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Caatinga Ethnoherpetology: Relationships between herpetofauna and people in a semiarid region of northeastern Brazil

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***Abstract.*—We investigated the interactions between humans and herpetofauna in the semiarid region of Paraíba State, Brazil. Data were obtained by means of interviews with 124 hunters or ex-hunters using semi-structured questionnaires, complemented by informal conversations. We recorded 18 species (17 reptiles and one amphibian) that local human populations interact with because they have some utilitarian value or because of conflicting relations with local inhabitants. Implementation of conservation measures aimed at the herpetofauna in this region is particularly difficult due to the aversion that local people hold toward many of these species. Therefore, environmental education strategies should be adopted. These efforts should not be solely directed at species subject to hunting, but should be all-inclusive and take into consideration the cultural, social, and utilitarian role that governs the interactions of human populations and the herpetofauna of the Caatinga.**

Key words. Caatinga, conservation, ethnobiology, ethnozoology, hunting, reptiles, wildlife use

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Introduction

Humans and herpetofauna (amphibians and reptiles) have interacted for millennia, virtually wherever they have been in contact (Alves et al. 2013b). As a result, interactions between humans and these animals are quite varied, encompassing utilitarian, symbolic, and conflicting aspects (Alves et al. 2008, 2009a, 2012b, c; Fernandes-Ferreira et al. 2012a; Franke and Telecky 2001; Klemens and Thorbjarnarson 1995; Morris and Morris 1965; Moura et al. 2010; Schlaepfer et al. 2005). Such interactions can be studied through ethnoherpetology, a subdivision of ethnozoology, which examines the relationships between human cultures and herpetofauna (Bertrand 1997; Das 1998; Goodman and Hobbs 1994; Speck 1946). Ethnozoological studies can aid in the evaluation of the impacts human populations have on native animal species and in the development of sustainable management plans, and thus, they are essential to conservation efforts (Alves 2012; Alves and Souto 2011).

Caatinga is the name given to the semiarid region that occupies the largest portion of Northeast Brazil and represents one of the major examples of a semiarid environment in the Neotropical region (Albuquerque et al. 2012; Alves et al. 2012b). In this biome, 205 herpetofaunal species have been recorded (65 amphibians, 66 lizards, 12 amphisbaenids, 53 snakes, five testudines, and four crocodilians), many of which interact with local human populations, where they furnish products exploited by the local people or are hunted and killed due to conflicting relations with people (Alves et al. 2009b, 2012a, b, c; Barbosa et al. 2011; Fernandes-Ferreira et al. 2013). In this context, understanding of the relations between humans and the herpetofauna of the region is an important step in designing strategies for management and sustainable use, and should consider the ecological, economic, and cultural aspects associated with these interactions.

Ethnoherpetological studies have only recently begun in Caatinga, although general ethnozoological research indicates that reptiles and amphibians are hunted by rural and urban populations of the region (Albuquerque et al. 2012; Alves et al. 2012b; Fernandes-Ferreira et al. 2012a). In an effort to contribute to our ethnoherpetological knowledge and its implications in the semiarid region of northeastern Brazil, we investigated the interactions between humans and herpetofauna in the municipality of Pocinhos in the semi-arid region of Paraíba State (PB). Our aim was to record the patterns of interactions of the local people with representatives of this animal group in the region. This information may be used to enhance conservation of the Caatinga's herpetofauna.

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Materials and Methods

Study area

The present study was carried out in the municipality of Pocinhos, located in the semi-arid region of Paraíba State, Brazil (Fig. 1; Ribeiro 2003). Pocinhos is 630 km^2 in area, with approximately 17,032 inhabitants. Average annual temperature is 23 °C, which varies little throughout the year. The region has a very low rainfall rate, fluctuating annually between 400 and 600 mm. The climate is hot, semi-arid, with rainfall in the autumn and winter months (Ribeiro 2003) and the vegetation is dominated by sub-deciduous and deciduous forests typical of semi-arid regions (Alves et al. 2009b; Ribeiro 2003).

Procedures

The study was conducted in the period of June 2010 to June 2011. The information was obtained by means of interviews with hunters or ex-hunters using semistructured questionnaires, complemented by informal conversations (Bernard 1994; Huntington 2000). The selection of informants was done by the "snowball" sampling technique (Bailey 1994), where from the initial contact, an informant indicates another who in turn indicates still another and so forth. Before each interview, the nature and objectives of the research were explained, and the interviewees gave their permission to record the information, by signing an informed consent form.

