

Hunting Activities and Wild Fauna Use: A Profile of Queixo D'antas Community, Campo Formoso, Bahia, Brazil

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ABSTRACT

Brazil's wild animals are still used nowadays as a food source by traditional populations. However, there is little knowledge about hunting activities in the Northeastern region of Brazil. The aim of this research was to evaluate the hunting activities and use of wild fauna by the inhabitants of Queixo D'antas. It is a community located within the area where the Parque Nacional do Boqueirão da Onça (PNBO, Boqueirão da Onça National Park) will be established in the town of Campo Formoso, Bahia. In order to obtain data, we did 40 semi-structured interviews in May 2010. Most of the interviewees (67.5%) admitted to do hunting activities, 55.17% for subsistence and 37.93% for recreation purposes. The 'tatu-verdadeiro' (*Dasypus novemcinctus*) is the most hunted animal in the study area. The hunters showed preference for using a rifle as the preferred hunting tool (47.5%). The interviewees mentioned a total of 16 wild animal species that they think are disappearing from the study area. A total of 35% consider over-hunting as the major cause for the disappearance of the species. The community's inhabitants also raise wild animals as pets and birds were the most mentioned species used for this purpose (17.5%). Wild fauna is also used as a source for therapeutic treatments. Fifteen species were mentioned as the source of 11 raw materials used to prepare medicine to treat 17 illnesses. Our data show that the establishment of the PNBO and the implementation of educational programs for the local inhabitants are fundamental for the management and conservation of the study area's biodiversity.

Keywords: caatinga, conservation, ethnozoology, fauna exploitation

Abbreviations: IBAMA, Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute of Environment and Renewable Natural Resources); IBGE, Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics); ICF, Informed Consent Form; ICMBio, Instituto Chico Mendes de Conservação da Biodiversidade (Chico Mendes Conservation and Biodiversity Institute); PNBO, Parque Nacional do Boqueirão da Onça (Boqueirão da Onça National Park); SEI, Superintendência de Estudos Econômicos e Sociais da Bahia (Economic and Social Studies Agency of the State of Bahia)

INTRODUCTION

Brazil has a great diversity of ecosystems. It has approximately 13% of the whole planet's biodiversity (Lewinsohn and Prado 2005); especially vertebrate animals and higher plants (Mittermeier *et al.* 2005). The Caatinga is a typical Brazilian biome. It presents thorny shrublands and seasonally dry forest. It comprehends an area of approximately 735.000 km² (Silva *et al.* 2004a; Valle 2007). Compared to other Brazilian biomes, the Caatinga has unique meteorological features, like high annual average temperature, low levels of relative humidity, high potential evapotranspiration and low annual precipitations (Valle 2007). Non sustainable human activities are leading to the degradation of Caatinga through slash-and-burn agriculture, wood exploitation, deforestation for cattle and goats pasture and uncontrolled hunting of wildlife (Leal *et al.* 2005).

According to Robinson and Redford (1991), human beings use wild animals for several purposes like: i) subsistence hunting, the process of obtaining animal resources for self consumption; ii) local commercialization, animal exploitation for doing local commerce; iii) production systems, animal production in private properties; iv) sport hunting, hunting activities only with recreational purposes; v) large-scale commercialization, use of animal products and sub-products for large scale commercialization. Wild fauna is still a source of food for many countryside regions around

the world. This is especially true for Brazil, due to its rich biodiversity and impoverished human groups (Figueira *et al.* 2003). Subsistence hunting is the most frequent manner in which wildlife is exploited in developing countries. It is often an integrative part of the population's life style. Subsistence hunting expressively contributes to some nation's economy and, mainly, to the welfare of rural populations (Dourojeanni 1985). According to Naranjo *et al.* (2004), subsistence hunting is defined as wild animals' hunting for obtaining food, skin, medicine, and other products consumed by the hunter and his family, or for bartering with other hunters for his own benefit without commercial purposes.

Subsistence hunters are typically from rural regions and are poor. They basically hunt for sustaining their own families (Mayor *et al.* 2007). Therefore, wild animals' consumption, apparently, has a significant nutritional importance for them and their families, considering their few economical resources for buying meat from markets (Costa-Neto 2000; Nogueira-Filho and Nogueira 2000). In some areas of the world, species like 'queixada' (*Tayassu pecari*), 'anta' (*Tapirus terrestris*), 'veado' (*Mazama gouazoubira*), 'paca' (*Cuniculus paca*) and other large vertebrates compose the greatest proportion of biomass extracted from the wild fauna (Naranjo *et al.* 2004).

Wild fauna have been seen as a renewable natural resource and for this reason it should be managed (Ferraz *et*

al. 2001). History has been showing that animal species in several parts of the world are declining as a result of habitat loss and overexploitation, due to the expansion of human populations (e.g. Redford 1992; Robinson and Bennett 2000; Fa and Peres 2001). Natural resources utilization became a growing necessity for human populations, as it guarantees their survival (Mayor *et al.* 2007). Ethnozoology has a major key in helping us understand wildlife hunting by human populations, because it is a science focused directly in the human/ animal relationship (Santos-Fita *et al.* 2009). Several ethnozoological studies about hunting practices performed by traditional populations are considered fundamental to support management plans (Pereira 2008; Torres *et al.* 2009). However, there are few ethnozoological studies about subsistence hunting in the Brazilian semi-arid region (e.g. Mourão *et al.* 2006; Costa-Neto 2006). Few approaches bring together the human beings and the nature around them as elements of the same ecosystem, taking into consideration traditional populations' knowledge (Valle 2007).

