

KEEPING WILD BIRDS AS PETS IN A SEMIARID REGION OF RIO GRANDE DO NORTE STATE, NORTHEASTERN BRAZIL

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ABSTRACT.— There is a wide variety of wild birds in the semiarid region of Brazil. Some of these birds are frequently used by local populations in various ways, and the habit of keeping wild birds in cages as pets is very common. The objective of this study was to survey the birds kept as pets in a semiarid region of Rio Grande do Norte state in northeastern Brazil. Field study was conducted from September 2009 to March 2010 in the districts of Caicó, São João do Sabugi, Serra Negra do Norte, and Timbaúba dos Batistas. A total of 101 individuals were interviewed, including 91 male respondents, with ages ranging 10–75 years. Data were collected using semi-structured interviews of local residents who kept wild birds as pets. Twenty-five species of wild birds kept as pets, belonging to seven families, were mentioned by the respondents. The family Thraupidae was the most represented, with 10 bird species. *Sporophila albogularis*, *Paroaria dominicana* and *Icterus jamacaii* had the highest use values, all of them species endemic to the Caatinga and Brazil. Capturing wild birds for caged keeping is an activity still practiced in the study area by local human populations, who prefer species endemic to Brazil.

KEY WORDS: *Brazilian semiarid, Caatinga, endemic birds, ethno-ornithology, use value.*

RESUMEN. USO DE AVES SILVESTRES COMO MASCOTAS EN UNA REGIÓN SEMIÁRIDA DEL ESTADO DE RIO GRANDE DO NORTE, NORESTE DE BRASIL.— Hay una gran diversidad de aves silvestres en la región semiárida de Brasil. Algunas de ellas son a menudo utilizadas por las poblaciones locales de diferentes maneras, siendo muy común el hábito de criarlas en jaulas como mascotas. El objetivo de este trabajo fue relevar las aves utilizadas como mascotas en una región semiárida del estado de Rio Grande do Norte, en el noreste de Brasil. El trabajo de campo fue realizado entre septiembre de 2009 y marzo de 2010 en las localidades de Caicó, São João do Sabugi, Serra Negra do Norte y Timbaúba dos Batistas. Fueron entrevistadas 101 personas, incluyendo 91 varones, de 10–75 años de edad. Los datos fueron obtenidos mediante entrevistas semiestructuradas con habitantes que utilizaban aves silvestres como mascotas. Los entrevistados mencionaron 25 especies de aves silvestres utilizadas como mascotas, pertenecientes a 7 familias. La familia Thraupidae fue la más representada, con 10 especies. *Sporophila albogularis*, *Paroaria dominicana* e *Icterus jamacaii* presentaron los mayores valores de uso, siendo todas endémicas de la Caatinga y de Brasil. La captura de aves silvestres para su uso como mascotas en jaula es una actividad todavía practicada por las poblaciones locales del área de estudio, donde las especies endémicas de Brasil son preferidas.

PALABRAS CLAVE: *aves endémicas, Caatinga, etno-ornitología, semiárido brasileño, valor de uso.*

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The relationship between humans and animals has existed since ancient times and has been expressed in different ways, reflecting influences from environmental and cultural conditions (Alves 2012, Alves and Souto 2015). In the case of birds, ethno-ornithology is the branch of ethnobiology that contributes to the understanding of the cognitive, behavioural and symbolic relationships between humans

and birds (Farias and Alves 2007, Tidemann and Gosler 2010).

A long and close relationship has been established between birds and human populations, allowing these animals to be present in the everyday life and imagination of human cultures in various ways (Vargas-Clavijo and Costa Neto 2008). Ancient cultures around the globe are known to have captured, kept and

bred wild birds as pets (Carrete and Tella 2008, Anderson 2010, Bonta 2010, Alves 2012). Currently, birds are still recognised for their use as pets in many places worldwide (Balderas et al. 2001, Jepson and Ladle 2005, 2009, Pangau-Adam and Noske 2010, Alves 2012, Roldán-Clarà et al. 2014). Passeriformes are often kept in cages as pets worldwide because they have characteristics that differentiate them from other groups of birds, including beautiful plumage, melodious singing, or both (Tully 2009). Psittacidae also stand out because of their ability to vocally imitate humans (Balsby et al. 2012), as well as their beauty and docility. They are also one of the most popular bird families and are sought as pets worldwide (RENTAS 2001, Alves et al. 2013a).

