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# Influence of Sociodemographic Profile on Interactions Between Human Populations and Fauna in the Semi-Arid Region of Northeast Brazil and Its Relationship with Conservation

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**Simple Summary:** The relationship between human populations and wild animals dates back across centuries of interactions, enabling the construction of belief systems in communities. Thus, the objective of our work was to understand how humans use the animals around them. It was observed that the rural community investigated has relationships with 82 species of animals. Additionally, we identified that socioeconomic variables influence the knowledge and use of wildlife resources. In short, the influence of socioeconomic variables may vary according to the taxonomic group, as well as the type of cultural domain.

**Abstract:** Background: The relationship between human populations and wild animals dates back across centuries of interactions, enabling the construction of belief systems in communities. The socioecological perspective allows us to understand the interactions between the social and ecological dimensions of a population and nature. Methods: In this context, 133 residents of a rural community were interviewed to assess their knowledge and use of animals. We sought to evaluate the following: (i) animal species used by community residents, (ii) types of use and (iii) the effects of socioeconomic variables on different uses of vertebrate animal taxa. Results: The fauna cited were represented by 82 ethnospecies distributed in 48 families; it was not possible to identify nine ethnospecies and two were identified only at the genus level (*Columbina* sp. and *Turdus* sp.). Among the identified species, birds presented the greatest taxonomic richness (n = 34/41.0%), followed by mammals (n = 22/27.0%) and reptiles (n = 15/18.0%). Through generalized linear models, we identified which socioeconomic variables influenced the knowledge and use of wildlife resources. Furthermore, the influence of socioeconomic variables varied between taxa and use categories. Conclusions: The influence of socioeconomic variables may vary according to the taxonomic group, as well as the type of cultural domain, favoring the increase or decrease in the use of a resource.

**Keywords:** faunistic resources; ethnozoology; hunting system; socioeconomic variables



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## 1. Introduction

The relationship between humans and wild animals dates back across centuries of interactions that have led to the construction of vast knowledge about fauna [1]. The different ways of interacting with fauna influence different socioecological systems, which have specific functioning patterns [2–6]. In this context, the socioecological perspective emphasizes understanding the interactions between the social and ecological dimensions of a community [7]. This includes the analysis of cultural practices, forms of use, traditional knowledge systems, forms of social organization and the effects of these factors on biodiversity.

In Brazilian rural communities, the use of wild animals for food, medicine and pets is widely present in the daily lives of people, providing essential resources and establishing a strong connection with nature [8–11]. In terms of food use, many rural communities have wild animals as part of their diet. These animals are obtained through hunting techniques, and their meat is valued for its nutritional value, as well as for its local cultural importance [3,9,12–14]. Many species of fauna are valued for their therapeutic properties and are used in the preparation of traditional remedies, also known as zootherapy [15,16]. For example, whole or parts of animals can be used in the production of medicines with therapeutic properties to treat a variety of diseases and health conditions [17]. In addition, wild animals can play the role of pets in rural communities. Some species are captured and raised as pets, establishing emotional ties and providing companionship to local residents [18].

A socioecological system is influenced by different forms of fauna use and presents patterns and processes determined by several variables, including socioeconomic variables. These variables play a significant role in the interaction between humans and fauna, making it essential to understand how age, education, gender and income influence the use of and interaction with faunal resources [2,5,19–21]. Age can influence traditions and the transmission of knowledge related to the use of these animals, with younger generations adopting different perspectives compared to older generations [20,22]. Schooling plays a crucial role in how individuals understand the ecological and ethical impacts of wild animal use [21]. Gender also plays an important role in the use of wild animals, as traditional practices and gender roles can influence the participation of men and women in hunting, fishing or other activities related to wild animals [21,23]. In addition, income and profession directly influence the use of wild animals. People from different socioeconomic levels have different access to resources, including alternative sources of food and livelihoods [20]. Additionally, human knowledge about fauna can be influenced by the type of profession that people have [14].

Understanding the complex interactions between these socioeconomic variables and wildlife use is essential for developing conservation and sustainability strategies. The consideration of these factors can guide policies and programs that promote the preservation of biodiversity, the protection of species and the well-being of human communities that depend on natural resources. In this sense, research on the knowledge and use of fauna in rural communities in northeastern Brazil is an important area of investigation on this topic. Human interaction with fauna in the Northeast region, especially in communities in the Caatinga biome, indicates an intense relationship of use [2,3].

The objective of the present study is to evaluate the knowledge/use of animals by residents of a rural community in the semi-arid region of Bahia and to present a theoretical model that considers socioeconomic variables in conservation policies. More precisely, we sought to assess the following: (i) animal species used by community residents, (ii) types of use and (iii) the effects of socioeconomic variables on different uses of taxa of vertebrate animals.

## 2. Materials and Methods

### *2.1. Study Area*

This study was carried out in the rural community of Lagoa do Porco, located in the municipality of Campo Formoso (10°20′17.2″ S 40°37′12.7″ O) in the state of Bahia, 407 km from the capital Salvador (Figure 1a). The municipality of Campo Formoso has a territory of 7161.827 km$^2$ and had an estimated population of 71,754 in 2021 [24].

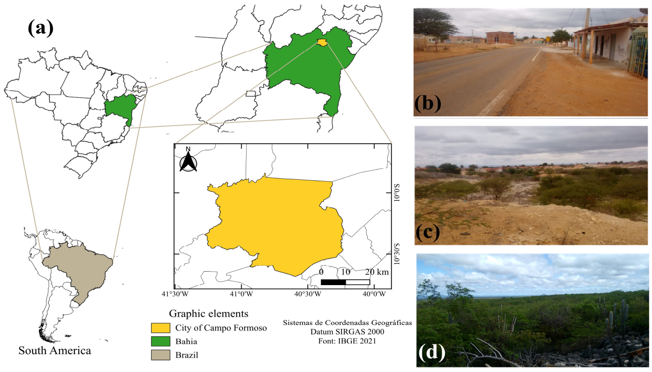


**Figure 1.** Study area (**a**); characterization of the community (**b**–**d**) and the environment in which the community is placed.