The aim of this work was to obtain data about hunting activities and wild fauna use by the inhabitants of the Queixo D'antas Community, Campo Formoso, Bahia. Data obtained from this study are intended to contribute to future management plans and conservation programs in the study area. The Parque Nacional do Boqueirão da Onça (PNBO) is proposed to be established in the region in which this research was developed. Its establishment may have a positive effect in the conservation of the local biodiversity, since many inhabitants of that region perform hunting activities. This research is also relevant because the data generated by it may provide the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) with scientific information to justify the establishment of the park.

MATERIALS AND METHODS

Study area and population

Campo Formoso has an estimated population of 68.101 inhabitants and an area of 6.806 km² (IBGE 2009). It is situated 400 km from Salvador, the capital city of the state of Bahia. It has a semi-arid climate and its predominant vegetation is the opened and dense arboreal Caatinga without palm trees (SEI 2010).

Queixo D'antas community is approximately 150 km far from the central urban area of Campo Formoso (Fig. 1). It is composed only by 101 houses. It is inhabited by poor 'quilombola' people (descendants of slaves who escaped from slave plantations) (s/a 2010). According to this community's inhabitants the tapir (*Tapirus terrestris*) used to be the most abundant animal in that region, hence the community's name "Queixo D'antas" (Tapirs' Chin).

The study area is within the region in which the PNBO is proposed to be established. This proposal is under legal evaluation by the ICMBio. The PNBO has a proposed area of 823.000 ha. It includes five towns of the state of Bahia, Sento Sé, Sobradinho, Umburanas, Campo Formoso e Juazeiro. The study region presents poorly studied Caatinga ecosystems (Fig. 2) and may have several endemic and endangered species (ICMBio 2010).

Data collection and statistical analysis

The field work was done during May 2010. We conducted 40 structured interviews – composed by close-ended questions with previously established possible answers – and semi-structured interviews – in which the interviewees could formulate their own answers to open-ended questions (Chizzotti 1991; Ditt *et al.* 2003). As often as possible, husband and wife of each family were interviewed with different questionnaires adapted to their genre. At first, the interviewees were chosen because they were previously recommended to us as members of the community that practiced hunting activities, as proposed by Alarcon (2006). A member of a local Workers Syndicate and a Queixo D'antas community's teacher recommended us some people who were interviewed in this study. Afterwards, the first interviewees themselves indicated us possible new informants, a technique named "snowball" (Bailey

1982).

We questioned the interviewees about the most hunted animals in the study area and its use; period in which the animals were hunted and hunting sites; techniques and tools applied for hunting; possible reductions of wild animal populations and the reasons for those reductions; as well as, recipes used for cooking wild animals' meat.

Each interview lasted for about 30 to 40 min. Before each interview, it was presented to all the participants an Informed Consent Form (ICF) and each of them could decide whether they wanted to take part on the study or not. Their signatures on the form were obtained individually in their houses after the reasons for the study were explained to them.

To confirm the consistence and truthfulness of some answers, we did repeated interviews in synchronic (in which the same question is made to different people in a short amount of time) and diachronic (the same question is repeated to the same person after a long time) (Sandelowski 1999). Hence, during the interviews we made similar questions, like: "what is the animal that you most hunt?" and "what is your favorite hunting animal?", so that we could verify the consistence and truthfulness of the answers, according to Cullen-Júnior *et al.* (2004). Besides it, we presented to the interviewees photos of wild animals that occur and do not occur at the study area, also to verify truthfulness and to help to identify the animals.

To better understand our data, we inserted it in a data sheet using the Excel 2003 software. After it, we used the software SPSS 15.0 for Windows to perform statistical analyses and generate graphs.

We used chi-square for simple frequency data to analyze how sex, monthly income and education level influence hunting activities.

Data were also evaluated by description, since the variables are qualitative. To do so we prepared description tables.

RESULTS AND DISCUSSION

Interviewees' profile

We did a total of 40 interviews, eleven were conducted with women and 29 with men. The interviewees' ages ranged from 19 to 83 years old. Seven of the interviewees had ages from 19 to 29 years old, nine from 30 to 40, six from 41 to 51, eight from 52 to 62, seven from 63 to 73, and only one from 74 to 84. Two interviewees did not declare their ages. The average age of male interviewees was 48,5 years, ranging from 19 to 83 years old. While the average age of the females interviewees was 46 years, ranging from 23 to 70.

Most of the interviewees, 19 (47.5%), did not complete elementary school, eight (20%) did not have any level of education, and only three (7.5%) finished high school education. A high rate of illiteracy among respondents was expected, since in the Caatinga region the number of illiterate people over 15 years old is quite large, reaching 60% in almost all municipalities in that region (Batista and Sampaio 2003).

Our data show that most of the respondents, both men and women, are agricultural laborers (n = 19). Farm work is common in the Caatinga region. It includes agricultural, cattle raising and extractive activities (Batista and Sampaio 2003). The per capita monthly income of 15 interviewees (37.5%) ranged from 466.00 to 930.00 reais. One of the interviewees said that his monthly income comes from a Brazilian welfare program called 'Bolsa Família'. It provides financial aid to poor and indigent Brazilian families. Only one of the interviewees declared to not have any monthly income.