Brazil, with its impressive territorial extent and biodiversity, has one of the most diverse avifauna in the world (Marini and Garcia 2005), including more than 1900 known species (Piacentini et al. 2015). Brazil also stands out because of its wide variety of birds used as pets by local human populations (Alves et al. 2010, 2013a, Barbosa et al. 2010, Bezerra et al. 2011a, Fernandes-Ferreira et al. 2012, Licarião et al. 2013, Paixão et al. 2013). In Brazil, historical document analyses indicate that indigenous have captured songbirds and ornamental birds as pets since ancient times because of their beauty, singing and companionship (Alves 2012). This practice still continues today and is firmly rooted in local cultures and traditions in various Brazilian regions (Barros et al. 2011, Alves 2012, Fernandes-Ferreira et al. 2012).

The Caatinga is a Brazilian region in which the capture of birds for caged keeping as pets is quite common (Sick 1997, Alves et al. 2010, 2013b, 2016, Licarião et al. 2013). This region is a natural semiarid area in the northeastern portion of the country, with occurrence records of 591 bird species (Hauff 2010, MMA 2015), many of which are also commonly used by local human populations for different purposes, including, for example, illegal trade (Pereira and Brito 2005, Rocha et al. 2006, Gama and Sassi 2008), traditional medicine (Alves et al. 2008, Ferreira et al. 2009, Bezerra et al. 2013), and food (Bezerra et al. 2011b, Alves et al. 2013c, Galvagne-Loss et al. 2014). The Caatinga encompasses 925043 km², which corresponds to 13% of the total area of Brazil (Sá et al. 2003), and is considered one of the

most biodiverse semiarid regions in the world (Silva et al. 2003). The Caatinga spans nine Brazilian states, including Rio Grande do Norte. Recent studies have highlighted the importance of the avifauna for local human populations living in the semiarid region of Rio Grande do Norte, whether it be for cultural or socio-economic reasons (Bezerra et al. 2011a, 2011b, 2013). However, ethno-ornithological studies conducted in the semiarid region of Rio Grande do Norte are still scarce compared with those conducted in other Brazilian semiarid regions.

In this context, the need for further studies is evident, especially considering that the capture of wild birds has been identified as a factor of fundamental importance to local populations and has clear implications for conservation (Alves et al. 2010). Thus, the objective of this study was to identify the bird species kept, their forms of use and reasons for breeding birds as pets by the local population of the semiarid region of Rio Grande do Norte, in order to answer the following questions: (1) is the age and educational level of the respondent related to the number of bird species kept as pets?, and (2) which bird species are preferred for caged keeping?

METHODS

Study area

The study area included the districts of Caicó, São João do Sabugi, Serra Negra do Norte and Timbaúba dos Batistas, all of them located in a semiarid area of Rio Grande do Norte State (Fig. 1), in environments belonging to the Caatinga biome.

The climate is hot semiarid, according to the Köppen classification, characterised by scarce and highly irregularly distributed rainfall, low cloudiness, strong insolation, high evaporation rates, and high mean temperatures. The rainfall regime is summer–autumn, with rainfall concentrated in January–April. Total rainfall varies between years (350–800 mm annually), with a historical mean of approximately 600 mm (Amorim et al. 2005). The local flora is classified as hyperxerophilic, arboreal-shrubby caatinga (Varella-Freire 2002, Santana and Souto 2006). The vegetation structure of the region is characterised by small trees, which are often shorter than 7 m, with sparse distribution and fewer species than other types of caatingas (Duque 1980).

Sampling procedures

The field study was conducted from September 2009 to March 2010. Data were collected through interviews with local residents who kept or interacted with wild birds. The informants were selected using the snowball sampling technique (Biernacki and Waldorf 1981), which consists of locating other target informants for the study via referral from the first contacts. This referral sequence enabled the identification of key informants (Nardel 1939), who are people recognised in the community as having more experience or greater knowledge on a particular subject of interest for the study. The identification of key informants in each locality studied enabled the collection of more detailed ethno-ornithological data on the keeping of wild birds as pets.