The rural community of Lagoa do Porco is located 45 km from the municipal seat, and it has approximately 1000 inhabitants and is in the Caatinga biome (Figure 1b–d). According to residents, the creation of the community occurred more than 90 years ago; it is reported that two hunters went hunting and found a valley with wild pigs bathing in a pond. From then on, hunters began to make excursions to the region, always returning home with many captured or slaughtered animals. After realizing that in addition to the richness of animals, the land was fertile, the families established housing in the region, founding the community (personal observations by the authors and reports by the residents). The main income of the residents of the community comes from agriculture, mainly sisal farming and the irrigated planting of tomatoes and onions. The practice of hunting and the consumption of wild animal meat is recorded among the population (personal observations and reports by residents).

### *2.2. Ethical and Legal Aspects*

The participants were informed both about the objectives and nature of this study and their rights (anonymity, withdrawal at any time), being asked to sign the Free and Informed Consent Term (TCLE), which authorizes the collection, use and publication of the data obtained, as required by Resolution No. 196, 10 October 1996, of the National Health Council. This study was submitted to the Ethics Committee for Research with Human Beings of the Universidade Federal do Vale do São Francisco (UNIVASF) (CAAE: 1.339.845). This study was also registered in the National System for the Management of Genetic Heritage and Associated Traditional Knowledge (SisGen) under registration number ADD9FB5.

### *2.3. Data Collect*

Data collection took place between November 2016 and February 2017. Information on the use of local fauna and population interactions with wild animals was obtained through semi-structured forms, complemented with free interviews and informal conversations [25]. The forms were applied to men and women aged at least 18 years old and addressed the following aspects: the frequency and type of relationship with each animal, hunting place, hunting tools and techniques used, changes in the population of animals over time, cultural aspects related to use, perceptions about the bioecological aspects of the most used species and the socioeconomic profile of the participant (age, marital status, education, profession and monthly income).

The sampling was random for convenience, ensuring that there was no preference in choosing participants. Thus, residents who wanted to participate in this study were included in the sample. Regarding the sample size, a minimum of 5% of the resident population was established.

### *2.4. Data Analysis*

The data were analyzed quantitatively, according to the union model of the different individual competences [26]. A species accumulation curve (Sobs) was created to verify whether the sampling effort was significant. The ICE and Chao 1 and 2 estimators were used to estimate species richness. The ICE is a richness estimator based on the concept of sample coverage, considering the presence or absence of species that quantify rarity. Chao 1 considers species abundance, that is, the number of species represented by individuals in the samples. And Chao 2 is an estimator based on the incidence of species [25].

The estimation of species richness was performed using the EstimateS© version 9.1 program [27]. For data entry, a matrix of type respondents (columns) and species (rows) was constructed, saved in text format (separated by tabs) and imported into the program. In the matrix, the value 1 was assigned to species mentioned by the interviewee and 0 to those not mentioned. The entire analysis was randomized 1000 times and estimated with a confidence interval equal to 95% [28].

For the analysis of the cultural importance of the species, the use value (VU) and Smith's Salience Index (S) were calculated. The VU estimates the relative importance of a natural resource, considering that the best-known resource is also the most used, establishing a directly proportional relationship, that is, the greater the availability, the greater the use value of a resource [29,30]. Use value was calculated according to Rossato et al. [31] and adapted by Lucena et al. [30], using the following formula:

$$VU = U/n;$$

where VU = the current use value of species (species known and effectively used); U = the number of citations of current use by species; and n = the number of informants.

Smith's Salience Index (S) is used to analyze the cultural importance of a resource within a cultural domain; this index considers both the frequency and the classification of a citation, returning values between 0 and 1, with the more salient a feature (close to 1), the more important the species [32,33].

A generalized linear model (GLM) was calculated to analyze the effect of socioeconomic variables on knowledge of hunting species. First, the normality of the data was verified with the Shapiro test, reporting that the data did not follow a normal distribution. GLM were constructed using the Poisson error distribution, considering the number of cited species as the dependent variable and age, income, education, profession and gender as the independent variables.

We proposed that human populations would establish different interactions for each animal class, so we created a generalized linear model for each animal class (birds, reptiles and mammals). Subsequently, other models were created for each category of use (food, zootherapy and pet) considering the domestic or wild nature of an animal. In this way, a GLM was created with all species for each class of animal and six submodels (domestic mammals for food, wild mammals for food, domestic mammals as pets, wild mammals as pets, domestic mammals as zootherapy and wild mammals as zootherapy). The same strategy was applied to birds and reptiles.

For the selection of the most parsimonious models, a global model was elaborated, using all the available variables, and later the "StepAIC" function of the MASS package [34] was used to eliminate the less significant variables until finding the model with the lowest value of AIC (Aikaike Information Criteria). Data tabulation, descriptive measures and use value were determined in the Microsoft Excel program. The generalized linear model was set in the R version 4.1.0 program [35], considering $p < 0.05$ to be significant.

## 3. Results

A total of 133 informants were interviewed, with 90 (68.0%) being male and 43 (32.0%) being female. The age range ranged from 18 to 75 years old, with the vast majority being married (65.0%); most of their schooling was incomplete elementary school (41.0%); and more than half of them used agriculture (53.0%) as their main source of income (Figure 2).