The characteristics of the hunting practices

The hunting activity in the study area is practiced by most of its residents, since, according to the survey, 67.5% of the interviewees declared that they do hunting activities. We also asked women from the community if their husbands perform hunting activities. Seven women (66.63%) ans-

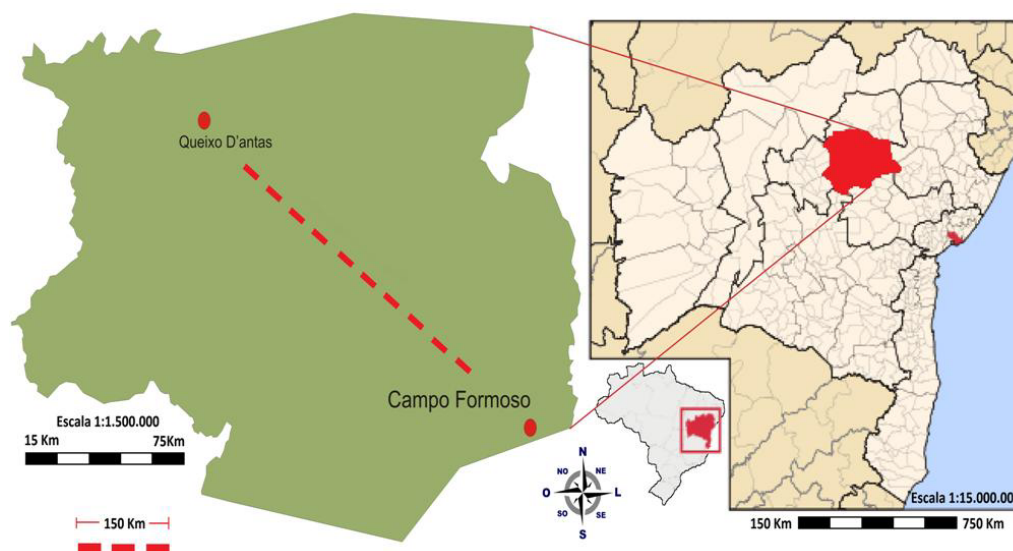


Fig. 1 Map of the town of Campo Formoso in the state of Bahia and the location of the Queixo D'antas Community in it. Modified from the Portal Campo Formoso. Available online: <http://www.portalcampoformoso.com.br>



Fig. 2 Local landscape characteristics. (A) Aroboreal Caatinga (B) and (C) Shrublands in Caatinga and rock outcrop. (D) A view of the mountain range in Queixo D'antas community, a local proposed to be within the limits of the Parque Nacional do Boqueirão da Onça (PNBO). By Rangel Carvalho.

wered that their husbands do it, while four (33.37%) said that their husbands do not hunt.

Data indicate that gender has an influence on the activity of hunting ($\chi^2 = 23.59$, $df = 1$, $P < 0.005$), as the percentage of men who hunt (89.7%) compared to female hunters (9.1%) is 10 times higher. Thus, it becomes clear that hunting in Queixo D'antas community, despite being practiced by both men and women, is a male predominant activity. It may be an indication of a cultural aspect of Queixo D'antas community, because, according to Vargas (2000), the hunting activity provides prestige and braveness recog-

nition for those men who perform it.

Our data show that monthly income ($\chi^2 = 5.52$, $df = 6$, $P > 0.05$) and education ($\chi^2 = 4.22$, $df = 7$, $P > 0.05$) do not influence the activity hunting in the studied community. Hunting activities may be more related to cultural reasons.

The most practiced type of hunting in the study area is the subsistence one (55.17%), but we also registered the practice of sport hunting (37.93%) and the capture of wild animals to raise them (6.9%). According to Mayor *et al.* (2007) subsistence hunters are typically rural, have low monthly income and practice hunting to support their fami-

Table 1 Animals used as food by the inhabitants of Queixo D'antas community, Campo Formoso, Bahia, Brazil.

Cited animals	Probable taxonomic classification	Number of citations	% of the interviewees
'Tatu-verdadeiro'	<i>Dasyurus novemcinctus</i>	16	40.0%
'Tatu-peba'	<i>Euphractus sexcinctus</i>	12	30.0%
Peccary	<i>Pecari tajacu</i>	4	10.0%
Deer	<i>Mazama gouazoubira</i>	3	7.5%
Bird	Passeriformes	3	7.5%
Agouti	<i>Dasyprocta leporina</i>	2	5.0%
Opossum	<i>Didelphis albiventris</i>	2	5.0%
Pigeon	<i>Columba palumbus</i>	2	5.0%
'Tatu-bola'	<i>Tolypeutes tricinctus</i>	1	2.5%
Jaguar	<i>Panthera onca</i>	1	2.5%
'Tamanduá-mirim'	<i>Tamandua tetradactyla</i>	1	2.5%
'Nambú'	<i>Crypturelus tataupa</i>	1	2.5%
Did not know how to answer		15	37.5%
Total number of citations		63	
Number of interviewed people			40

lies. While sport hunting is not held for the purpose of acquiring an extra source of protein, but in order to pursue an activity for recreation and sport. This practice is rooted in the population as a cultural activity (Laufer 2009). Confessor *et al.* (2009) mentions that hunting activity is knowledge transmitted from generation to generation and that it is part of the Caatinga inhabitants' cultural traditions. Thus, the practice of hunting can be influenced by cultural preferences (Escamilla *et al.* 2000).

Results indicate that 42.5% of the interviewees eat wild animals' meat annually, and 32.5% eat it monthly. These data raise some doubts about the purpose of subsistence hunting in the region. If the local population really needed wild fauna for their own consumption, then they would eat it daily or weekly, but not only annually, as reported by most of the local residents. We think that the hunting activities in the study area may be better supported on cultural and social explanations than on subsistence purposes. Among the animals used for food, according to the interviewees, the *D. novemcinctus* had the highest number of citations ($n = 16$, **Table 1**).

According to the Brazilian law, predatory hunting practices are considered a federal crime. It is likely that it has influenced the interviewees' answers. The Law 9.605/98, Article 29, establishes that it is forbidden to kill, pursue, hunt, catch and use native fauna species or animals in migratory route, without permission, license or authorization from a competent authority, or in disagreement with that obtained permission (Brazil 1998). However, subsistence hunting of non-endangered species is allowed when the individual has no other source of protein.

