ETHNOBIOLOGY AND CONSERVATION

RESEARCH ARTICLE

Ethnobiology and Conservation, 15:09 (11 April 2026)
doi:10.15451/ec2026-04-15-09-1-16
ISSN 2238-4782 ethnobioconservation.com

The role of Local Ecological Knowledge on the Behavioral Ecology of mammals

Tamires Maria-Silva[1*], María Fernanda De la Fuente[1,2], Antonio Souto[3] and Nicola Schiel[1]

ABSTRACT

While the role of Local Ecological Knowledge (LEK) is widely recognized for its dialogue and complement in ecology and conservation contexts, its role on the behavioral ecology of mammals is still unknown. With that in mind, we investigated LEK on the behavioral ecology of mammals, and which variables could influence such knowledge. The study was carried out in the municipality of Cabaceiras, state of Paraíba, Brazil. Data collection was divided into two stages: (i) free list (192 interviewees), to identify the mammals known in the region; (ii) and semi-structured interviews (150 interviewees). We found that conspicuous behaviors were significantly more familiar than cryptic ones, and higher LEK by residents with a rural occupation, who lives longer in the locality and encounters animals more frequently. Thus, when considering LEK on the behavioral ecology of mammals, it is important to recognize that its contribution occurs, to a greater degree, in relation to more visible behaviors and the informants more contact. LEK emerges as a complementary source of information, optimizing data collection efforts and strengthening the inclusion of local knowledge in conservation strategies. Furthermore, considering in the future bridging LEK and Behavioral Ecology of mammals would lead to a two-way street that can promote a more equitable approach between these two knowledge systems.

Keywords: Ethnozoology; Caatinga; Mammals; Free list; Local community..

1 Laboratory of Theoretical and Applied Ethology (LETA), Department of Biology, Federal Rural University of Pernambuco, Rua Dom Manoel de Medeiros, Dois Irmãos, 52171900 - Recife, Pernambuco, Brazil.

2 National Zoo of Chile (Parquemet), Pío Nono, 450 Recoleta, Santiago – Chile.

3 Laboratory of Ethology (LabEt), Department of Zoology, Federal University of Pernambuco, Cidade Universitária, 50670420 - Recife, Pernambuco, Brazil.

* Corresponding author ✉. E-mail address: TMS (tamires.msilva@ufrpe.br)

SIGNIFICANCE STATEMENT

This study investigates the role of Local Ecological Knowledge (LEK) in the behavioral ecology of mammals, an interface still underexplored in the scientific literature. By analyzing which behaviors are more commonly recognized by local populations and the factors that influence this knowledge (i.e., occupation, length of residence in the region, and frequency of wildlife encounters), the research highlights the potential of LEK as a complementary source of behavioral data. The findings reinforce the importance of incorporating local knowledge into conservation strategies reinforcing bridging LEK and behavioral ecology as a promising path toward more equitable and effective approaches to biodiversity conservation. .

INTRODUCTION

Throughout history humans have developed a wide variety of ways to interact with animals (Alves 2012), which has allowed them to acquire a wealth of knowledge about the biology and ecology of species (Alves and Lopes 2018). This empirical knowledge, called Local Ecological Knowledge (LEK), can be obtained through everyday experiences and extensive and direct contact with nature (Berkes 1993). LEK has become a relevant source for the development of nature conservation, as it provides important data about different animal species (Lima et al. 2017; Simo et al. 2020; Borges et al. 2025). It is important to mention that, more and more researchers have discussed the epistemic relevance of LEK and exploring how it can dialogue and complement in ecology and conservation contexts (e.g., Albuquerque et al. 2021; Braga-Pereira et al. 2021; Torrents-Ticó et al. 2021; Borges et al. 2025). Furthermore, other researchers argue that LEK and other academic areas can mutually enrich each other and improve biodiversity management and conservation strategies (Alves and Lopes 2018; Albuquerque et al. 2021; Borges et al. 2025). The possible convergences and divergences between the provided information from these two types of knowledge and the possibility of using them as complementary knowledge have been discussed (Albuquerque et al. 2021; Torrents-Ticó et al. 2021). Some studies have addressed LEK in mammals regarding their abundance (carnivores: Torrents-Ticó et al. 2021; primates: Torres-Junior et al. 2016; Afriyie and Asare 2020; ungulates: Afriyie and Asare 2020), geographic distribution (primates: Freire-Filho et al. 2018), and population surveys (artiodactyls: Camino et al. 2020). However, to date, there are no studies that explore the LEK of the behavioral ecology of this animal group.