Ethno-ornithological data were collected using semi-structured interviews and direct observations, including data collection through pre-formulated questions with open-ended answers on the proposed topic (Mello 1986, Albuquerque et al. 2014). The semi-structured interviews addressed aspects regarding the types of birds kept, their forms of use and reasons for breeding birds as pets. The interviews were conducted individually

and recorded with an MP3 player. The interviews were transcribed as faithfully as possible and organised into a standardised database. A field notebook was used to take notes during the interviews in which recording with the MP3 player was not allowed. Tests were performed to assess the consistency and validity of the responses based on interviews repeated in synchronic and diachronic situations (Marques 1991). A social questionnaire was also applied to characterise the target population and analyse the relationship between social characteristics and the number of bird species kept as pets.

Social profile of respondents

The human populations in the localities studied are largely composed of people involved in small-scale agricultural activities such as subsistence agriculture, animal husbandry (goats, sheep, and cattle), and the service sector (e.g., small businessmen, teachers) who also undertake cynegetic activities in the region. The populations in the study area consider themselves to be "sertanejos". In the categories developed by Diegues and Arruda (2001) to describe traditional populations, the sertanejos/vaqueiros correspond to traditional non-indigenous populations that occupy

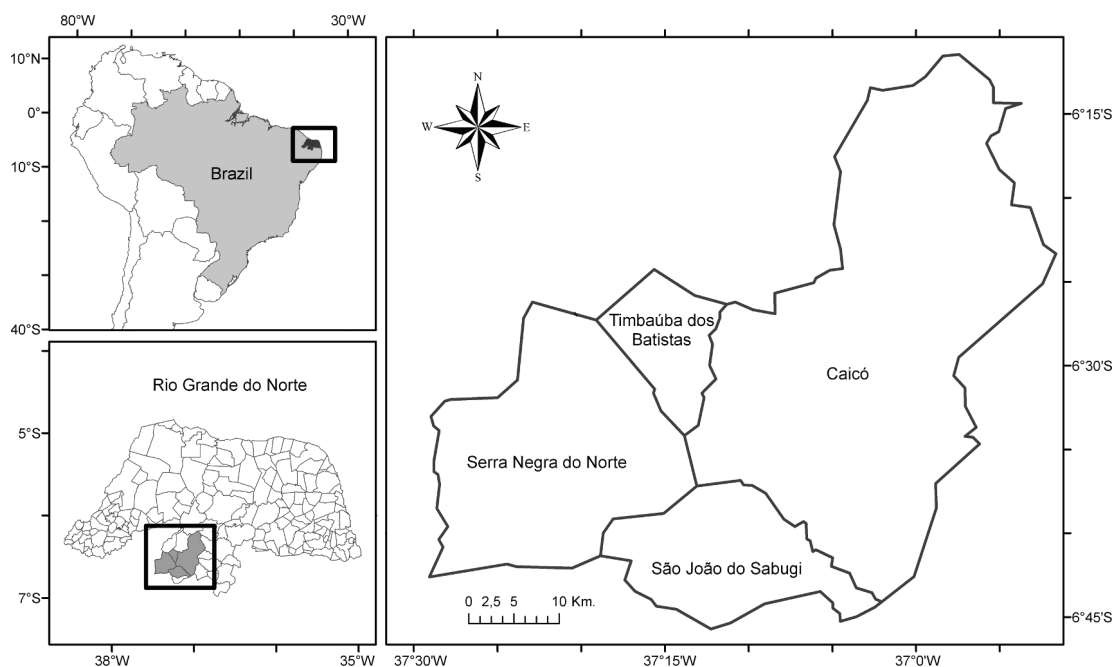


Figure 1. Map of the study area showing the districts of Caicó, São João do Sabugi, Serra Negra do Norte and Timbaúba dos Batistas in Rio Grande do Norte state, northeastern Brazil.

inland areas of northeast Brazil and can also advance into the semiarid Caatinga region.

The purpose and general objectives of the study were explained to potential respondents in plain language. Permission to conduct interviews and record data was requested, and the right of individuals to refuse to participate was respected; additionally, the anonymity of the respondents was ensured.