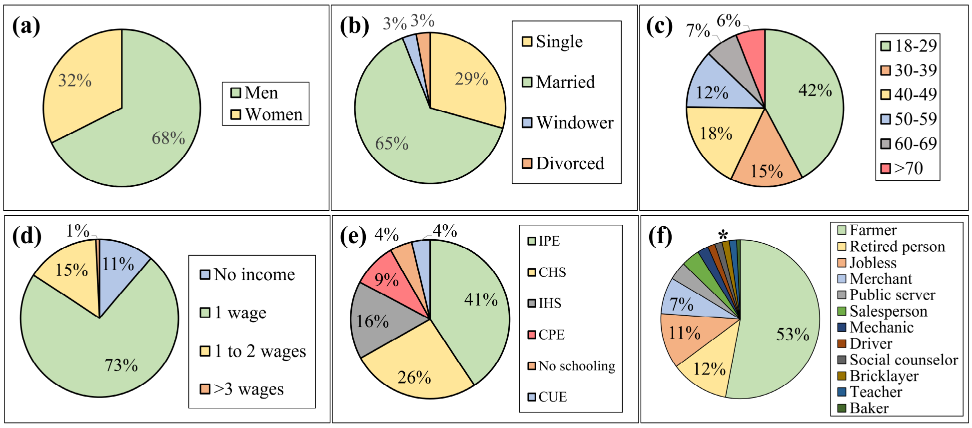


**Figure 2.** Socioeconomic profile of participants (n = 133) in relation to gender (**a**), marital status (**b**), Age (**c**), monthly income (**d**), education (**e**) and profession (**f**). Legend: Education: IPE—incomplete primary education; CPE—complete primary education; IHS—incomplete high school; CHS—complete high school; CUE—complete university education; (*) professions with 17% percentage.

The cited fauna were represented by 82 ethnospecies distributed in 48 families; it was not possible to identify nine ethnospecies, and two were identified only at the genus level (*Columbina* sp. and *Turdus* sp.). Among the identified species, birds had the highest taxonomic richness (n = 34/41.0%), followed by mammals (n = 22/27.0%) and reptiles (n = 15/18.0%). Among birds, the families with the highest number of species mentioned were Columbidae, Thraupidae and Tinamidae, with four species for each family. For the group of mammals, the Felidae family recorded three species, and the Dasypodidae, Didelphidae and Procyonidae families recorded two species each. The Colubridae family was the family most representative of reptiles, with three species mentioned (Table 1).

**Table 1.** Cited species, use categories and estimated variables.

| Family/Ethnospecies (English Name) | Scientific Name | Usage Categories and Citation Number | | | Salience | *p* Value * | Use Value | Status |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | | | | |
| Amphibia | | | | | | | | |
| Bufonidae | | | | | | | | |
| Frog | *Rhinella jimi* (Stevaux, 2002) | ** | ** | ** | 0.0145 | <0.001 | ** | LC |
| **Birds** | | | | | | | | |
| Accipitridae | | | | | | | | |
| Roadside Hawk | *Rupornis magnirostris* (Gmelin, 1788) | ** | ** | ** | 0.0410 | 0.002 | ** | LC |
| Anatidae | | | | | | | | |
| Duck | *Anas platyrhynchos* Linnaeus, 1758 | ** | ** | ** | 0.0075 | <0.001 | ** | LC |

**Table 1.** *Cont.*

| Family/Ethnospecies (English Name) | Scientific Name | Usage Categories and Citation Number | | | Salience | *p* Value * | Use Value | Status |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | | | | |
| Cardinalidae | | | | | | | | |
| Ultramarine Crosbeak | *Cyanocompsa brissonii* (M.H.K. Lichtenstein, 1823) | | | 5 | 0.0521 | 0.01 | 0.037 | LC |
| Cariamidae | | | | | | | | |
| Red-legged Seriema | *Cariama cristata* (Linnaeus, 1766) | 6 | 1 | | 0.1467 | 0.009 | 0.052 | LC |
| Cathartidae | | | | | | | | |
| Black Vulture | *Coragyps atratus* (Bechstein, 1793) | | 3 | | 0.0564 | <0.02 | 0.022 | LC |
| Columbidae | | | | | | | | |
| Rolinha | *Columbina* sp. | 21 | | | 0.1805 | <0.001 | 0.157 | LC |
| Scaled Dove | *Columbina squammata* (R. Lesson, 1831) | ** | ** | ** | 0.0146 | <0.001 | ** | LC |
| Grey-fronted Dove | *Leptotila rufaxilla* (Richard & Bernard, 1792) | 2 | | | 0.0753 | 0.17 | 0.015 | LC |
| White-tipped Dove | *Leptotila verreauxi* Bonaparte, 1855 | 7 | | | 0.1228 | 0.08 | 0.052 | LC |
| Corvidae | | | | | | | | |
| White-naped Jay | *Cyanocorax cyanopogon* (Wied-Neuwied, 1821) | ** | ** | ** | 0.0094 | <0.001 | ** | LC |
| Cuculidae | | | | | | | | |
| Smooth-billed Ani | *Crotophaga ani* Linnaeus, 1758 | | 1 | | 0.0170 | <0.001 | 0.007 | LC |
| Cracidae | | | | | | | | |
| White-browed Guan | *Penelope jacucaca* Spix, 1825 | 1 | | | 0.0282 | <0.001 | 0.007 | VU |
| Falconidae | | | | | | | | |
| Saffron Finch | *Caracara plancus* (Miller, 1777) | ** | ** | ** | 0.0663 | 0.07 | ** | LC |
| Icteridae | | | | | | | | |
| Chopi Blackbird | *Gnorimopsar chopi* (Vieillot, 1819) | ** | ** | ** | 0.0081 | <0.001 | ** | LC |
| Campo Troupial | *Icterus jamacaii* (Gmelin, 1788) | ** | ** | ** | 0.0499 | 0.009 | ** | LC |
| Passeridae | | | | | | | | |
| House Sporraw | *Passer domesticus* (Linnaeus, 1758) | ** | ** | ** | 0.0468 | 0.005 | ** | LC |
| Phasianidae | | | | | | | | |
| Chicken | *Gallus Gallus domesticus* (Linnaeus, 1758) | | 24 | | ** | ** | 0.180 | LC |
| Psittacidae | | | | | | | | |
| Cactus Parakeet | *Eupsittula cactorum* (Kuhl, 1820) | | | 20 | 0.0043 | <0.001 | 0.150 | LC |
| Turquoise-fronted Parrot | *Amazona aestiva* (Linnaeus, 1758) | | 1 | 10 | 0.1754 | <0.001 | 0.082 | LC |
| Blue-winged Macaw | *Primolius maracana* (Vieillot, 1816) | ** | ** | ** | 0.0131 | <0.001 | ** | NT |
| Strigidae | | | | | | | | |
| Ferruginous Pygmy Owl | *Glaucidium brasilianum* (Gmelin, 1788) | ** | ** | ** | 0.0086 | <0.001 | ** | LC |
| Burrowing Owl | *Athene cunicularia* (Molina, 1782) | ** | ** | ** | 0.0106 | <0.001 | ** | LC |