Behavioral Ecology is a field dedicated to the study of the relationships between behavior, ecology, and evolution of animals, including humans (Danchin et al. 2007). It can contribute with essential data for the conservation of animal species (Ritzel and Gallo 2020; Fashing et al. 2022; Marske et al. 2023) and has become increasingly relevant, especially in the context of studies concerning mammals (Ewart et al. 2024). This is probably because they are one of the animal groups most affected by anthropogenic impacts (Loiseau et al. 2020). In this context, LEK emerges as a complementary source of information, optimizing data collection efforts and strengthening the inclusion of local knowledge in conservation strategies. It would be interesting to investigate LEK regarding the behavioral ecology of mammals, and the variables which could influence such knowledge. Elucidating these points is important to further promote integrated forms of research and conservation.

Observation of animals in nature can depend both on the frequency with which behaviors occur and on individual experiences and length of contact with nature – factors that vary depending on the informant's profile. For example, people are probably more familiar with basic ecological information and conspicuous behaviors (behaviors which are more visible and easily noticed) (Krebs and Davies 1996) than with more specific ecological information or cryptic behaviors (behaviors which are less visible and difficult to observe) (Krebs and Davies 1996). Also, it is suggested that variables related to the informant's profile (e.g., age, time living in a region, occupation and frequency of encounter with species) enable greater contact with nature and thus promote greater LEK on local biodiversity (Sousa et al. 2014; Reibelt et al. 2017; Sampaio et al. 2018; Zhang et al. 2020). Turvey et al. (2016) found that residents who work in rural areas had greater knowledge and were more likely to identify the species they were studying (Hainan gibbon, *Nomascus hainanus*). It has also been observed that people who have lived longer in places close to natural areas have greater knowledge about the abundance of mammals compared to more recent residents (Afriyie and Asare 2020). In addition, older people who live in rural areas are generally those who have greater knowledge about natural resources compared to younger people, as they have been in contact with nature for a longer time (Torres-Avilez et al. 2018). Furthermore, in a study on perception and local knowledge about a lemur species (Primates, *Hapalemur alaotrensis*), Reibelt et al. (2017) observed that the frequency of encounters that people had with these animals influenced their knowledge about the physical characteristics and species distribution.

Given the above, we intend to evaluate Local Ecological Knowledge (LEK) regarding the behavioral ecology of mammals, and which variables influence this knowledge. We hypothesize that LEK on the behavioral ecology of mammals is influenced by the characteristics of the animals' behavior (i.e., conspicuous or cryptic behaviors) (H1). Given that conspicuous behavioral characteristics, as opposed to cryptic ones, are more visible and easily noticed, we expect that people will have (i) greater knowledge about conspicuous mammal behaviors (e.g., activity period, social organization, where they live, resting environment, and feeding habits) to the detriment of cryptic behaviors (e.g., time of year they have offspring, how many times a year they have offspring, number of offspring, and parental care). We also hypothesize that LEK on the behavioral ecology of mammals is influenced by the informant's profile (H2). Thus, we expect that: (i) older people; (ii) people who perform rural activities; (iii) people who have lived in the area for a longer time; and (iv) people who encounter the species more frequently have greater knowledge about the behavioral ecology of mammals in the region.

MATERIAL AND METHODS

Study area

The study was conducted in the communities of Ribeira and Sítio Alto da Boa Vista inserted in the municipality of Cabaceiras, State of Paraíba, Brazil (7° 29' 21" S, 36° 17' 18" W) (Figure 1). The municipality of Cabaceiras has 469,171 km2 and its population is estimated at 5,537 inhabitants (IBGE 2022). The main economic activities are: livestock, especially goat farming (IBGE 2022) leather industry, in which the municipality stands out for developing goat leather crafts and leather tanning.

Study subjects

A census was conducted with residents aged 18 or over for this study, with the aim of covering the entire population of both communities (Albuquerque et al. 2014). The community of Ribeira is composed of approximately 45 families with 157 adults (≥18 years), and the community of Sítio Alto da Boa Vista has around 30 families with approximately 83 adults (information provided by the District's Family Health Unit), totaling 240 adult residents. Of these, 192 residents agreed to participate in the application of free lists and 150 residents in the semi-structured interviews (for more details see: data collection). Of the 150 residents interviewed, the ages ranged from 19 to 90 years (mean = 47.1 ±17.0), with 92 women (61%) and 58 men (39%). Regarding occupation, 29 (19%) work in rural areas, and 121 (81%) work in non-rural areas (e.g., commerce, crafts, public service). The length of residence the interviewees had lived in the study region varied between 2 and 83 years (mean = 43.1 ±20.4) (For more details see Table 1).

