access to them increases the risk that exploitation may occur at predatory levels, contributing to the decline of their local populations (Torres *et al.*, 2009). However, from another perspective, according to Alves *et al.* (2012), the multiple uses attributed to many species are a reflection of the optimization strategies adopted to cope with adversities and different socioeconomic conditions or also due to food preferences and aversions shared among members of local communities that use these resources, enhancing its use. Even if an animal is slaughtered for food, other products or by-products can be used for other purposes. Therefore, animals' uses multiplicity must be better investigated as to its negative or positive impacts, since these can contribute to the decline of their populations, or they can reduce hunting pressure on this or other species or even other taxonomic groups.

The use of animals for medicinal purposes is commonly observed in ethnozoological studies performed in northeastern Brazil, being in most cases associated with traditional communities, rural communities with low financial conditions, or with difficult access to medical care (Moura and Marques, 2008). Sloths and armadillos have been documented in several papers, playing a leading role in the diet, medicine, religion, and the cosmology of different traditional cultures (Costa-Neto, 2000b; Ferreira *et al.*, 2012). In a study conducted in Alter do Chão, municipality of Santarém, state of Pará, Branch and Silva (1983), reported that sloth body fat (*Bradypus* sp.) was used to treat cases of vaginal excretion (in addition to insect and scorpion bites), something similar to what was documented in our work, with a record of the use of hair to treat syphilis.

Armadillos, families *Chlamyphoridae* and *Dasypodidae*, had their food, medicinal and magical uses already reported. In the traditional medicine of the Pankararés, Costa-Neto (1999), reported that the Six-banded armadillo (*E. sexcinctus*) has body fat, bones, and blood used to treat wounds, and the Nine-banded armadillo (*D. novemcinctus*) has its shell used to treat wounds, make smokers and treat asthma. Barros *et al.* (2012), report that the tail of the Greater Naked-tailed Armadillo is used as a rod to treat earaches and deafness. The present work documents that the Southern Naked-tailed Armadillo (*C. unicinctus*) has its tail used to treat ear pain and deafness. According to Marques (1995), the tail is placed in the ear for the person to hear better and relieve the pain.

Paca (*C. paca*) had its medicinal use (fat) documented in this work to treat bronchitis. On the other hand, in traditional communities present in the Riozinho do Anfrízio Extractive Reserve, in Pará and a rural community located in Macaúbas (Bahia), respectively, Barros *et al.* (2012) and Souza *et al.* (2015), recorded the use of fat to treat skin diseases. The Brazilian porcupine (*C. prehensilis*), together with the Bristle-spined Porcupine (*C. subspinosus*) and the Black-rumped agouti (*D. prymnolopha*) have also had their medicinal uses reported in other works, in addition to consumption (Ferreira *et al.*, 2012; Alves *et al.*, 2016). From the burning of the spines of *C. subspinosus*, smoke is infused to treat "bad air/wind diseases" and pain and improve the accuracy of the scent of hunting dogs (Castilho *et al.*, 2013). The Brazilian porcupine (*C. prehensilis*) has its spines commonly used to treat epilepsy and respiratory problems, as reported by residents in the Marimbus/Iraquara Environmental Protection Area (Costa-Neto 2000a) and Recife, Pernambuco (Silva

et al., 2004). Unlike reported in our study, (Silva Neto *et al.*, 2017) reports that instead of using the fur, the Black-rumped agouti's tail (*D. prymnolopha*) is used to treat pain by residents of communities located in the Environmental Protection Area of Chapada do Araripe.

The Felidae family species demonstrated low use-values, and some species are not preferred for consumption. This trend, for the felines group, was also observed by Santos *et al.* (2019) and Alves *et al.* (2016) in their studies conducted in rural and urban communities in the municipalities of Santo André, Lagoa Seca, and Lagoa located in the state of Paraíba. In the mentioned studies, these species are slaughtered because they are considered targets of conflict or dangerous for the people in the community or the domestic animals.

The fact that conflicting relationships influence low use-values is associated with the low importance from the utilitarian perspective that these animals have for the community. Except for *P. concolor*, the other species of felines were mentioned by few informants, which reinforces the lack of appreciation for consumption, or possibly other types of uses, or even the insufficient knowledge about them, although they pose risks to farm animals (chickens, goats, and sheep), mostly free-range. Although this work has not evaluated the relationship of predation events with livestock confinement, according to Schulz *et al.* (2014), carnivores attack domestic species due to the decrease in their natural prey abundance, usually related to the reduction and fragmentation of habitat, accentuated by predatory hunting.

Among the species, less consumed due to certain aspects of their meat and that also presented low use-values, the interviewees revealed family preferences, dislikes, and taboos. According to De Garine (2002), food taboos are reproduced as social markers and act as fundamental elements to limit or expand the consumption of available foods (Macbeth and Lawry, 1997). Consequently, food taboos can benefit some species, rejected for taste or adverse effects (physical and magical), or increase the pressure, if they are more appreciated for consumption in a particular aspect (Ross *et al.*, 1978).

According to Cajaiba *et al.* (2015), Capybara (*H. hydrochaeris*), Southern Tamandua or anteater (*T. tetradactyla*), and White-eared Opossum (*D. albiventris*) have low use values in the rural settlements of Uruará (Pará) and rural communities of Solânea and Santo André in the state of Paraíba; however, no dietary taboos were reported. The same animals mentioned in this work are also avoided for consumption for practical reasons associated with taste, appearance, or unpleasant smell, as recorded in the study by Silva (2007) performed in riverside communities in the Middle Rio Negro (Amazonas). The present study observed that the interviewed avoided *T. tetradactyla* and *C. thous* because of their foul smell and unpleasant taste. The Tayra (*E. barbara*) is avoided because it eats honey, and therefore, according to the informants, its meat has a sweet taste. Likewise, monkeys are also avoided due to their similarity to humans and also because of their meat's unpleasant smell.