**Table 1.** *Cont.*

| Family/Ethnospecies (English Name) | Scientific Name | Usage Categories and Citation Number | | | Salience | *p* Value * | Use Value | Status |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | | | | |
| Thraupidae | | | | | | | | |
| Sayaxa Tanager | *Thraupis sayaca* (Linnaeus, 1766) | ** | ** | ** | 0.0031 | <0.001 | ** | LC |
| Saffron Finch | *Sicalis flaveola* (Linnaeus 1766) | ** | ** | ** | 0.0056 | <0.001 | ** | LC |
| Red-cowled Cardinal | *Paroaria dominicana* (Linnaeus, 1758) | | | 2 | 0.0811 | 0.25 | 0.015 | LC |
| Yellon-bellied Seedeater | *Sporophila nigricollis* (Vieillot 1823) | ** | ** | ** | 0.0125 | <0.001 | ** | LC |
| Tinamidae | | | | | | | | |
| White-belied Nothura | Nothura boraquira (Spix, 1825) | 33 | | 1 | 0.2628 | <0.001 | 0.255 | LC |
| Spotted Nothura | *Nothura maculosa* (Temminck, 1815) | 26 | | | 0.2564 | <0.001 | 0.195 | LC |
| Red-winged Tinamou | *Rhynchotus rufescens* (Temminck, 1815) | 19 | 1 | | 0.1364 | 0.02 | 0.150 | LC |
| Red-winged Tinamou | *Crypturellus zabele* (Spix, 1825) | ** | ** | ** | 0.0355 | <0.001 | ** | LC |
| Turdidae | | | | | | | | |
| Sabia | *Turdus* sp. | ** | ** | ** | 0.0229 | <0.001 | ** | LC |
| Tyrannidae | | | | | | | | |
| Great Kiskadee | *Pitangus sulphuratus* (linnaeus, 1766) | ** | ** | ** | 0.0066 | <0.001 | ** | LC |
| Rallidae | | | | | | | | |
| Common Gallinule | *Gallinula galeata* (Lichtenstei, 1818) | ** | ** | ** | 0.0098 | <0.001 | ** | LC |
| Rheidae | | | | | | | | |
| Greater Rhea | *Rhea americana* (Linnaeus, 1758) | 2 | 2 | | 0.1242 | 0.08 | 0.030 | NT |
| **Mammals** | | | | | | | | |
| Bovinae | | | | | | | | |
| Cow | *Bos taurus* Linnaeus, 1758 | | 1 | | ** | | 0.007 | LC |
| Callitrichinae | | | | | | | | |
| Sagui Comum | *Callithrix jacchus* (Linnaeus, 1758) | ** | ** | ** | 0.0360 | <0.001 | ** | LC |
| Canidae | | | | | | | | |
| Crab-eating Fox | *Cerdocyon thous* Linnaeus, 1766 | ** | ** | ** | 0.4131 | <0.001 | ** | LC |
| Caprinae | | | | | | | | |
| Ram | *Ovis aries* Linnaeus, 1758 | | 15 | | ** | | 0.112 | LC |
| Caviidae | | | | | | | | |
| Brazilian Guinea Pig | *Cavia aperea* Erxleben 1777 | 21 | 1 | | 0.2967 | <0.001 | 0.165 | LC |
| Cercidae | | | | | | | | |
| South American Brown Brocket | *Mazama gouazoubira* (G. Fisher [von waldheim], 1814) | 17 | | | 0.4337 | <0.001 | 0.127 | LC |
| Chlamyphoridae | | | | | | | | |
| Tatu Bola | *Tolypeutes tricinctus* (Linnaeus, 1758) | ** | ** | ** | 0.0520 | 0.01 | ** | VU |