Regarding the interviewees occupation associated with length of residence, among the 29 respondents who were engaged in rural activity, 17 were concentrated in the age range of residents with 40 to 60 years (Figure 2). The graph shows the distribution of residents according to their length of residence (Figure 2).

Those who agreed to participate in the study received an Informed Consent Form before each interview, containing information about the purpose and nature of the study. The signatures of the interviewees were requested for registration required by current legislation (Resolution 466/12 of the National Health Council). This study was approved by the National Research Ethics Commission (CONEP) with a Certificate of Presentation for Ethical Consideration (Certificate of Presentation for Ethical Appreciation CAAE) no. 53269621.8.0000.9547.

Data collection

Data collection was conducted in two stages: (1) Application of free lists; (2) Structured interview on the behavioral ecology of the species. With the free list we aimed to identify the local mammal species known to the community. In this sense, the participants were invited to freely list the species of wild mammals that they knew from the region (i.e., Albuquerque et al. 2014). The following question was asked: "What wild animals with fur (mammals) do you know from this region?" Then, we performed the non-specific induction and rereading techniques to encourage the interviewees to recall more items (Albuquerque et al. 2014). In addition, an informal conversation was held with a resident considered by the community to have great knowledge of the local fauna in order to eliminate synonyms and ensure identification of the species mentioned in the lists (adapted from Chaves et al., 2020), while published articles and books on the mammal species of the study region were also consulted (i.e., Alves et al. 2012; Passos-Filho et al. 2015). Items from the free list which could be considered idiosyncrasies (i.e., items cited by only one informant: Borgatti and Halgin 2013) were eliminated to select the species to be used in the semi-structured interviews on the behavioral ecology of animals. A total of 11 species of wild mammals were selected, distributed in nine families (Table 2).

Next, semi-structured interviews (Albuquerque et al. 2014) were conducted with the residents who participated in the first stage to access the LEK on the behavioral ecology of the selected species. The species were randomized in the R program so that each interview had a different sequence of species. Photographs of the species were used (colored images on a white background, all the same size, printed on A4 paper, enveloped in transparent plastic separately) during the dialogue to ensure greater reliability in the information exchange and identification of the species presented (Albuquerque et al. 2014). The interview form consisted of questions about the behavioral ecology of

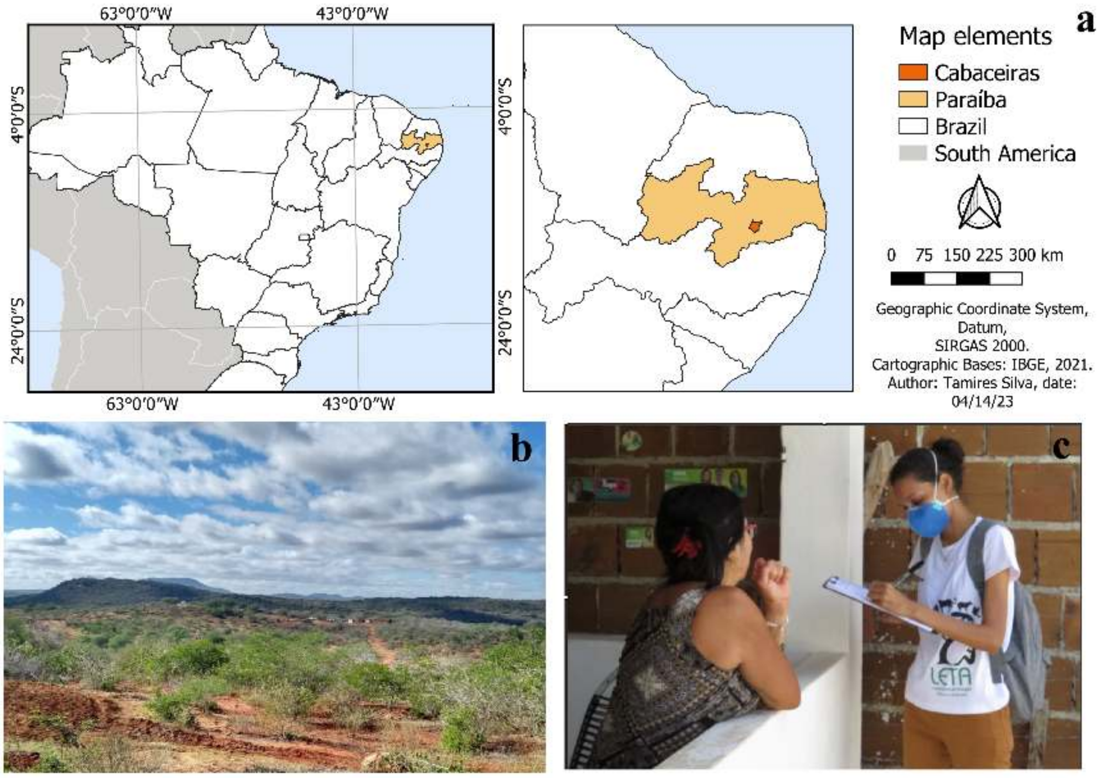

Figure 1. **a)** Map of the study site indicating the location of the municipality of Cabaceiras in the state of Paraíba, Northeastern Brazil; **b)** Characterization of the Caatinga, the biome of the study region; **c)** Interview with a local resident of Cabaceiras.