The questionnaires were applied to 124 hunters from the municipality, of which 98 (79%) live in urban areas but frequently travel to rural areas to hunt, while 26 (21%) live in the rural zone. The ethical approval for the study was obtained from the Ethics committee of Hospital Lauro Wanderley (protocol number: CEP/HULW nº 103/10).

Vernacular names of the specimens cited were recorded and the animals identified in the following ways: (1) analysis of the specimens or parts thereof donated by the interviewees; (2) analysis of photographs of animals taken during the interviews and during the accompaniment of hunting activities; (3) use of identifications by taxonomists familiar with the fauna of the study area and use of vernacular names; and (4) information from previous ethnozoological studies carried out in the study area (Alves et al. 2009b; Confessor et al. 2009; Mendonça et al. 2011). The scientific nomenclature of the species that are cited in this study follows the guidelines of the Brazilian Society of Herpetology (http://www.sbherpetologia.org.br/).

After analysis, specimens were deposited at the zoological collections of the Universidade Federal da Paraíba. Samples were collected with the permission of the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) and the Sistema de Autorização e Informação em Biodiversidade (SISBIO), license number 25926-2.

Data Analysis

An accumulation curve of the herpetofaunal species cited by interviewees was prepared. In an accumulation curve for ethnobiological data, the X-axis corresponds to the number of individuals interviewed and Y-axis the number of species cited by the respondents. The curve was randomized 1,000 times and the means were calculated using the software EstimateS© version 8.2 (Colwell 2009). EstimateS© permits the statistical analysis of species richness (for this work, species richness can be interpreted as the richness of species locally exploited) of samples by determination of the Chao2 index (Colwell and Coddington 1994). This index has been used in pre-

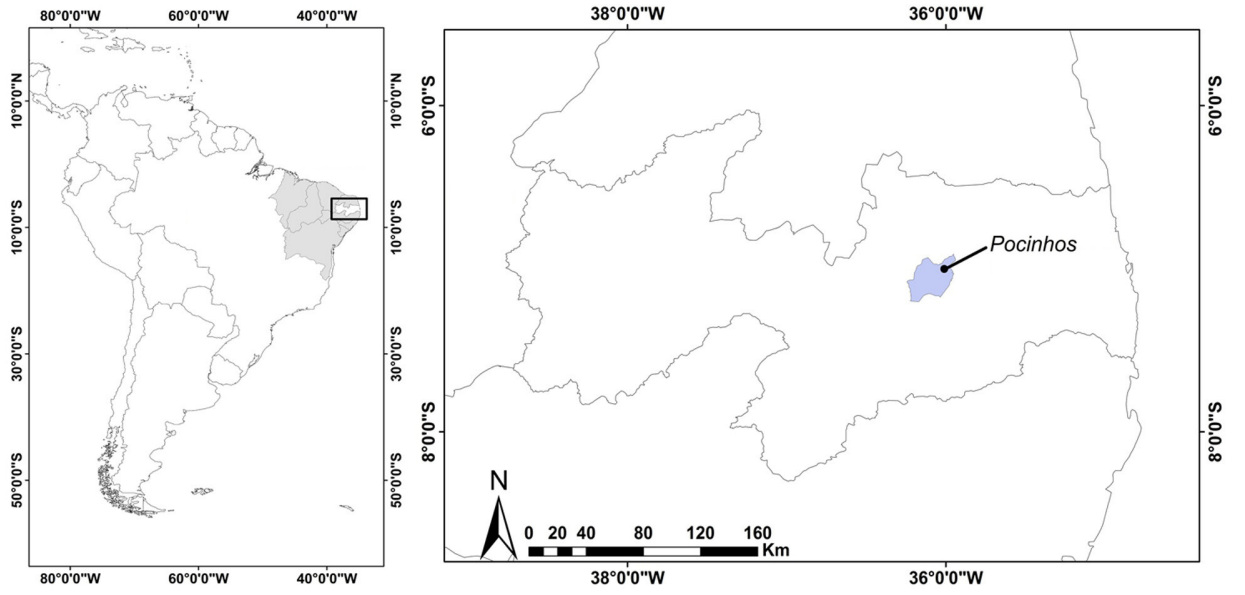

Fig. 1. Location of the municipality of Pocinhos (Paraíba State, Northeast Brazil), where the study was conducted.

vious ethnozoological studies (Ferreira et al. 2012; Souto et al. 2011; Whiting et al. 2011).