**Table 1.** *Cont.*

| Family/Ethnospecies (English Name) | Scientific Name | Usage Categories and Citation Number | | | Salience | *p* Value * | Use Value | Status |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | | | | |
| Dasypodidae | | | | | | | | |
| Six-banded Armadilo | *Euphractus sexcinctus* (Linnaeus 1758) | 58 | 23 | 1 | 0.7359 | <0.001 | 0.616 | LC |
| Long-nosed Armadillo | *Dasypus novemcinctus* Linnaeus, 1758 | 39 | 5 | | 0.6193 | <0.001 | 0.330 | LC |
| Didelphidae | | | | | | | | |
| White-eared Opossum | *Didelphis albiventris* Lund, 1840 | 10 | 6 | | 0.4068 | <0.001 | 0.120 | LC |
| Rock Cavy | *Kerodon rupestris* (Wied, 1820) | 1 | | | 0.0096 | <0.001 | 0.007 | LC |
| Dasyproctidae | | | | | | | | |
| Black-rumped Agouti | *Dasyprocta prymnolopha* Wagler, 1831 | ** | ** | ** | 0.0615 | 0.04 | ** | LC |
| Erethizontidae | | | | | | | | |
| Brazilian Porcupine | *Coendou prehensilis* (Linnaeus, 1758) | ** | ** | ** | 0.0048 | <0.001 | ** | LC |
| Felidae | | | | | | | | |
| Tiger Cat | *Leopardus tigrinus* (Schreber, 1775) | ** | ** | ** | 0.1321 | 0.1321 | ** | EN |
| Cat | *Feliz catus* (Linnaeus, 1758) | ** | ** | ** | ** | ** | ** | LC |
| Jaguar | *Panthera onca (Linnaeus, 1758)* | | 3 | | 0.1295 | 0.05 | 0.022 | NT |
| Leporidae | | | | | | | | |
| Tapeti | *Sylvilagus brasiliensis* (Linnaeus, 1758) | ** | ** | ** | 0.0078 | <0.001 | ** | LC |
| Myrmecophagidae | | | | | | | | |
| Southem Tamandua | *Tamandua tetradactyla* (Linnaeus, 1758) | 32 | | | 0.3056 | <0.001 | 0.240 | LC |
| Tayassuidae | | | | | | | | |
| Collared Peccary | *Dicotyles tajacu* Linnaeu, 1758 | 10 | 1 | | 0.2629 | <0.001 | 0.082 | LC |
| Procyonidae | | | | | | | | |
| Crab-eating Raccoon | *Procyon cancrivorus* (G. [Barão] Cuvier, 1798) | ** | ** | ** | 0.0201 | <0.001 | ** | LC |
| South American Coati | *Nasua nasua* (Linaeus, 1766) | ** | ** | ** | 0.0069 | <0.001 | ** | LC |
| Suidae | | | | | | | | |
| Pig | *Sus domesticus* Erxleben, 1777 | ** | ** | ** | ** | ** | ** | LC |
| **Reptiles** | | | | | | | | |
| Amphisbaenidae | | | | | | | | |
| Wagler's Worm Lizard | *Amphisbaena vermicularis* Wagler, 1824 | ** | ** | ** | 0.0230 | <0.001 | ** | LC |
| Boidae | | | | | | | | |
| Jiboia | *Boa constrictor* Linnaeus, 1758 | | 19 | | 0.2989 | <0.001 | 0.142 | LC |
| Rainbow Boa | *Epicrates cenchria* (Linnaeus, 1758) | ** | ** | ** | 0.0415 | 0.02 | ** | LC |
| Colubridae | | | | | | | | |
| Yellow Rat Snake | *Spilotes pullatus* (Linnaeus, 1758) | ** | ** | ** | 0.0453 | 0.004 | ** | LC |

**Table 1.** *Cont.*

| Family/Ethnospecies (English Name) | Scientific Name | Usage Categories and Citation Number | | | Salience | *p* Value * | Use Value | Status |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | | | | |
| Brown vinesnake | *Oxybelis aeneus* (Waggler, 1824) | ** | ** | ** | 0.0576 | 0.02 | ** | LC |
| Crown Ground Snake | *Liophis viridis* (Günther, 1862) | ** | ** | ** | 0.0125 | <0.001 | ** | LC |
| Green Racer | *Philodryas nattereri* (Steindachner, 1870) | ** | ** | ** | ** | ** | ** | LC |
| Elapidae | | | | | | | | |
| South American Coral Snake | *Micrurus lemniscatus* (Linnaeus, 1758) | ** | ** | ** | 0.2143 | <0.001 | ** | DD |
| Iguanidae | | | | | | | | |
| Camaleão | *Iguana iguana* (Linnaeus, 1758) | 3 | | | 0.0492 | 0.008 | 0.022 | LC |
| Teiidae | | | | | | | | |
| Calango | *Cnemidophorus ocellifer* Spix, 1825 | ** | ** | ** | 0.0393 | 0.001 | ** | LC |
| Giant Tegu | *Salvator merianae* Dumério & Bibron, 1839 | 32 | 20 | | 0.3972 | <0.001 | 0.390 | LC |
| Tropiduridae | | | | | | | | |
| Striped Lava Lizard | *Tropidurus semitaeniatus* (Spix, 1825) | | 2 | | 0.0616 | 0.04 | 0.015 | LC |
| Viperidae | | | | | | | | |
| Middle American Rattlesnake | *Crotalus simus* Latreille, 1801 | | 14 | | 0.5119 | <0.001 | 0.105 | LC |
| Jararacussu | *Bothrops jararacussu* Lacerda, 1884 | ** | ** | ** | 0.0501 | 0.009 | ** | EN |
| Caatinga Lancehead | *Bothrops erythromelas* Amaral, 1923 | ** | ** | ** | 0.3088 | <0.001 | ** | LC |
| Apidae | | | | | | | | |
| Mandassaia | *Melipona quadrifasciata* Lepeletier, 1836 | | 5 | | ** | ** | 0.037 | LC |
| **Not identified (Vernacular names)** | | | | | | | | |
| Pica Pau | | ** | ** | ** | 0.0021 | <0.001 | ** | |
| Rondador | | ** | ** | ** | 0.0581 | 0.02 | ** | |
| Beija Flor | | ** | ** | ** | 0.0142 | <0.002 | ** | |
| Cagado | | | | 1 | 0.0120 | <0.001 | 0.007 | |
| Macauba | | ** | ** | ** | 0.0494 | 0.008 | ** | |
| Arara | | ** | ** | ** | 0.0049 | <0.001 | ** | |
| Acauã | | ** | ** | ** | 0.0187 | <0.001 | ** | |
| Rã | | ** | ** | ** | 0.0135 | <0.001 | ** | |
| Perereca | | ** | ** | ** | 0.004 | <0.001 | ** | |

Legend: Food (A), zootherapy (B), pet (C) and variable not registered for the species (**); statistical significance attributed to the saliency from a null scenario, considering $p < 0.05$ to be significant (*). Status: Least Concern (LC), Vulnerable (VU), Endangered (EN), Near Threatened (NT), and Data Deficient (DD).

The species accumulation curve (Sobs) reached stability in approximately 50 interviews, which indicates sample efficiency in data collection (Figure 3). The consensus of the three estimators for the number of cited species can be seen: Chao 1 and Chao 2 indicated a diversity of 82.5 species and the ICE estimator registered a diversity of 82.92 species.

The most cited species considering the use value were *Euphractus sexcinctus* (UV = 0.616), *Salvator merianae* (UV = 0.390), *Dasypus novemcinctus* (UV = 0.330), *Nothura boraquira* (UV = 0.255) and *Tamandua tetradactyla* (UV = 0.240). Regarding the state of conservation, it was noted that *Leopardus tigrinus* and *Bothrops jararacussu* have Endangered status.