each species, addressing the following aspects: questions about conspicuous behaviors (e.g., life habits, live in a group or not, living environment, resting environment, feeding habits); and questions about cryptic behaviors (e.g., time of year when they have offspring, how many times a year they have offspring, number of offspring born, who cares for them and how they care for them). Furthermore, the interviewees answered a question about their frequency of encountering each of the species.

Statistical analysis

To verify the most well-know species in the community, we calculated the salience index of the items cited in the lists (Smith 1993; Chaves et al. 2019). The salience of the items was calculated using the *salience* function available in the script published by Chaves et al. (2019). This method integrates the frequency of citation and the position of items in individual lists, allowing the identification of the most cognitively relevant elements among the respondents. The most relevant species in the lists were those that presented the highest salience indices with a significant p-value ($p \leq 0.05$) were chosen for the next stage of the study.

A Wilcoxon test was performed to test H1, as the data residuals did not present a normal distribution and did not show independence between the samples, since the interviewees answered about all behavioral aspects. The behavioral aspects studied were used as the predictor variable (classified as conspicuous or cryptic) and the informant's knowledge (frequency of "I know" responses given by the informants) was used as the response variable to perform the Wilcoxon test.

To test H2, respondents' answers to each question about the behavioral ecology of species were classified as: (i) "I know" (when the respondent had some knowledge about the question); (ii) "I don't know" (when the respondent did not know any information about the question) (adapted from Silvano and Begossi 2002). The respondents' profile was classified according to four criteria: (1) age, (2) occupation, (3) length of residence at the location, and (4) frequency of encountering the species. Length of residence and age were considered continuously in years. Occupation was classified into two categories, namely: "rural activity" (i.e., farmers and livestock breeders); "non-rural activity" (e.g., trade workers, artisans, and civil servants). The frequency of encountering each species was classified as: daily, weekly, monthly, annually, more than an-

Table 1. Profile of informants who participated in interviews to collect data on Local Ecological Knowledge in relation to the behavioral ecology of mammals, in the Ribeira District, Cabaceiras, PB, Brazil.

Sociodemographic chacacteristics	Number of respondents (%)
Sex	
Female	92 (61%)
Male	58 (39%)
Age (yr)	
19-29	22 (15%)
30-39	25 (17%)
40-49	27 (18%)
50-59	30 (20%)
60-69	26 (17%)
70	20 (13%)
Length of residence (yr)	
2-18	17 (11%)
19-29	21 (14%)
30-39	19 (13%)
40-49	24 (16%)
50-59	25 (17%)
60-69	24 (16%)
70	20 (13%)
Occupation	
Rural activity	29 (19%)
Non-rural activity	121 (81%)

nually, and never seen. The data were organized into: (1) transforming the occupation variable into binary in which the value 0 (non-rural activity) or 1 (rural activity); (2) transforming the variable frequency of encounter into an ordinal variable, being: Never seen (0) < More than annually (1) < Annually (2) < Monthly (3) < Weekly (4) < Daily (5); (3) transforming the informants' response into binary, being 0 for "I don't know" and 1 for "I know". Then, a generalized linear mixed model (GLMM) was constructed, in which the response variable was the LEK, and the predictor variables were the criteria used to classify the informant's profile. The variables "informant" (each person interviewed) and "family" (interviewees from the same family) were used as random factors. We used these variables to reduce biases associated with pseudoreplicas. In addition, the data distribution family was defined as binomial. A multicollinearity analysis was then performed after defining the model, for which the Variance Inflation Factor (VIF) was used. The VIF showed collinearity between the age of residents and length of residence at the location. We chose to remove 'age' as a variable from the analyses as the aim of the study was related to accumulated experience in the local environment and direct exposure to the species, which is directly related to an individual's time of residence rather than an individual's age (e.g., Wayland and Walker 2014). The data were analyzed using the statistical software R 4.2.3 (R Development Core Team, 2023), employing the packages "dplyr" for data manipulation, "ggplot2" for graphical visualization, "knitr" for report reproducibility, "here" for directory management, and "lme4" for fitting linear mixed-effects models, while the "car" package was used