Hunting in the region is not an activity performed only by the local residents of Queixo D'antas community. According to the interviewees, people from outside the community, especially from Juazeiro (a nearby town in the State of Bahia), Lage dos Negros and Salitre (both are communities in the town of Campo Formoso), go to the study area for hunting, because it has a vast quantity of wild animals. The main reasons for this practice can be attributed to recreation and commercialization of wildlife. As mentioned by one of the interviewees: "A perseguição maior dos bichos é do povo de fora" (The animals are more hunted by people that are from outside the community) (Mr. J. J. F. 60 years old), "Vem um pessoal rico caçar aqui" (Rich people come here for hunting) (Mr. M.S.S. 48 years old), "O pessoal mata pra comer, alguns pra vender e comercializar" (People kill animals to eat, and some to sell and commercialize it) (Mr. S.J.S. 60 years old).

Many local residents said that they do not like jaguars (*Puma concolor*, *Leopardus tigrinus* or *Panthera onca*). According to them, jaguars attack their livestock. Predation of livestock by wild carnivores may occur due to their high demand for rich nutritional sources (Valle 2007) and to the few occurrences of natural preys such as deer, peccaries, agoutis and other species that occur in the Caatinga at the

Queixo D'antas community. Livestock predation by jaguars was also reported in other studies conducted in Brazil (Pianca 2004; Rocha-Mendes *et al.* 2005; Palmeira and Barrella 2007). However, during our stay at the study site, several people said that even the dogs were killing their livestock. They were attacking mostly goats (*Capra hircus*) and chickens (*Gallus gallus domesticus*). In some parts of Brazil, many wild species are hunted because they represent risks to the domestic creations (Trinca and Ferrari 2006; Alves *et al.* 2009). These wildlife-human conflicts are a widespread conservation issue of increasing concern to conservationists, especially in regions where protected areas are being established. Usually, the conflicts between wildlife and human communities occur when the needs and behaviors of wild animals have negative impacts on health or economy of the human population (Treves *et al.* 2006). Thus, these conflicts result in losses for both sides. The interaction between humans and wildlife is an important factor in management plans for conservation of ecosystems (Alves *et al.* 2006).

The reduction of the number of wild species in the study area was also reported by the local residents. Sixteen species have been mentioned by the interviewees. The most mentioned were the 'tamanduá-bandeira' (*Myrmecophaga tridactyla*; $n = 17$), the jaguar (*Panthera onca*; $n = 7$) and the tapir (*Tapirus terrestris*, $n = 3$), as **Table 2** shows. The reasons for this reduction were attributed to excessive hunting (35%), the increase of human population (15%), and the migration of wildlife (10%).

The interviewees cited as the most hunted species, the 'tatu-verdadeiro' (*Dasyurus novemcinctus*), 'tatu-peba' (*Euphractus sexcinctus*), veado (*Mazama* sp.), 'mocó' (*Kerodon rupestris*), caititu (*Tayassu tajacu*), 'tatu-bola' (*Tolypeutes tricinctus*) and the 'gato-do-mato' (*Leopardus pardalis*). Among avian species they mentioned the 'juriti' (*Leptotila rufaxilla*), 'codorna' (*Nothura* sp.), and pigeon (*Zenaidura macroura*). The 'teiú' (*Tupinambis* sp.) was the only reptile species cited (**Table 3**).

An important point to be addressed is that the 'papa-gaio-galego' (*Alipiopsitta xanthops*) was mentioned as one of the most hunted animals used for consumption. However, previous studies reported that animals of this species are used for local commercialization (Souza and Soares-Filho 2007).

The 'tatu-verdadeiro' *D. novemcinctus*, 'peccary' *P. tajacu*, 'tatu-bola' *T. tricinctus* and the 'codorna' *N. boraquiria* were cited by the interviewees as wild animals that are disappearing from the study area. However, these are the same animals which were mentioned as the most hunted ones. This data shows the population's knowledge about the species of the region which may be at risk of local extinction. But it also led us to realize that, although these animals are disappearing, they are still being captured by hunters in the region, thus a large environmental education program is needed in the study area.

Table 2 List of animals that are disappearing or had its populations reduced in Queixo D'antas community, according to the local inhabitants.

Cited animals	Probable taxonomic classification	Number of citations	% of cited animals
'Tamanduá bandeira'	<i>Myrmecophaga tridactyla</i>	17	42.5%
Jaguar	<i>Panthera onca</i>	7	17.5%
Brazilian tapir	<i>Tapirus terrestris</i>	3	7.5%
'Papagaio-galego'	<i>Alipiopsitta xanthops</i>	3	7.5%
'Tatu-verdadeiro'	<i>Dasypus novemcinctus</i>	2	5.0%
'Preá'	<i>Didelphis albiventris</i>	2	5.0%
'Luis-cacheiro'	<i>Coendou sp.</i>	2	5.0%
Peccary	<i>Pecari tajacu</i>	2	5.0%
'Canário verdadeiro'	<i>Sicalis flaveola</i>	2	5.0%
'Queixada'	<i>Tayassu pecari</i>	1	2.5%
'Tatú-canastra'	<i>Priodontes giganteus</i>	1	2.5%
Capybara	<i>Hydrochoerus hydrochaeris</i>	1	2.5%
'Zabelê'	<i>Crypturellus noctivagus</i>	1	2.5%
'Tatu-rabo-de-couro'	<i>Cabassous unicinctus</i>	1	2.5%
'Tatu-bola'	<i>Tolypeutes tricinctus</i>	1	2.5%
'Codorna'	<i>Nothura sp.</i>	1	2.5%
'Arara'	<i>Ara ararauna</i>	1	2.5%
Did not know how to answer		3	7.5%
Total number of citations		51	
Number of interviewed people			40

Table 3 The most hunted animals by the inhabitants of Queixo D'antas community, Campo Formoso, Bahia.