The species *Tolypeutes tricinctus* and *Penelope jacucaca* are in a state of vulnerability and *Primolius maracana*, *Rhea americana* and *Panthera onca* are almost threatened.

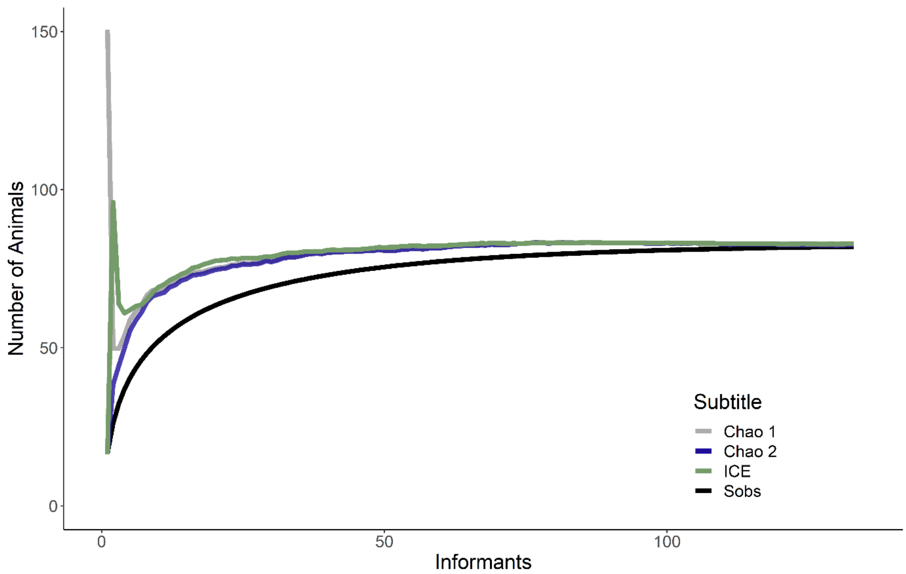


**Figure 3.** The accumulation curve of observed species (Sobs) compared to the estimators.

Among the vertebrates cited in use categories, 19 (22.8%) were used as food, 21 (25.3%) as zootherapy and 7 (8.4%) as pets. It was found that in the food category, there was a greater recurrence of mammals (eight species cited) and birds (seven species cited). Only two reptiles (*Iguana iguana* and *S. merianae*) were identified as food resources. In zootherapy, 7 mammals, 5 birds and 4 reptiles were cited.

The main part cited for zootherapy was lard (animal fat); however, the use of the whole animal, meat, rattle, poison, and tail was cited. Animal fat was touted as a treatment for inflammation, swelling, joint pain, body aches, earache, and toothache. The cultural importance of animals that were not cited in use categories was measured based on salience. The most salient animals with statistical significance ($p < 0.05$) in a null scenario were *Cerdocyon thous* (0.4131), *Bothrops erythromelas* (0.3088) and *Micrurus lemniscatus* (0.2143). The least salient species were *Coendou prehensilis* (0.0048) and *Thraupis sayaca* (0.0031).

The generalized linear models rejected the null models for the number of mammals, reptiles and birds mentioned in some categories of use, which points to the influence of socioeconomic variables in relation to the knowledge and use of animals. Regarding mammals, there were six statistically significant relationships. Educational level showed a negative relationship with the total number of mammals mentioned and with the number of mammals used in the food and zootherapy categories (Table 2). There was a tendency for informants who completed or reached high school to cite fewer species when compared to other educational levels.

**Table 2.** GLM Poisson results for the mammalian class, including estimated regression parameters, standard errors, z values and $p$ values.

| | **Estimate** | **Std.Error** | **Z Value** | **P (>∣Z∣)** |
|---|---|---|---|---|
| | • Cited total mammals * | | | |
| (Intercept) | 1.943 | 0.048 | 40.115 | <0.001 |
| Schooling (High School) | −0.298 | 0.078 | −3.792 | 0.00015 |
| Schooling (Higher Education) | −0.844 | 0.579 | −1.458 | 0.144 |

**Table 2.** *Cont.*

| | **Estimate** | **Std.Error** | **Z Value** | **P (>∣Z∣)** |
|---|---|---|---|---|
| • Wild mammals used as food | | | | |
| (Intercept) | 0.590 | 0.321 | 1.839 | 0.065 |
| Gender (Male) | 0.788 | 0.218 | 3.604 | 0.0003 |
| Schooling (High School) | −0.737 | 0.736 | 1.033 | 0.3017 |
| Schooling (Higher Education) | 0.736 | 0.736 | 1.033 | 0.301 |
| Income | −0.329 | 0.143 | −2.300 | 0.02 |
| • Wild mammals used as zootherapy | | | | |
| (Intercept) | −1.762 | 0.567 | −3.105 | 0.001 |
| Age | 0.023 | 0.010 | 2.314 | 0.020 |
| Schooling (High School) | −1.235 | 0.528 | −2.338 | 0.001 |
| Schooling (Higher Education) | 1.061 | 1.042 | 1.018 | 0.308 |

Legend. (*) To verify the influence of socioeconomic variables on the knowledge and use of animals, the generalized linear models were divided by animal class, a model was made for domestic animals or wild animals.

Gender influenced the number of mammalian animals mentioned as food, and men were more likely to mention more species. A slight positive relationship could also be seen between age, the mammals used as zootherapy and income and the total number of mammals cited (Table 3). Age positively and education negatively influenced knowledge about wild mammals used in zootherapy.