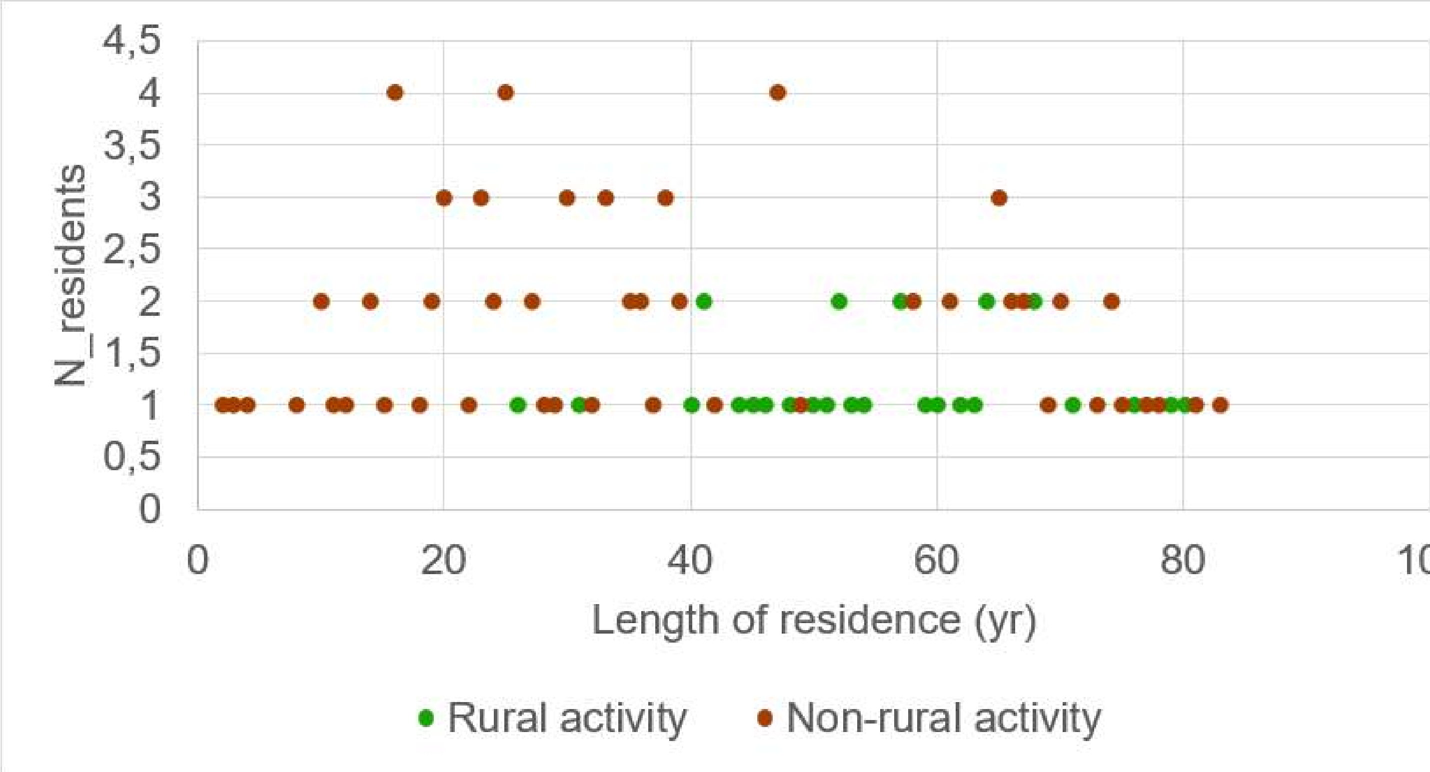

Figure 2. Distribution of the number of interviewed residents (N_residents) according to their occupation (rural and non-rural activity) and length of residence in the location (years). Each dot corresponds to one or more respondents with the same length of residence and occupational category, indicating the relative frequency.

for additional model assessments, including analyses of variance and assumption checking. The significance level established for all analyses was p-value ≤ 0.05.

Descriptive data on the Local Ecological Knowledge (LEK) on the behavioral ecology of the studied species can be observed at Table 3. Patterns of the behavioral ecology were classified as conspicuous or cryptic behaviors, and further categorized in accordance to ecological aspects such as: lifestyle, social organization, living environment, resting environment, feeding habit, when offspring are born, times per year offspring are born, number of puppies per litter, who cares and how cares.

RESULTS

H1: Influence of the Behavioral Ecology of mammals (conspicuous or cryptic) in LEK

The LEK for conspicuous behaviors was significantly higher than for cryptic behaviors (Wilcoxon: V = 11325, $p < 0.001$; Figure 3), corroborating our first hypothesis.