Species identification

The birds mentioned were identified to the species level using field guides (van Perlo 2009, Ridgely and Tudor 2009, Sigrist 2014), direct observation, photographic records during interviews, and the checklist-interview method (Alexiades 1996), which consisted of showing images of birds to the respondents.

Data analysis

A questionnaire on social aspects was used during the interviews to collect data on the profile of the population that keep wild birds as pets. This information enabled the assessment of whether the age and educational level of the respondents affected this type of use. This is important to understand the sociocultural significance of the use of birds as pet in the Brazilian semiarid region. Spearman's correlation was used to assess whether there is a relationship between the age of each of the respondents and the respective number of species mentioned. The Kruskal-Wallis test was used to compare the number of species mentioned and the education level of respondents (illiterate, primary level incomplete, primary level complete, secondary level incomplete, finished high school, higher education incomplete or complete). All analyses were performed using the *BioEstat* 5.0 program (Ayres et al. 2007), adopting a significance level of 5%.

Use values were calculated for the species mentioned as pets by all respondents. The use value demonstrates the relative importance of the locally known species and is calculated using the following formula (adapted from Phillips et al. 1994 and described by Rossato et al. 1999): $UV = \sum U_i/n$, where U_i is the number of citations per species, and n is the total number of informants.

Species accumulation curves of pet birds mentioned by the respondents were plotted.

In the ethno-ornithological data accumulation curve, the x-axis corresponded to the number of individuals interviewed, and the y-axis to the number of bird species mentioned. The curve was randomised 1000 times, and the means were calculated using the program *EstimateS* version 9.1 (Colwell 2013). Chao 2 was used to estimate the number of species known by the local population. This richness estimator is based on incidence (presence-absence) data that express rarity based on "uniques" and "duplicates", that is, the number of species found in only one or two samples, respectively (Peroni et al. 2008). This index has been used in several ethno-zoological studies (Araujo and Nishida 2007, Souto et al. 2011, Fernandes-Ferreira et al. 2012, Alves et al. 2013a). The following assumptions enabled the use of this estimate based on the results of the interviews: the wide spatial distribution of the data acquired and the identification and interview of the maximum number of key informants in each community (Araujo and Nishida 2007). The selection of the Chao 2 estimator resulted from the requirement of working exclusively with incidence data.

RESULTS

A total of 101 individuals (91 men and 10 women) were interviewed, and their ages ranged from 10–75 years, with a mean age of 34 years. Most respondents lived in urban areas (77.5%, $n = 93$). The respondents predominantly had a low level of formal education, with 63.3% of the sample consisting of illiterate or individuals with incomplete primary education. The number of bird species mentioned was not affected by the educational level of respondents ($H = 7.7636$, $p = 0.2559$; Kruskal-Wallis test). However, there was a negative correlation between the age group of respondents and the number of pet bird species mentioned ($r_s = -0.2783$, $p = 0.0048$).

A total of 25 wild bird species kept as pets, belonging to 7 families, were mentioned (Table 1). All bird species were native to Brazil, including 3 endemic to the Caatinga (*Eupsittula cactorum*, *Paroaria dominicana* and *Sporophila albogularis*) and 2 endemic to Brazil (*Cyanocorax cyanopogon* and *Icterus jamacaii*). The families Thraupidae (10 species), Columb-

Table 1. Use value of wild bird species kept as pets by human populations in the semiarid region of Rio Grande do Norte state, northeastern Brazil.

Bird species	Use value
Columbidae	
<i>Columbina minuta</i>	0.10
<i>Columbina talpacoti</i>	0.20
<i>Columbina squammata</i>	0.24
<i>Columbina picui</i>	0.21
<i>Patagioenas picazuro</i>	0.04
Psittacidae	
<i>Eupsittula cactorum</i>	0.27
<i>Forpus xanthopterygius</i>	0.06
Corvidae	
<i>Cyanocorax cyanopogon</i>	0.21
Turdidae	
<i>Turdus rufiventris</i>	0.11
Mimidae	
<i>Mimus saturninus</i>	0.06
Traupidae	
<i>Coereba flaveola</i>	0.03
<i>Coryphospingus pileatus</i>	0.08
<i>Paroaria dominicana</i>	0.50
<i>Sicalis flaveola</i>	0.31
<i>Sicalis luteola</i>	0.09
<i>Volatinia jacarina</i>	0.02
<i>Sporophila nigricollis</i>	0.31
<i>Sporophila lineola</i>	0.33
<i>Sporophila albogularis</i>	0.61
<i>Sporophila bouvreuil</i>	0.28
Icteridae	
<i>Icterus pyrrhopterus</i>	0.20
<i>Icterus jamaicaii</i>	0.47
<i>Gnorimopsar chopi</i>	0.16
<i>Molothrus bonariensis</i>	0.03
<i>Cacicus solitarius</i>	0.03