The non-parametric estimator Chao2 (Chao 1987) is calculated by the following formula:

$$Chao2 = Sobs + \left(\frac{L^2}{2M}\right)$$

where: Sobs corresponds to the number of species in a given sample, L is the number of species in only one sample ("uniques"), and M is the number of species that occur exactly in two samples. The utilization of the Chao2 estimator is recommended for ethnozoological studies since it is a non-parametric estimator based on data of incidence.

The data were entered in EstimateS© using a spreadsheet of type of respondent (rows) x type of species (columns). In preparing the spreadsheet, a value of 1 was given for each species mentioned by an interviewee and 0 for those that were not recorded.

For each species we calculated the Use-Value [adapted from the proposal of Phillips et al. (1994)], a quantitative method that demonstrates the relative importance of species known locally. This value was calculated using the following formula: UV = ∑ U/n, where: UV = Use-Value of the species; U = number of citations per species; *n* = number of informants. The calculations of the Use-Values of any species is based objectively on the importance attributed by the informants themselves, and does not depend on the opinion of the researcher.

Results

We recorded 18 species of herpetofauna (17 reptiles and 1 amphibian) that interacted with people in the surveyed area, either because they have some utilitarian value or because they are involved in conflicting relations with local inhabitants (Table 1). Products derived from herpetofauna were used for the following purposes: food (*n* = 7 species), medicinal use (*n* = 7 species), pets (*n* = 4 species), ornamental use (*n* = 4 species), and commerce (*n* = 2 species). Additionally, 13 species were hunted because they are considered harmful (particularly snakes), although some of these also provide products of utilitarian value.

Based on the data collected, the mean number of species observed (Sobs) was compared with that expected to be cited in the surveyed area (Fig. 2). The results demonstrated that the sampling efficiency was adequate, since 78.4% of all species of the herpetofauna of ethnozoological importance for the study area (Chao2 = 22.96 ± 5.07) were recorded. The species accumulation curve showed a tendency to stabilize.

When we considered the utilitarian value of the herpetofauna in the area studied, a greater number of species were cited for their utilization as food (*n* = 7 species), where lizards were the principal group cited for this purpose, mainly the White tegu (*Salvator merianae*, Duméril and Bibron 1839; Use-Value = 0.66). Other lizards reported as being used for food were the Green iguana (*Iguana iguana*, Linnaeus 1758) and the whiptail lizard (*Ameivula ocellifera*, Spix 1825), with the latter being rarely consumed, as it was cited by only two interviewees. In relation to snakes, only three hunters cited species useful as food: rattlesnake (*Crotalus durissus*, Linnaeus 1758) and Rainbow boa (*Epicrates assisi*, Machado 1945). The Northeastern pepper frog (*Leptodactylus vastus*, Lutz 1930) is the only amphibian used for food according to interviewees.

The medicinal use of herpetofauna, reported by 28 hunters, appears to be the most common form of utilization for this animal group. The species most utilized for this purpose, according to the interviewees, are the White tegu (*n* = 28 citations), Green iguana (*n* = 14 citations), and rattlesnake (*n* = 8 citations; Table 2). From the animals cited as useful in popular medicine, various parts or medicinal subproducts are extracted, especially the fat and hide, which are used in the treatment of various diseases and are administered in various ways (Table 2).

Use of reptiles as pets was recorded in only three of the homes visited, suggesting that the use of herpetofauna as pets is not a common practice in the study area. Species used as pets were: Red footed tortoise (*Chelonoidis carbonaria*, Spix 1824; raised by three hunters), Tuberculate toadhead turtle (*Mesoclemmys tuberculata*, Lüederwaldt 1926), White tegu, and Boa snake (*Boa constrictor*, Linnaeus 1758; cited by only one hunter). The hunter who mentioned this last species stated that he captured the animal by hand on a hunting trip, but that he did not keep the animal long at his home because he was unable to feed it adequately, thus letting it go in the forest.