**Table 3.** GLM Poisson results for the class of birds, including estimated regression parameters, standard errors, z values and *p* values.

| | **Estimate** | **Std.Error** | **Z Value** | **P (>∣Z∣)** |
|---|---|---|---|---|
| • Total Birds cited | | | | |
| (Intercept) | 1.654 | 0.094 | 17.440 | <0.001 |
| **Age** | **0.004** | **0.002** | **1.999** | **0.04** |
| • Wild birds used as food | | | | |
| (Intercept) | −0.632 | 0.242 | −2.608 | 0.009 |
| **Gender (male)** | **0.761** | **0.264** | **2.882** | **0.003** |
| • Wild birds used as zootherapy | | | | |
| (Intercept) | −6.590 | 1.761 | −3.741 | <0.001 |
| Age | **0.069** | **0.028** | **2.485** | **0.012** |
| • Domestic birds used as zootherapy | | | | |
| (Intercept) | −0.900 | 0.277 | −3.248 | 0.001 |
| **Gender (male)** | **−1.284** | **0.433** | **−2.961** | **0.003** |

For the group of birds, the variables that influenced the number of species were the age of the informant, which influenced the total number of birds cited, and the number of wild birds used in zootherapy. The gender of the participants showed two relationships: a positive relationship between the number of birds consumed by men, and a negative relationship between domestic birds used as zootherapy by men (Table 3).

Regarding the number of cited reptiles, our models showed statistical significance for the participant's educational level and income regarding the total number of cited reptiles. Participants who reached or completed high school tended to cite fewer reptiles than participants with other educational backgrounds. On the other hand, income had a positive influence on the number of cited reptiles. The participant's age was also statistically significant, with a weak positive influence on the number of reptiles used in zootherapy (Table 4).

**Table 4.** GLM Poisson results for the reptile class, including estimated regression parameters, standard errors, z values and *p* values.

| | Estimate | Std.Error | Z Value | P (>∣Z∣) |
|---|---|---|---|---|
| • Total cited reptiles | | | | |
| (Intercept) | 1.465 | 0.151 | 9.762 | <0.001 |
| Schooling (High School) | −0.221 | 0.084 | −2.610 | 0.009 |
| Schooling (Higher Education) | −0.391 | 0.502 | −0.779 | 0.436 |
| Income | 0.156 | 0.073 | 2.135 | 0.03 |
| • Wild reptiles as food | | | | |
| (Intercept) | −2.180 | 0.916 | −2.380 | 0.01 |
| Age | 0.019 | 0.015 | 1.253 | 0.210 |
| Gender (male) | 1.151 | 0.567 | 2.031 | 0.04 |
| Schooling (High School) | 0.178 | 0.466 | 0.383 | 0.701 |
| Schooling (Higher Education) | −12.712 | 1275.75 | −0.010 | 0.992 |
| Income | −0.504 | 0.420 | −1.201 | 0.229 |
| • Wild reptiles as zootherapy | | | | |
| (Intercept) | −2.218 | 0.401 | −5.529 | <0.001 |
| Age | 0.032 | 0.007 | 4.226 | <0.001 |

The participant's profession did not show statistical significance with any analyzed animal class or use category. The number of wild reptiles cited as food was also not influenced by the socioeconomic profile, and no variable was significant for the number of wild or domestic birds cited as pets.

## 4. Discussion

### *4.1. Knowledge, Use of Fauna and Socioeconomic Influence*

Our data indicate that most respondents were male, of varying ages, and engaged in some activity related to agriculture, with incomes of up to the minimum wage (Brazilian currency) and incomplete primary education. This socioeconomic profile found is in line with other ethnobiological studies carried out in Brazil [22,36,37]. The recurrence of informants who are low-income individuals, have a low educational level and work in agriculture has been pointed out as a motivator for identifying an alternative source of subsistence and food, especially in the Brazilian semi-arid region. In these regions, hunting activities and interactions with the fauna have a double character: (i) utilitarian, in which animals are incorporated into different uses, and (ii) cultural, in which the fauna are associated with myths, taboos, symbologies and emotions [3,21,38–42].

Regarding the game fauna, the group of birds had the highest number of citations, followed by mammals and reptiles. This result is identified in several works around the world that studied the interactions between wild fauna and human populations, indicating the predominance of avifauna or mammals in categories of use such as food, zootherapy and pets; reptiles are often cited as food or for use in zootherapeutic practices [43–48].

The predominance of citations for the bird group can be justified by their abundance and species richness in the semi-arid region and the use of these animals in trafficking, providing a greater number of interactions for this group. Studies indicate that birds from the Thraupidae, Icteridae and Psittacidae families are most commonly used as pets due to their attractive colors, beauty and pleasant song, while the Columbidae and Tinamidae family are recurrently used as food [2,45,49].

It is understood that the use of wildlife is an activity that ensures food security for traditional and non-traditional peoples in rural and urban spaces around the globe. In this way, hundreds of species are hunted for their meat, which is important both to support nutrition through the provision of proteins, fats and macronutrients and to sustain the identities and cultural practices of human populations [50]. In this context, the use of birds and mammals for food are portrayed as being the groups with the highest biomass, with high species richness and pleasant taste [51,52]. However, recent research indicates that populations in the Brazilian semi-arid region have developed strategies to take advantage of medium and small-sized species, since large-sized species are absent or scarce [38]. Additionally, local studies have found that subjective variables such as the preference for the taste of meat and the leisure associated with hunting shape the preference of hunters [2,3,53–56].

The use of animals as medicines in health treatments is performed worldwide; in this way, the total use or use of parts of mammals, birds, reptiles and bees, as recorded in our data, is corroborated by other studies [57,58]. Domestic animals like *Gallus Gallus domesticus* and *Ovis aries* or wild species like *Euphractus sexcinctus*, *Boa constrictor*, *Salvator merianae* and *Melipona quadrifasciata* are cited in other studies as zootherapy, used to treat conditions such as ear pain, skin wounds, swelling, infections, respiratory diseases, musculoskeletal problems and snake bites [59].

The ethnobiological literature points out that in Latin America, more than 510 species of animals distributed in 13 taxonomic categories and 215 families are used in zootherapeutic practices. Mammals register the highest number of species, followed by birds, fish, reptiles and insects [59]. Animal fat is generally used in treatments; however, there are records of the use of other parts such as honey, wax, urine, feces, meat, skin, penis, tail, gizzard, eggs, gallbladder, scales and animal teeth. The form of use is also diverse, and treatments can be administered orally, topically (directly on the skin, in the eye or inhaled) and subcutaneously (on cuts and wounds) [16,42,58,60–62].