Cited animals	Order	Family	Scientific names	N. of citations	% of the interviewees
MAMMALIA					
'Tatu-verdadeiro'	Cingulata	Dasypodidae	<i>Dasypus novemcinctus</i>	22	55%
'Tatu-peba'	Cingulata	Dasypodidae	<i>Euphractus sexcinctus</i>	12	30%
Peccary	Artiodactyla	Tayassuidae	<i>Pecari tajacu</i>	7	17.5%
'Tatu-bola'	Cingulata	Dasypodidae	<i>Tolypeutes tricinctus</i>	1	2.5%
Deer	Artiodactyla	Cervidae	<i>Mazama gouazoubira</i>	1	2.5%
'Gato-do-mato'	Carnivora	Felidae	<i>Leopardus tigrinus</i>	1	2.5%
Agouti	Rodentia	Dasyproctidae	<i>Dasyprocta leporina</i>	1	2.5%
'Mocó'	Rodentia	Caviidae	<i>Kerodon rupestris</i>	1	2.5%
AVIAN					
'Nambú'	Tinamiformes	Tinamidae	<i>Crypturellus tataupa</i>	3	7.5%
Pigeon	Columbiformes	Columbidae	<i>Columba palumbus</i>	3	7.5%
'Codorna'	Tinamiformes	Tinamidae	<i>Nothura sp.</i>	1	2.5%
'Juriti'	Columbiformes	Columbidae	<i>Leptotila rufaxila</i>	1	2.5%
Unidentified				4	10%
REPTILIA					
'Teiú'	Squamata	Teiidae	<i>Tupinambis teguixin</i>	1	2.5%
None				4	10%
Total				63	

Table 4 Animals with the tastiest meat, according to the inhabitants of Queixo D'antas community, Campo Formoso, Bahia, Brazil.

Cited animals	Probable taxonomic classification	Number of citations	% of citations
'Tatu-verdadeiro'	<i>Dasypus novemcinctus</i>	20	50.0%
Peccary	<i>Pecari tajacu</i>	7	17.5%
'Tatu-peba'	<i>Euphractus sexcinctus</i>	5	12.5%
Agouti	<i>Dasyprocta leporina</i>	3	7.5%
Pigeon	<i>Columba palumbus</i>	2	5.0%
'Juriti'	<i>Leptotila rufaxila</i>	2	5.0%
Deer	<i>Mazama gouazoubira</i>	1	2.5%
'Nambú'	<i>Crypturellus tataupa</i>	1	2.5%
Bird	Passeriformes	1	2.5%
'Codorna'	<i>Nothura sp.</i>	1	2.5%
Did not know how to answer		4	10.0%
Total number of citations		47	
Number of interviewed people			40

The 'tatu-verdadeiro' (*D. novemcinctus*) was mentioned by the local residents as the wild animal with the most tasteful meat ($n = 14$) and the second most mentioned was the caititu (*P. tajacu*; $n = 4$) (Table 4).

The high occurrence of captures of the *D. novemcinctus*, mentioned by 22 (55%) of the interviewees, may be due to its meat be considered tasteful by the local residents and because these animals are easy to be located in the study area.

Our data shows that Queixo D'antas community's inhabitants have a preference for mammals. This may be related

to the fact that these animals have a relatively large size which implies a higher amount of meat and also because mammals' meat are tastier (Bolkovic 1999).

Hunting methods and techniques

The Queixo D'antas community's inhabitants mentioned three different types of methods and techniques that they apply on hunting. According to Alves *et al.* (2009), hunting methods and techniques are passed from generation to generation and it is a cultural feature of the people who live

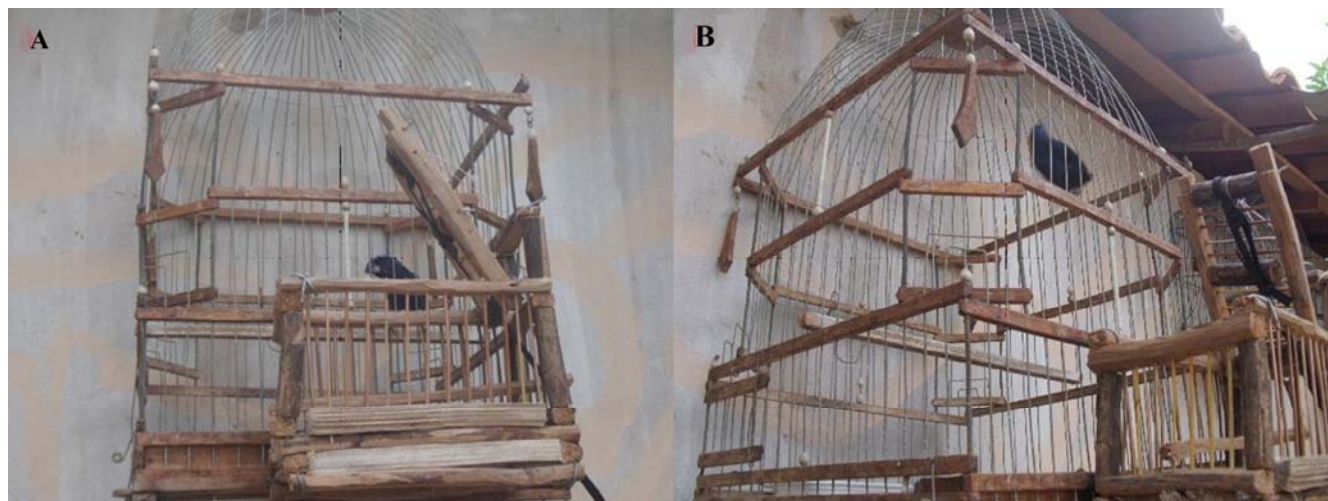


Fig. 3 The 'Arapuca', a kind of trap used to capture avian species. The animals are attracted by a singing individual inside the cage, as soon as the attracted animal enters the 'arapuca', it is closes and captures it. (A) Frontal view. (B) Side view.