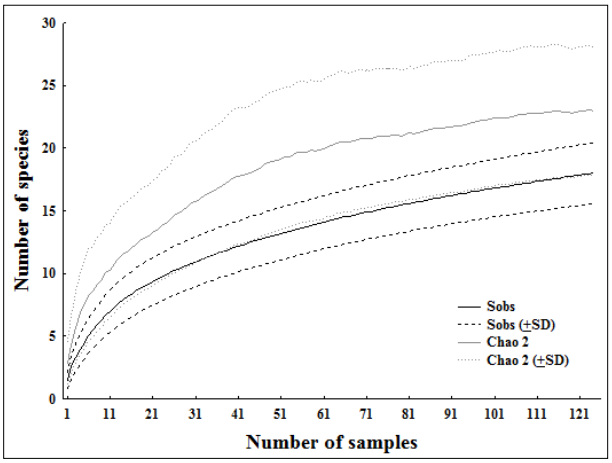

Fig. 2. Graphs showing the values obtained with the richness estimators of herpetofaunal species hunted in surveyed area. Number of Species Observed (Sobs = 18 ± 2.44), Number of species estimated (Chao2 = 22.96 ± 5.07).

Table 1. Hunted herpetofaunal species with their respective popular names in the surveyed area. Legend: **F** = food resource, **M** = medicinal, **C** = commerce, **P** = pets, **O** = ornamentation and decoration, and **CR** = conflicting relationships.

Family/species/popular name	Use-Value	Uses and/or conflicting relationships					
		F	M	C	P	O	CR
Leptodactylidae							
Leptodactylus vastus (Lutz, 1930) – "Jia," Northeastern pepper frog	0.01	X	X				
Testudinidae							
Chelonoidis carbonaria (Spix, 1824) –"Jabuti," Red footed tortoise tortoise	0.01		X		X		
Chelidae							
Mesoclemmys tuberculata (Luederwaldt, 1926) – "Cágado d'água," Tuberculate toadhead turtle	0.008		X	X			
Iguanidae							
Iguana iguana (Linnaeus, 1758) – "Camaleão," Common green iguana	0.20	X	X	X			
Teiidae							
Ameivula ocellifera (Spix, 1825) – "Calango," Spix's whiptail	0.008	X					
Salvator merianae (Duméril and Bibron, 1839) – "Teju," White tegu	0.66	X	X	X	X	X	X
Boidae							
Boa constrictor (Linnaeus, 1758) – "Cobra de veado," "jibóia," Boa snake	0.03	X	X			X	X
Epicrates assisi (Linnaeus, 1758) – "Salamanta," Rainbow boa	0.16	X				X	X
Colubridae							
Oxybelis aeneus (Wagler, 1824) – "Cobra de cipó," Brown vine snake	0.008						X
Dipsadidae							
Boiruna sertaneja (Zaher, 1996) –"Cobra preta," Black snake	0.02						X
Philodryas olfersii (Linchtestein, 1823) – "Cobra verde," Lichtenstein's Green racer	0.02						X
Leptodeira annulata (Linnaeus, 1758) – "Jararaca," Salamanta de parede, Banded cat-eyed snake	0.11						X
Philodryas nattereri (Steindachner, 1870) – "Cobra corre campo," Paraguay green racer	0.04						X
Pseudoboa nigra (Duméril, Bibron e Duméril, 1854) – "Cobra de leite," Black false boa	0.01						X
Xenodon merremii (Wagler, 1824) – "Jararaquinha," "Goipeba," Wagler's snake	0.01						X
Elapidae							
Micrurus ibiboboca (Merrem, 1820) – "Cobra coral," Caatinga coral snake	0.11						X
Viperidae							
Bothrops erythromelas (Amaral, 1923) – "Malha de cascavel," Jararaca da seca, Caatinga lancehead	0.02						X
Crotalus durissus (Linnaeus, 1758) – "Cascavel," South American rattlesnake	0.20	X	X	X		X	X

The use of herpetofauna to make artisanal products was mentioned by only three interviewees, where the hide is the principal product used for this purpose. This product is used mainly in the manufacture of accessories (belts, purses, and key chains). The species used for this purpose are: rattlesnake, whose rattle is used in the manufacture of key chains by some hunters and the hide, which can be used to make belts; and Boa snake, Rainbow boa, and White tegu, whose hide is used in the manufacture of accessories.