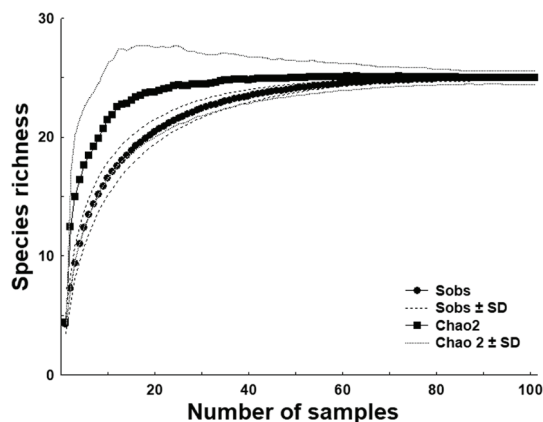


Figure 2. Species accumulation curves of wild bird species kept as pets by human populations in the semiarid region of Rio Grande do Norte state, northeastern Brazil. Number of samples refers to the number of individuals interviewed ($n = 101$). The number of species mentioned (S_{obs}) and the number of species estimated (Chao 2), along with their respective standard deviations, are shown.

idae (5) and Icteridae (5) were the most represented regarding the number of species mentioned (Table 1). The number of species mentioned was compared with the expected number of species (Fig. 2). Species accumulation curves stabilised at expected mean (\pm SD) values of 25 ± 0.59 species.

The use values of the species ranged from 0.03–0.61 (Table 1). The highest values correspond to *Sporophila albogularis*, *Paroaria dominicana* and *Icterus jamaicaii* (Fig. 3). According to the respondents, the song and the beauty of the plumage are the main reasons for breed-



Figure 3. Wild bird species endemic to Brazil with the highest use value as pets in the semiarid region of Rio Grande do Norte state, northeastern Brazil. A: *Icterus jamaicaii*, B: *Paroaria dominicana*, C: *Sporophila albogularis*. Photos: DMM Bezerra.

ing these bird species as pets. However, other motives have also been cited, such as charisma by birds and for considering it an entertainment activity.

DISCUSSION

There was no correlation between the educational level and the keeping of wild birds as pets in the study region. Similar results were observed in other Brazilian semiarid locations (Alves et al. 2009, 2013a), where the keeping of wild birds as pets has great cultural significance and continues to be widespread among the local population. According to Alves et al. (2010), the practice of keeping pet birds is carried out by people of all education, with the associated knowledge being transmitted from generation to generation.

The negative correlation between the age of the respondents and the number of bird species mentioned may indicate that younger respondents have greater preference for keeping wild birds as pets compared with older individuals. This result suggests that this type of use remains widespread and is practiced among the young generation of the local human populations of the studied region, probably because young people have more time for bird-keeping activities and more time to care for birds compared to older people. Hunting is an activity predominantly practiced by men in the northeastern semiarid region and also in other regions of Brazil (Alves et al. 2009, Hanazaki et al. 2009, Barros et al. 2011, Bezerra et al. 2011b), probably explaining the small sample of women interviewed in this research.

The richness of wild birds used for keeping as pets in the study area was lower than that found in other ethno-ornithological studies conducted in Caatinga sites: for example, Alves et al. (2010), Fernandes-Ferreira et al. (2012) and Alves et al. (2013a), identified 38, 44 and 40 wild bird species kept in captivity as pets, respectively. The lower number of species cited in this study may be related to the cultural differences among areas, but also may be due to the lower species diversity present in the study area.