in the Caatinga region. Hunting activities start in early childhood when small animals (generally birds) are hunted for food or sport. They are hunted with sling-shots, or captured in traps and turned into pets. Hunting among adults is carried out using several capture techniques that are adapted to the type of prey and the habitat where the species live in (Alves *et al.* 2009).

The most cited method was "hunting with shotgun" ($n = 19$), which can be a homemade shotgun or a caliber shotgun, especially .36. Shotgun hunting is performed through walks on roads, pathways and streams. It can be made for up to two individuals, keeping a certain distance between them. To successfully apply this technique, the hunters must be able to detect the animal before it can notice their presence (Pereira 2008). This kind of technique was also reported by e.g. Pianca (2004), Nucamendi (2006) and Pereira (2008).

The second most mentioned technique by the interviewed people was "hunting with dogs" ($n = 16$). It is the use of a dog to locate and surround a wild animal until the arrival of the hunter, who then can capture or kill the animal. This type of technique has been reported in other studies and it is also used by hunters who live in regions of the Atlantic Forest, Caatinga and Cerrado (Rocha-Mendez *et al.* 2005; Alves *et al.* 2009; Lim 2010). Alves *et al.* (2009) reported, in a study developed in the Caatinga region (Paraíba state), that two or more men can hunt using dogs. Usually, one or two trained dogs are used. It is performed at night and the target-prey is generally a mid-sized mammal, such as the *Dasypus novemcinctus* or *Tamandua tetradactyla*.

The least mentioned technique ($n=4$) was the use of traps. It is the use of special devices to capture wild animals. The most used types of traps in the study area are the 'arataca' (iron snap-trap) and the 'arapuca' (crude cages).

The 'arapuca' is an artifact of indigenous origin. It consists of a trap made of sticks, with a pyramidal shape, and designed to catch different kinds of birds, small mammals or other small wild animals. Its structure is made like a cage of small pieces of wood, which get smaller and smaller on the top. It is usually tied with string or wire with overlapped layers in parallel directions (Fig. 3). According to Alves *et al.* (2009), depending on the exact size of the 'arapuca', it can capture a variable number of individuals. This type of technique was also described by Rosas (2006) in a study conducted with the Seringais Cachoeira's inhabitants, located in the southwestern of the state of Acre. In that study the use of traps was related by 20% of the interviewees.

Alves *et al.* (2009), described 'arataca trap' use for control hutting, the animals that are most hunted using this technique are the *Puma yagouaroundi*, *Leopardus tigrinus* and the *Cerdocyon thous*, as these animals usually attack domestic animals and destroy plantations. The 'arataca' was

Table 5 Techniques and tools used for the hunting activities practiced by the inhabitants of Queixo D'antas community.

Techniques and tools	Number of citations	% of citations
Shotgun	10	25.0%
Shotgun and dog	5	12.5%
Sling-shots	3	7.5%
Dog	2	5.0%
Shotgun and sling-shot	2	5.0%
Dog and machete	2	5.0%
Digger	1	2.5%
Machete	1	2.5%
Trap	1	2.5%
Wooden spear	1	2.5%
Dog and trap	1	2.5%
Dog and sling-shot	1	2.5%
Dog and wooden spear	1	2.5%
Dog, sling-shot and digger	1	2.5%
Dog, machete and wooden spear	1	2.5%
Dog, shotgun and trap	1	2.5%
Dog, digger and machete	1	2.5%
Machete, digger and hoe	1	2.5%
None	4	10.0%
Total number of citations	40	
Total number of interviewed people		40

also the most used hunting technique by the hunters of a rural settlement in Nova Bandeirantes, Mato Grosso, as reported by Trinca and Ferrari (2006).

Besides the techniques mentioned above, the interviewees also mentioned some tool used for hunting as: i) the digger, which is useful for catching 'tatus', ii) slingshots, often used to catch birds and, iii) the hoe, which is a widely used tool to capture the 'tatu-verdadeiro' and the 'tatu-peba'. Several other tools were mentioned by the interviewees, as the Table 5 shows. The use of hoes and diggers are generally associated with the "hunting with dogs" technique. In this technique, the dogs search for a prey's burrow. When it is found, the hunter removes the land until the animal can be caught.

Preferences, uses and values of the hunting activity

The majority of the interviewed people said that they prefer to capture wild animals in open areas (25.5%), i.e., open areas with low vegetation. But they also mentioned other hunting places, like closed areas, that can be defined as a place of dense and closed vegetation; trails, which are nar-



Fig. 4 Wild birds domesticated by the inhabitants of Queixo D'antas community, Campo Formoso, Bahia, Brazil. (A) 'Periquito vaqueiro' *Aratinga cactorum*. (B) 'Pássaro preto' *Gnorimopsar chopi*. (C) 'Cardial' *Paroaria dominicana*. (D) 'Canário da terra' *Sicalis flaveola*.

Table 6 Periods of highest consumption of protein from animals hunted by the inhabitants of Queixo D'antas community, Campo Formoso, Bahia, Brazil.