The results presented in the previous paragraphs reinforce the cultural importance of wildlife, in which several species are cited for different cultural domains. Additionally, the data obtained from the generalized linear model allow for a deeper debate on how some socioeconomic variables influence the use of wildlife. Thus, our data indicate that the socioeconomic variables of the interviewees can shape knowledge of wildlife, corroborating other studies [6,54,63]. At this point, there is a consensus that the use of game species is influenced by regional heterogeneity, that is, direct (environmental) or indirect (economic, social, political, cultural, scientific and technological) factors are responsible for the patterns of use of wildlife resources [48].

Analyzing the effect of each socioeconomic variable, gender influenced knowledge of species in some cultural domains, as men cited more species than women (see Tables 2–4). The literature indicates that men know more species of animals that are used as food (especially mammals and birds) and women know more species used as zootherapy. This behavior can possibly be explained by the social roles of men and women within the family, as men are generally seen as the family providers and women assume the role of caregivers and performers of domestic activities [38,64].

It is important to highlight that the differences in the number of men and women interviewed influence the gender knowledge differences shown in the GLM. Therefore, our analysis of the role of gender in traditional knowledge is limited. However, although the literature indicates that traditional practices such as hunting are linked to men, there is no restriction on women's participation [65]. It is worth noting that the predominant behavior of the male hunter is a recent cultural motivation, since in ancestral hunter-gatherer communities, the participation of all capable individuals was encouraged [23,66,67].

The variable "age" was significant, as a positive relationship was observed for the number of medicinal animals cited for the three classes (mammals, birds and reptiles). Older people are expected to have more knowledge about natural resources, since through experience they accumulate skills and practices that make the use of a resource more efficient [19,20,22,68].

Finally, education and income are variables directly linked to the use of wildlife resources. It was noted that informants who completed high school tended to mention fewer species used when compared to other educational levels. A similar situation was found in a study with birds, indicating that their consumption was significantly lower when the interviewees completed high school or higher education [69]. Regarding income, informants with higher incomes knew fewer species when compared to interviewees with lower incomes [19,70].

Analyzing the influence of socioeconomic profile on interactions between human populations and wildlife has proven to be complex. According to Marques et al. [65], socioeconomic factors do not historically define a human population's knowledge about wildlife. However, other studies indicate that gender, age, education and income affect the following: knowledge and use of natural resources [20,21,71], the number of species hunted [2], the influence on the perception of the abundance of natural resources [68], and interactions of empathy or antipathy with wildlife [6,72].

### *4.2. Relationship of Sociodemographic Data with Conservation*

Our data indicate that socioeconomic variables may influence wildlife use. We found that they vary across animal classes and use categories. In this sense, the conservation literature points out that variables such as emotions [39], local ecological knowledge [73] and socioeconomic variables influence animal population management from a global perspective [74,75]. Thus, investigating how these variables locally modulate the way humans know and use wildlife enables debates that help develop conservation policies.

Thus, we can discuss our results considering how these data can enable wildlife conservation policies. Locally, variables such as age, gender, education level and income influence people's perceptions of certain species. In the study by Prokop and Fančovičová [76], young people between 10 and 20 years old were consulted to verify their emotions and willingness to protect aposematic species, and it was found that younger participants demonstrated a greater willingness to protect the species presented. Regarding the perception of the abundance of hunting resources, the study developed by Silva-Neto et al. [68] compared two groups of hunters (younger, <40 years old, and older, >40 years old), recording that younger informants perceived that the abundance of the species was lower than older interviewees. In addition, older people tended to be more negative about wolf and bear conservation [77]. Therefore, the effect of age on human attitude has several perspectives of approach, reinforcing the need for local studies investigating this topic.

With regard to gender, a case study in Bhutan found that women are more involved in dog conservation than men [78]. On the other hand, it is often pointed out that women tend to attribute greater conservation value to non-human animal species [79]. Thus, the established consensus is that men and women tend to exhibit different behaviors and perceptions and attribute different values towards wildlife, which should be considered in conservation policies.

Schooling also influences the perception of fauna in different ways. It is predicted that individuals with higher levels of education tend to have fewer prejudices and negative perceptions about traditionally persecuted species [39]. Some case studies corroborate this perspective, showing that people with higher levels of education were more positive towards four carnivorous species [77]. Thus, formal education combined with economic compensation policies can help to gain public support for animal conservation [75,80].

Finally, the relationship between an individual's income and interactions with wildlife varies locally. It is pointed out that the consumption of wild animals ensures food security for rural and urban populations living in poverty [81]; therefore, populations with lower incomes tend to slaughter more animals and resist conservation policies. However, the literature indicates that the influence of income may not be so linear; in case studies, it is found that income is not related to animal consumption [2,67]. An example would be related to the increase in the consumption of wild animals by human populations with higher incomes, as people with higher incomes have access to better hunting tools, increasing their ability to capture wild animals [82].

In this way, we understand that conservation policies must start from the socioeconomic characterization of local communities, including conducting a survey of the uses of natural resources and, finally, adapting awareness strategies to the reality of each human population.

## 5. Conclusions

Fauna are important resources for the maintenance of human populations. In our study, birds, mammals and reptiles are used mainly for food and zootherapy, ensuring food security and promoting health. In this way, the utilitarian importance of fauna contributes to the cultural identities of local human communities.

We emphasize that analyzing the influence of the socioeconomic profiles of human populations on knowledge and use of fauna is a complex process. Several variables had a low influence on the number of animals cited; however, some influenced knowledge associated with fauna in some cultural domains, acting differently according to the animal class and category of use.

Therefore, it is recommended that future studies include analyses of the influence of socioeconomic variables, considering hunting motivation, categories of use and local preferences for animals. A better understanding of how these variables function within a socioecological system can favor wildlife conservation policies.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in this study.

**Data Availability Statement:** All data are available in the body of the article. Further information may be requested directly from the authors.

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