Extinction, Management, and Conservation Measures. As mentioned, older respondents, over 60 years old, reported the local disappearance of *P. onca* and two species of pigs: *T. pecari* and *P. tajacu*. The three mentioned species, therefore, can be considered as locally extinct. The last two species form large groups (herds), which probably should facilitate both the encounter and the slaughter of many individuals simultaneously, besides demanding large areas of life and foraging. The time scale indicated (±30-40 years; 1980s) for the disappearance of pigs coincides with the replacement of sugarcane fields at the expense of introducing pastures in the Santa Luzia do Itanhy region to the sugarcane crisis at that time.

According to Freire (1977), in the mid-twentieth century, Sergipe began a new period of expansion of livestock and pastures. In Santa Luzia do Itanhy, this new period gradually occurred after the sugar cane crisis in the 1960s. This activity was replaced by the expansion of cattle farming and coconut cultivation (Silva, 2016).

From 1980 onwards, citriculture was also introduced to reduce the impasses generated by the drop in

sugarcane production (Freire, 1977). All informants, except the youngest (23 years old), reported that the forest remnants – currently fragmented – existing in Santa Luzia do Itanhy formed a single forest, which was quickly replaced by deforestation and the advancement of pastures in the region. *Tayassu pecari* and *P. tajacu* may have suffered a strong impact from the loss of habitat, which, added to hunting, may have contributed to the population decline and local extinction.

According to Souza and Alves (2014) and Rocha-Mendes *et al.* (2005), hunters also reported the disappearance of these species caused by deforestation in forest fragments located in the municipalities of Fênix (Paraná) and Conde (João Pessoa). At the same time, Chiarello (2000) identified the reduction of their abundances in areas with high hunting pressure located in biological reserves in the state of Espírito Santo.

According to IUCN (2022), *T. pecari* is in the Vulnerable category (VU) and for the Atlantic Forest, is Critically Endangered (CR), and is considered extinct in much of Northeast Brazil (Keuroghlian *et al.*, 2012). On the other hand, *P. tajacu* is considered Least Concern (LC) according to (IUCN, 2022), and for the Atlantic Forest it is Nearly Threatened under high hunting pressure (Desbiez *et al.*, 2012).

Felids registered in this study, except for *L. pardalis*, are classified as vulnerable and endangered in national and international endangered species lists (ICMBio, 2018; IUCN, 2022). Furthermore, they are strongly affected by habitat loss and hunting because they are specialists and have various trophic requirements, low reproductive rate, long life and are very susceptible to anthropogenic disturbances. (Feijó and Langguth, 2013; Marinho *et al.*, 2018).

CONCLUSIONS

Thus, it is remarkable that the uses of animals are strongly related to the local culture, evidenced by the existence of a wide variety of interactions between residents and the expressive richness of native mammal species. Furthermore, these multiple uses of fauna and their impacts on populations need to be better and adequately evaluated. Its various uses must be considered during the elaboration of action plans for the conservation of species mentioned and considered threatened with extinction or even on the way to local extinction. This attitude refers especially to the frequently exploited species or those in more advanced degree of extinction threat (Alves and Rosa, 2007a, 2007b, 2007c).

The registration of this practice requires immediate measures such as the elaboration of the management plan for the RPPNs, highlighting the importance and need to consider the social and cultural aspects of the local communities involved. We expect that the present study helps to preserve the cultural identity of SLI, including the local biodiversity, guiding management strategies that consider the local community. Thus, environmental education programs, legal regulation, and hunting control must be implemented for better management plans to support and conserve local biodiversity. Another point that deserves attention could be establishing a community monitoring system for hunting target populations to manage the protected areas present in the study region.

Future researches can complement the pieces of information of the present study. Among the possible future researches may be included: identifying illegal trade in wild animals in the region and the current market demand (consumption and breeding); verify the number of poached specimens or local biomass; check for seasonal variation in the hunted species; survey the biomass of bush-meat consumed and the effects of subsistence hunting on local mammal community.

The present work results are expected to contribute to new ethnozoological studies in Sergipe, helping to preserve the community's cultural identity and the biodiversity contained in the forest fragments of Santa Luzia do Itanhy. In the meantime, the present research supports arguments so that local managers, population, and stakeholders can make changes or think of new collective strategies for managing UC in the region.

ACKNOWLEDGMENT

We thank to the Federal University of Sergipe to the PRODAP Fellow to MCSA, and the National Council for the Scientific and Technological Development (CNPq) for the Post-Doctoral fellowship to RB-M (150123/2018-3, at the time of research), and to the Brazilian Coordination for Higher Education Personnel Training (CAPES) for the current post-doctoral fellow to RB-M (88887.320996/2019-00). We are incredibly grateful to Mr. Francisco Mundi (Farm Manager) and Mr. Raimundo Juliano (former Farm owner (both in memoriam) for their kind acceptance to run field researches in the Private Nature Reserves mentioned above. Mr. Raimundo Juliano is one of the first, if not the first, to promote the private nature reserves in the State of Sergipe, mainly to protect the Endangered Coimbra-Filho's titi monkey (*Callicebus coimbrai*), and sadly died as a result of the COVID-19, thank you for your contribution and pioneering. We are also grateful to all the informers who shared their knowledge with this research.

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