Period	% of interviewees
Dry season	52.5%
Rainy season	5.0%
None	20.0%
Did not know how to answer	22.5%
Total	100.0%

row roads that cross the surroundings of the study area and; and near to water, an area near streams and creeks.

Most of the interviewees reported that they consume more wild animals' meat during the dry season (52.5%, **Table 6**), a period that runs from late December to early June. Nucamendi (2006) reported that the dry season is also the preferred period of the year for hunting to the hunters of the indigenous communities of Nahá (Lacandones) and Frontera Corozal (Cho'les) in the Lacandon jungle, southern Mexico. However, according to Pereira (2008), the summer is not the most appropriate time to hunt due to the large amount of dry leaves on the ground. It make too much noise when stepped on, driving away the animals.

The interviewees claimed to have a control of the hunting activity. According to them, this activity is not practiced during the rainy season (July to December), because it is the animals' reproduction period, so the females are pregnant or with newborn puppies. They also said that if during the hunting they capture pregnant animal they would release it immediately. Moreover, some said that they prefer to hunt male and adult animals, than female and young ani-

mals. However, our data lead us to question these reports, since the hunters themselves said to use hunting techniques and tools that hurt the animals. It is hard to believe that those animals would be released after been injured and caught.

In addition, the rainy season period mentioned by the interviewees is in disagreement with the scientific reports. According to Barros *et al.* (1999), the rainy season in the semi-arid region of northeastern Brazil is during the months from January to June, while the dry season, runs from July to December. Although most hunters claim to not practice hunting during the rainy season, many species of the Caatinga are more abundant during that time of year due to seasonal variation. There are also animal species that have a stable number of individuals throughout the year (Confessor *et al.* 2009).

Besides the uses mentioned above, interviewees (n = 15) also declared to raise some wild animals. Among those animals, they mentioned: the 'tamanduá' (*Tamandua tetradactyla*), birds (*Passeriformes*), 'mico' (*Callitrix argentata*), 'nambu' (*Crypturelus tataupa*), 'juriti' (*Leptotila rufaxila*) and the 'jandaia' (*Aratinga solstitialis*) (**Table 7**). Some species of birds were noted when we visited the houses of some interviewees, like the 'canário da terra' *Sicalis flaveola*, the 'cardial' *Paroaria dominicana*, the 'pássaro preto' *Gnorimopsar chopi* and the 'periquito vaqueiro' *Aratinga cactorum* (**Fig. 4**). The *A. solstitialis* and *L. rufoaxilla* were mentioned in Souza and Soares-Filho (2005) as species that are victim of illegal trade in the regions of Paraguaçu and southwestern of Bahia.

According to Nogueira and Nogueira-Filho (2000) wild animals' raising has been indicated as a possible source of animal protein for poor rural populations in developing

Table 7 Animals raised by the inhabitants of Queixo D'antas community, Campo Formoso, Bahia, Brazil.

Cited animals	Probable taxonomic classification	Number of citations	% of citations
Bird	Passeriformes	8	20.0%
'Jandaia'	<i>Aratinga solstitialis</i>	2	5.0%
'Rebança'	<i>Zenaida auriculata</i>	2	5.0%
'Juriti'	<i>Leptotila rufaxilla</i>	2	5.0%
'Papagaio-galego'	<i>Alipiopsitta xanthops</i>	2	5.0%
'Sagüi'	<i>Callithrix argentata</i>	1	2.5%
'Tamanduá-mirim'	<i>Tamandua tetradactyla</i>	1	2.5%
'Nambú'	<i>Crypturelus tataupa</i>	1	2.5%
Did not know how to answer		27	67.5%
Total number of citations		46	
Total number of interviewed people			40

Table 8 Animals hunted for therapeutic use by the inhabitants of Queixo D'antas community, Campo Formoso, Bahia, Brazil.

Cited animals	Raw material	How to prepare	Used to treat
Mammals			
'Saruê' or opossum <i>Didelphis albiventris</i>	Hair	Burn it and drink its ashes with water	Back pain /stroke
	Urine	Drink it with water	Vision problems/back pain, stomachache and intestinal colic
'Tatu-verdadeiro' <i>Dasyurus novemcinctus</i>	Fat	Fry it and put it on the aching place	Earache
	Tail nail	Smash it, fry it, turn it into powder and put it on the aching place	Earache
	Urine	Put in the ear	Earache /deafness
'Tatu-peba' <i>Euphractus sexcinctus</i>	Fat	Fry it and put it on the aching place	Remove thorns
Jaguar <i>Panthera onca</i>	Fat	Fry it and drink it with water	Cancer
Fox <i>Cercopithecus thous</i>	Fat	Fry it and drink it with water	Animals with problems to get pregnant
	Skin	Put the sick person to lie on it	Stroke
Deer <i>Mazama gouazoubira</i>	Marrow	Turn it into dust	Pain
'Tatu-bola' <i>Tolypeutes tricinctus</i>	Blood	Add it on meals	Malnutrition
'Luís cacheiro' <i>Coendou</i> sp.	Spine	Rust it, grind it and prepare tea with it	Epilepsy
Birds			
'Jacú'	Fat	Put it on the aching place	Earache
'Juriti' <i>Leptotila rufaxilla</i>	Feathers	Smash it, rust it, turn it into powder and drink it with water	Tuberculosis
Reptiles			
'Cascavel' <i>Crotalus durissus</i>	Fat	Fry it and eat it	Rheumatism/swelling and pain in legs
'Jibóia' <i>Crotalus durissus</i>	Fat	Fry it and eat it	Rheumatism and cancer
'Teiú' <i>Tupinambis merianae</i>	Fat	Put it on the aching place/ Fry it and eat it	Earache/ Measles
'Lagartixa' <i>Hemidactylus</i> sp.	The whole animal	Prepare tea with it	High fever

countries like Brazil. Furthermore, wildlife creation can also be related to cultural factors, since according to Alves *et al.* (2009), hunting activities begin in childhood when animals such as birds and reptiles are hunted by the use of sling-shots to be consumed, or are caught in traps and turned into pets.