The families Thraupidae, Icteridae and Columbidae stood out in this study in number of species. The preference for species from the families Thraupidae and Icteridae is because

they include some of the most attractive Brazilian birds and have vocalizations with beautiful repertoires (Sick 1997, Sigrist 2014), drawing the attention of pet bird keepers. Other studies on the use and trade of birds for cage keeping also found Thraupidae and Icteridae among the preferred families (Pereira and Brito 2005, Bezerra et al. 2011a, Fernandes-Ferreira et al. 2012, Licarião et al. 2013, Alves et al. 2013a, Teixeira et al. 2014). Columbidae species are also commonly used as pets in several Brazilian regions, primarily because of their beautiful plumage. Pigeons are among the first domesticated birds, sharing a large part of human history, and today the rearing of various Columbidae species remains a common pastime in many countries (Anderson 2010).

The results of the species accumulation curves showed that the sample of respondents was adequate because approximately 100% of the wild bird species kept in captivity as pets in the study region were recorded. Ethno-zoological studies in Brazil involve a number of difficulties, including the refusal of many inhabitants to participate in the study for fear of possible legal implications related to the use and trade of wild animals (Alves and Souto 2010), and this situation was also observed in the study area. Therefore, richness estimators become important for studies on this topic as a way to indicate whether the data collected are close to the actual number of known species used or hunted by a particular human group (Alves et al. 2013a).

Although some species of pet birds have also been related in this study to use in traditional medicine, in food and associated with symbolic aspects (see Bezerra et al. 2011a, 2011b, 2013), the choice of birds used as pets is affected mainly by vocalization and colourful plumage, as was found in previous studies (Alves et al. 2010, Fernandes-Ferreira et al. 2012). Bird species with the highest use value (*Sporophila albogularis*, *Paroaria dominicana* and *Icterus jamaicai*) have beautiful songs and plumage (Fig. 3), and are also endemic to Brazil. This finding suggests that endemism may be another trait explaining preference, most likely because of the ease of capture or perhaps the higher availability of individuals of these species typical of the region.

Bird keepers interviewed in this study preferred male specimens, primarily because of

their harmonious songs, which is a less obvious characteristic in females. This preference was also highlighted in Rocha et al. (2006), Gama and Sassi (2008) and Barbosa et al. (2010), who studied the trade and keeping of wild birds in Paraíba state. Male birds have more prominent songs than females in order to attract females and defend territory against other males (Gil and Gahr 2002), thereby corroborating data from the respondents.

Bird trade was not a prominent activity in the region, most likely because most respondents captured specimens directly from the environment to keep them as pets. *Sicalis flaveola* is an exception, because the clandestine sale and exchange of individuals occurs extensively in the region. This trade is inextricably linked to the use of this species in fights between males, a practice promoted by keepers, which was also recorded by Alves et al. (2010) in a study conducted in the semiarid region of Paraíba, where *Paroaria dominicana* was also found to be used in fights, in addition to *Sicalis flaveola*. Birds are placed in large cages, where aggressions extend for more than half an hour, causing injuries and loss of individuals. "Good fighting" individuals can acquire very high monetary values, contributing to the interest and continuation of this cultural practice, but considered illegal in Brazil (Gama and Sassi 2008).

The choice of a pet bird in the study area involves morphological, behavioural and ecological aspects of the species captured, combined with the cultural and socioeconomic aspects of the user human population, corroborating a trend already reported in the literature (Alves et al. 2010, 2013a, 2013b, Fernandes-Ferreira et al. 2012). Although keeping wild birds in captivity as pets is illegal as provided for in Brazilian laws 5197/67 (Wildlife Protection Act) and 9605/98 (Environmental Crimes Act), this cultural activity persists in Brazil and includes a wide variety of Brazilian bird species (Alves et al. 2010, 2013a, Barbosa et al. 2010, Bezerra et al. 2011a, Fernandes-Ferreira et al. 2012, Licarião et al. 2013, Paixão et al. 2013). This practice highlights the need for accounting bird keeping in strategies seeking the conservation of Brazilian wild avifauna (Alves et al. 2013a). Furthermore, a way to circumvent this problem would be to develop environmental education strategies, especially considering that the cul-

tural practice of breeding pet birds begins in childhood.

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