H2: Influence of the informant's profile in the LEK on the Behavioral Ecology of mammals

As expected, the model shows that local ecological knowledge is influenced by occupation, length of residence in the region, and frequency of encounters that people have with mammal species. People who have rural activities as their occupation showed significantly higher LEK regarding the behavioral ecology of mammals than those who do not have rural activities (GLMM: z = 2.99, $p < 0.001$; Figure 4). Furthermore, the LEK was significantly higher with longer residence in the region (GLMM: z = 2.63, $p < 0.001$; Figure 4). Finally, people showed higher LEK when there is a higher frequency of encounters with the species; thus, "daily" was significantly higher than the categories "never seen" (GLMM: z = 21.8, $p < 0.001$), "more than annually" (GLMM: z = -5.63, $p < 0.001$), and "annually" (GLMM: z = 3.6, $p < 0.001$). However, "daily" was not significantly higher than "monthly" (GLMM: z = -1.52, p = 0.127) and "weekly" (GLMM: z = 0.11, p = 0.90; Figure 4).

Table 2. Free list of wild mammal species used in the study in order of salience, locally known in Cabaceiras, Paraíba, Brazil.

Family Scientific name	Popular name (Portuguese/English)	Salience index	p-value
Canidae *Cerdocyon thous*	Raposa/Crab-eating / fox	0.6142	0.000
Mephitidae *Conepatus semistriatus*	Tacaca / Striped / hog-nosed skunk	0.3999	0.000
Caviidae *Galea spixii*	Preá / Spix's / Yellow-toothed cavy	0.2940	0.000
Callitrichidae *Callithrix jacchus*	Sagui / Marmoset	0.2668	0.000
Felidae *Herpailurus yagouaroundi*	Gato-vermelho / Jaguarundi	0.2280	0.000
Dasypodidae *Euphractus sexcinctus*	Tatu-Peba / Yellow Armadillo	0.2280	0.000
Caviidae *Kerodon rupestris*	Mocó / Rock cavy	0.2234	0.000
Procyonidae *Procyon cancrivorus*	Guaxinim / Crab-eating raccoon	0.1911	0.000
Myrmecophagidae *Tamandua tetradactyla*	Tamanduá-mirim / Lesser anteater	0.1892	0.000
Felidae *Leopardus tigrinus*	Gato-pintado / Oncilla	0.1802	0.0001
Didelphidae *Didelphis albiventris*	Timbú / White-eared opossum	0.1737	0.0001

Local Ecological Knowledge about the behavioral ecology of mammals (descriptive results)

In general, responses regarding conspicuous behaviors (e.g., activity period, social organization, living environment, resting and feeding locations), showed a lower frequency of "I don't know" responses. In contrast, for cryptic behaviors, especially those related to reproduction (season of offspring birth, number of litters, and number of offspring born), were a higher number of "I don't know" responses could be observed in virtually all species could be observed. This pattern also held true for questions related to parental care, particularly the question "Do you know offspring are taken care of?", which showed a high number of "I don't know" responses (see Table 3).