However, many wild animals, especially birds, are captured and kept in cages in the traders' houses until the time of sale (Rocha *et al.* 2006). Furthermore, bird traffic occurs intensively because of its beauty and its singing (Brito and Pereira 2005).

Queixo D'antas' inhabitants also use wild animals as medicinal resources. Fifteen species of animals are used as therapeutic resources, from which they obtained 11 kinds of raw materials used to prepare medicine for 17 illnesses. Animal fat was the main raw material used in the cure and treatment of various illnesses. The species reported were distributed in five taxonomic groups. The most mentioned were mammals (n = 9), followed by reptiles (n = 4) and birds (n = 2) according to **Table 8**.

The fat stood out as the main zootherapy product used by the community. Fats are also highlighted in studies by Costa Neto (1999a), Silva *et al.* (2004b), Pinto and Maduro (2003), Pereira (2008) and Ferreira *et al.* (2009). According to respondents, the fats of tegu (*Tupinambis merianae*) and real-armadillo (*D. novemcinctus*) can be used to cure ear pain. The fat of rattlesnake (*Crotalus durissus*) was reported to be used to treat rheumatism, swelling and pain in legs. The use of *T. merianae* as a remedy for earaches was also mentioned by Costa-Neto (2000) in a study in community of Remanso, in Bahia. The fat of *Crotalus durissus* has also

been reported to cure rheumatism in two different communities by Souza (2010) in the community of Missão do Sahy, municipality of Senhor do Bonfim and Moura (2002) in the village of Remanso, both studies in the semiarid region of Bahia state.

The possum or Saruê (*Didelphis albiventris*) was indicated by the informants as a source of medicine to treat vision problems, spinal pain, stomach cramps. From this animal it is extracted the urine, which is diluted in water and ingested. In other studies there are reports of the use of bone and fat of *D. albiventris* for treatment of arthritis and herniated disk (Moura 2002; Souza 2010).

The use of wildlife resources in the state of Bahia has been documented by several authors (e.g. Costa-Neto 1999a, 1999b, 1999c; Andrade and Costa-Neto 2005; Andrade and Costa-Neto 2006; Pereira 2008; Moura and Marques 2008). According to Hanazaki *et al.* (2009) the management of wildlife and sustainable hunting activities carried out by local communities can contribute to the conservation of wildlife resources, since these resources are also used for medicine.

Although we did not ask questions about the proposed establishment of the Parque Nacional do Boqueirão da Onça, some of interviewees said that after the visits and surveys of IBAMA/ICMBio started, the practice of hunting in the study area was reduced. Thus, this data leads us to realize that the establishment of the Parque Nacional do Boqueirão da Onça may be beneficial for the study area, since with its consolidation hunting for traffic and commerce can be reduced or even eliminated from there.

CONCLUSIONS

Although most of the interviewees claimed to practice subsistence hunting, our data shows that hunting in the study area is more related to recreational purposes, once hunting activities are not influenced by the hunters' monthly income and not also by their education level. Hence, hunting activities can be related to the local cultural values.

Interviewees demonstrated to have traditional knowledge about the study area, as their parents or grandparents also practiced hunting activities. In addition, information about the wildlife has also been transmitted within families.

According to the local hunters, the most captured animals are the 'tatu-verdadeiro' *D. novemcinctus*, the 'tatu-peba' *E. sexcinctus* and the peccary *P. tajacu*. The hunters showed preference for capturing wild animals in open fields with low vegetation. The *D. novemcinctus* is mentioned as the most hunted animal, probably, because it is easy to be found in the study site and also because its meat is considered tasteful by the local inhabitants.

The wild animals from the study area are hunted for food, fun and therapeutic use. The most common hunting technique adopted by the Queixo D'antas community's hunters is the use of shotgun.

It was reported that people from outside the community also go there for hunting. This fact is probably related with illegal traffic and commercialization of wildlife. Some birds raised by the local inhabitants are also considered victims of illegal trade, for example, the 'juriti' and 'jandaia'. Thus, the commercialization of wildlife can be attributed to outsiders who come to the community for hunting, as well as to the local residents themselves.

We suggest the establishment of an environmental education program in the study region. It should not only inform the local residents about the importance of wild animals to the food chain, but also prevent hunting activities with recreational and commercial purposes.

Furthermore, it is necessary to implement conservation programs aimed to control the hunting activities in the study area. It can ensure the maintenance of animal species native to the Caatinga ecosystem by preventing the uncontrolled exploitation of wildlife. In addition, uncontrolled hunting of wild animal species, is also threatening to the human populations that depend on these resources. Human activities directed to biodiversity's utilization should be planned, in order to promote a more efficient use of it and to preserve the biological elements which compose it (Ortega and Reyes 2008).

Another important point to be made is that the study area is included within the boundaries where it is proposed to be established the PNBO. Hence, the national park will be essential for the conservation of that area. Moreover, with the establishment of the PNBOIA the community's inhabitants could be able help in the park's maintenance and could also be employed as forest guards. Thus, they would help in the surveillance of that area, while strengthening their emotional bonds with the region. Therefore, the data reported in this study may be considered important for the establishment of the Parque Nacional do Boqueirão. It brings valuable information that may be used to support monitoring programs, as well as conservation strategies for the hunted wild animals in the study region.

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