Despite being sources of products used for different purposes, the main motivation for the hunting and killing of the herpetofauna in the study region is that many of the species cited are considered harmful, particularly the snakes, considered venomous and efficient predators that pose a risk to humans and their domestic animals. Forty (32.2%) hunters interviewed affirmed having killed some type of reptile while hunting or during daily activities in the countryside. Meanwhile, the hunters were unanimous in stating that they kill whatever snake they encounter. The most persecuted species are the rattlesnake (n = 26 citations), Rainbow boa (n = 21 citations), Caatinga lancehead (*Bothrops erythromelas*, Amaral 1923; n = 3 citations), and coral snake (*Micrurus ibiboboca*, Merrem 1820; n = 14 citations).

Besides snakes, the White tegu can be killed by some hunters (n = 4) of rural areas because they do damage, since this lizard feeds on chicks and chicken eggs. The latter are important food for local families, besides being a source of income when sold.

Table 2. Herpetofauna used for medicinal purposes cited by hunters in the Pocinhos city, Paraiba State, Brazil.

Species / vernacular name	Citations	Medicinal use (Treated diseases)	Parts
Chelonoidis carbonaria (Spix, 1824)	2	Rheumatism and swelling	Shell and fat
Mesoclemmys tuberculata (Luederwaldt, 1926)	2	Sore throat, cough, asthma, earache, wounds, rheumatism, haemorrhoids, shortness of breath, bronchitis	Fat
Iguana iguana (Linnaeus, 1758)	14	Suck a splinter out of skin or flesh, snakebite, choking, boils, rheumatism, earache, sore throat, and wounds	Skin, fat, and bone
Salvator merianae (Duméril e Bibron, 1839)	28	Sore throat, earache, choking, deafness, boils, wounds, arthritis, asthma, rheumatism, headache, tumor; suck a splinter out of skin or flesh, cough, and swelling	Fat, tongue, and skin
Crotalus durissus (Linnaeus, 1758)	8	Asthma, sore throat, skin problems, cancer, rheumatism, urinary problems, arthritis, toothache, haemorrhoids, backache, mycoses, wounds, deafness, and varicose veins	Rattle and fat
Leptodactylus vastus (Lutz, 1930)	1	Sore throat	Meat

Discussion

Our results reveal that the people of the surveyed area establish a greater interaction with reptiles than amphibians. This finding can be related to the greater richness of reptiles that occurs in the Caatinga (140 reptiles and 65 amphibians) and also among the reptiles there are larger-sized species, which can offer larger amounts of products for use. Snakes are feared animals in all of the semiarid northeast and in other places in Brazil, calling extra attention associated with the prevention of potential accidents (Alves et al. 2010b, 2012b, c; Moura et al. 2010).

Despite the negative view related to the many species of reptiles in the area studied, there are many species (even those killed because of conflicts) that supply products used by the local inhabitants. These observations are in agreement with Marques (1995), who noted that the link between humans and animals is fraught with contradictions and ambiguities, as the native fauna can represent either a resource or a risk to the local people.

The small number of species of herpetofauna used as food is not surprising, since traditionally, this group does not play an important role as a protein source for the populations living in the Caatinga. The principal groups of wild vertebrates used as a source of protein in the region are birds and mammals (Alves et al. 2009b; Bezerra et al. 2011, 2012a, b, 2013; Fernandes-Ferreira et al. 2012b). However, the game importance of the White tegu should be pointed out, as its meat is used as a source of protein in the Caatinga. Such observation can be substantiated in a parallel study on the consumption of bushmeat in the same area as the present study (Mendonça 2012), which monitored the consumption of meat by local families during a year and within the local herpetofauna, only recording the consumption of two species of reptiles: *S. merianeae* and *I. iguana*, with greater frequency for the former. The use of these two species for food also has been recorded in other localities of the semiarid northeast, including urban areas (Alves et al. 2012a; Marques and Guerreiro 2007). Considering the cultural and utilitarian importance of the lizard *S. merianae*, we do not exaggerate when we suggest that this animal represents one of the animals of greatest ethnozoological importance in the Brazilian Caatinga. This can be due to its size, since it is the largest species of lizard of the semiarid region (Vanzolini et al. 1980) and corroborates the findings of Alves et al. (2012b), which pointed out that *S. merianeae* represents the main game reptile of the semi-arid region of Brazil.