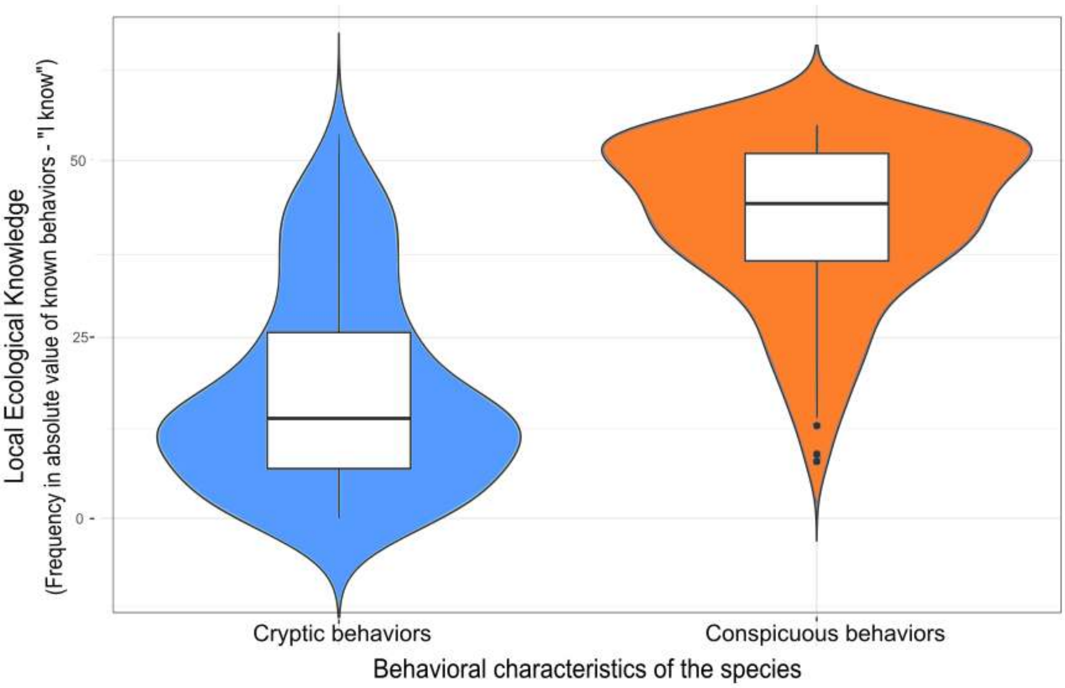

Figure 3. Estimation of the model that presents the difference in Local Ecological Knowledge between conspicuous and cryptic behaviors. Behavioral characteristics of the species are represented on the x-axis; the LEK, represented on the y-axis, is expressed in absolute values of the "I know" responses in relation to the behaviors known by people. The horizontal violins in shades of blue and orange represent the data density distribution for each category of behavioral characteristics. The shape and width of the violins indicate the density and distribution of the data.

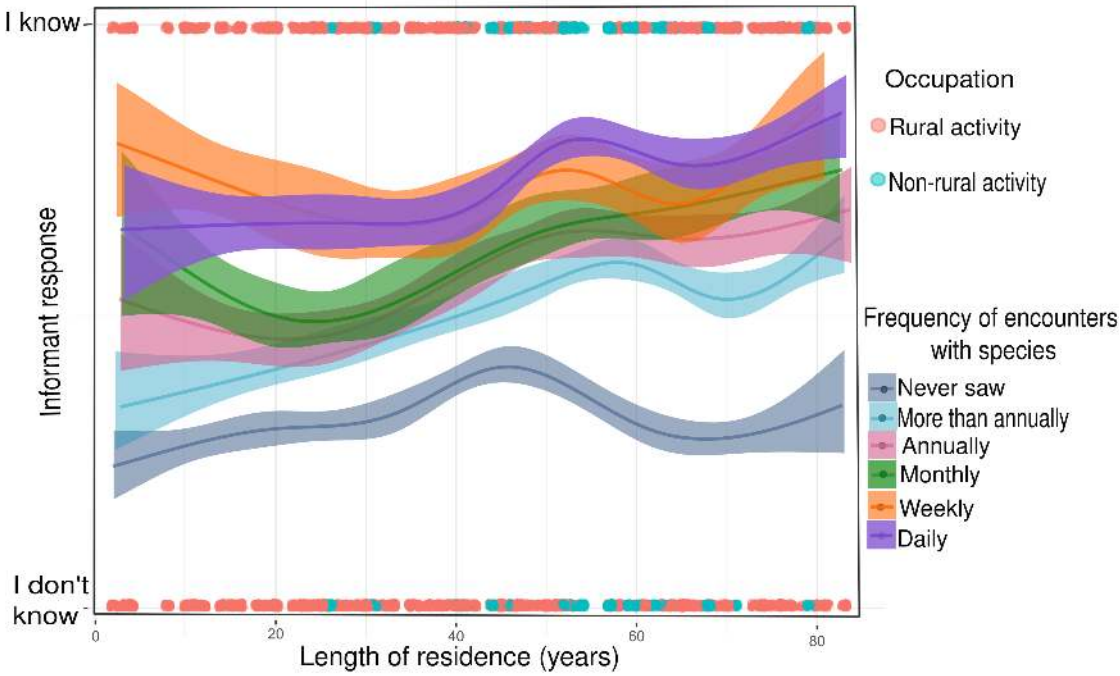

Figure 4. Estimation of the model showing the relationship between length of residence at the location (x-axis), informant response regarding the Behavioral Ecology of the species (y-axis) and their associations with occupation and frequency of encounter with the species. The scattered points (jitter) are colored according to occupation and represent the effect of this variable on the LEK, in which the upper and lower points on the y-axis correspond to the responses "I know" and "I don't know", respectively. The colored curves represent the categories of encounter frequency with the species: the curves referring to "daily" (pink), "weekly" (orange) and "monthly" (purple) are close to the upper limit of the y-axis because they present more "I know" responses, while the curves referring to "never seen" (gray), "more than annually" (blue) and "annually" (green) are closer to the lower limit of the y-axis because they present more "I don't know" responses.