Corroborating a tendency observed in other studies (Alves et al. 2012c; Marques and Guerreiro 2007; Santos-Fita et al. 2010), the consumption of snakes was little cited by the hunters in the study area. In Brazil, only five snake species have been reported as being used for human consumption: *Boa constrictor*, *Eunectes murinus*, *Lachesis muta*, *Crotalus durissus*, and *Epicrates assisi* (Alves et al. 2012c; Fernandes-Ferreira et al. 2013). Alves et al. (2012c) highlighted that the small numbers of snake species currently used as food in Brazil is not surprising given the negative images attributed to these animals in myths, legends, and popular beliefs. Reinforcing this notion, Rea (1981) noted that not only are snakes rejected because of their disagreeable nature but also any other creature with a similar shape or behavior. A study undertaken among human populations living along the banks of the Rio Negro (Amazonas State, Brazil) indicated that the electric eel (*Electrophorus electricus*) was one of the least favored meats because of its strong smell and the shape of its body—"it looks just like a snake" (Silva 2007).

Although the herpetofauna does not play an important role as a source of protein in the region studied, this group stands out when considering the popular medicine of the region. Despite having been cited less as medicinal species (n = 6 species) than as those used for food (n = 7 species), medicinal use showed a higher number of citations, suggesting its greater dissemination among the interviewees. In this context, the tegu was also featured with regard to number of citations as well its broad

medicinal applicability. Studies in various localities have already indicated the importance of this species of lizard in popular medicine in Brazil (Alves 2009; Alves et al. 2007, 2009a, 2011; Ferreira et al. 2012; Oliveira et al. 2010), even in urban areas, where the sale of products derived from *S. merianeae* (as well as other species of reptiles recorded in this work) is common in public markets in various cities in northeast Brazil (Alves and Rosa 2007; Alves and Rosa 2010; Ferreira et al. 2012).

Raising wild animals as pets, particularly wild birds (Alves et al. 2010a, 2013a; Bezerra et al. 2001, 2013; Fernandes-Ferreira et al. 2012b; Nobrega et al. 2012) is a very common practice in the semiarid northeastern region, but few species of the herpetofauna are utilized for this reason, in accordance with our finding presented here. Among the reptiles of the Caatinga, the Jabuti (*C. carbonaria*) is one of the species of the most popular pets, probably because it is considered docile and easy to capture and keep in captivity. Additionally, there is also a popular belief that its presence helps avoid illnesses such as bronchitis and asthma (Alves et al. 2009a).

The strong aversion to reptiles, especially snakes, is common in various places in Brazil (Alves et al. 2012b, c; Moura et al. 2010; Santos-Fita et al. 2010), and was also recorded in our study. This aversion serves as a strong motivation for hunters and the public in general to kill snakes indiscriminately, where they are persecuted and killed whenever they are encountered. People are used to killing not only venomous snakes but also the non-venomous species, and even those amphibians that have a similar body shape as snakes. Similarly, Santos-Fita et al. (2010) documented that all inhabitants of a semiarid area of the state of Bahia have strong negative reactions in relation to snakes, always killing them if possible. It should be emphasized that these conflicts involve other groups besides snakes. In our study, we recorded that even species of reptiles with high utilitarian value, such as the tegu, can also be killed for feeding on chicken eggs, causing financial losses for farmers.

Our data, together with previous findings of other ethnozoological studies carried out in the semiarid region of the northeast, allow us to suggest some patterns of interactions between the people and herpetofauna of the Caatinga: (1) there are more frequent interactions between the people and reptiles than with amphibians; (2) lizards comprise the group with the most important species for food, particularly the White tegu; (3) products from herpetofauna play an important role in popular medicine in the semiarid, northeastern region; (4) besides food and medicinal use, products from herpetofauna can be used in handicrafts and jewelry; and, (5) various reptile species, especially snakes, are hunted and killed because of cultural aversion to these animals and the risks they pose to people and domestic animals.

Information from previous studies and that obtained here demonstrate that in the semiarid region of Brazil's northeast, reptiles and amphibians are hunted because they are useful or considered dangerous, and sometimes for both reasons. The implementation of conservation measures aimed at the herpetofauna in this region is particularly difficult due to the aversion of the people to a good part of the species of this group. Therefore, strategies of environmental education should be adopted, besides specific actions directed at species of high game value, taking into consideration the cultural, social, and utilitarian role that governs the interactions of human populations and the herpetofauna of the Caatinga.

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