Table 3. Local Ecological Knowledge (LEK) regarding the conspicuous and cryptic behaviors of the studied species. Codes for mammal species: *L.tig* (*L. tigrinus*), *H.yag* (*H. yagouaroundi*), *P.can* (*P. cancrivorus*), *K.rup* (*K. rupestris*), *G.spi* (*G. spixii*), *C.tho* (*C. thous*), *C.jac* (*C. jacchus*), *C.sem* (*C. semistriatus*), *T.tet* (*T. tetradactyla*), *E.sex* (*E. sexcinctus*), *D.alb* (*D. albivestris*). c: Coivara (pile of dry branches). The numbers represent the sum of the number of responses given by the respondents for each piece of data. The sum may sometimes exceed the total number of respondents (n=150), since each person could cite more than one aspect for each question asked.

Behavioral ecology	**Mammal species**										
	L. tig	*H. yag*	*P. can*	*K. rup*	*G. spi*	*C. tho*	*C. jac*	*C. sem*	*T. tet*	*E. sex*	*D. alb*
Conspicuous behaviors											
Lifestyle	Question: At what time do you see this animal in the region (or know that it appears)?										
Twilight	10	12	6	25	24	18	4	2	6	6	6
Nighttime	49	42	105	20	29	105	5	147	70	103	91
Daytime	31	45	11	81	108	49	145	6	17	30	19
I don't know	67	62	32	33	12	8	2	2	61	24	38
Social organization	Question: When you see this animal in the region, how many do you usually see?										
Group	9	11	29	91	108	19	146	4	5	12	18
Solitary	78	85	79	37	41	129	7	140	94	120	104
Pair	10	10	14	6	8	40	0	15	8	10	14
I don't know	53	56	44	26	5	8	2	7	52	21	32
Living environment	Question: Where does this animal live (where does it roam)?										
Trees	2	3	12	1	1	0	144	1	12	0	24
Burning holes/holes	0	0	1	2	8	2	1	24	5	94	18
Rocks	28	29	19	116	61	25	0	22	16	7	14
Vegetation/bush	77	83	28	26	72	101	4	60	64	40	35
Riverbank	1	3	53	1	4	6	0	2	3	10	1
Plantations	0	0	0	2	26	1	1	2	0	5	1
Houses	0	0	1	0	0	0	9	2	1	0	10
Roads	0	2	0	0	0	5	0	3	0	1	0
Fences/walls	0	0	0	0	0	0	11	0	0	0	5
CoivaraC	0	0	1	0	20	0	0	1	0	0	0
I don't know	47	30	43	16	12	19	1	44	53	9	53
Resting environment	Question: Where does this animal sleep/rest?										
Trees	12	12	24	1	2	3	113	3	29	0	30
Burning holes/holes	3	1	4	4	23	5	0	41	13	127	23
Rocks	29	36	30	117	60	39	0	24	20	3	13
Vegetation/bush	36	44	25	12	47	52	1	37	27	13	18
Riverbank	1	0	8	0	0	2	0	0	0	1	0
Plantations	2	0	0	1	9	0	0	0	0	1	1

Continued on next page

Behavioral ecology	Mammal species										
	L. tig	*H. yag*	*P. can*	*K. rup*	*G. spi*	*C. tho*	*C. jac*	*C. sem*	*T. tet*	*E. sex*	*D. alb*
CoivaraC	1	1	0	0	6	2	0	0	0	0	0
I don't know	73	61	68	19	28	50	36	50	65	10	72
Feeding habit	Question: What does this animal eat?										
Dead animals	1	0	3	0	0	3	0	3	0	41	0
Local fauna	35	35	61	0	1	26	46	25	4	2	10
Tree resin	0	0	0	1	0	0	10	0	0	0	0
Tree bark	0	0	0	9	1	0	1	0	0	1	0
Insects	4	5	3	4	9	4	9	22	103	17	18
Native vegetation	1	12	7	72	68	1	18	15	12	45	14
Animal eggs	1	1	3	0	0	0	37	0	0	2	0
Farm birds and/or eggs	9	11	16	0	0	81	2	60	1	0	27
Farm mammals	26	46	1	0	0	17	0	0	0	0	0
Native plants	0	0	2	11	32	0	1	0	0	1	0
Exotic plants	0	0	25	3	24	1	2	3	0	9	1
Anthropogenic food	0	0	1	11	11	0	92	6	0	10	6
Carnivore	43	33	12	0	0	31	4	2	1	8	6
Herbivore	0	0	0	3	1	0	0	0	0	1	1
Omnivore	0	0	1	0	0	0	0	1	0	2	1
I don't know	48	47	48	47	26	22	6	40	40	35	76
Cryptic behaviors											
Reproduction											
When offspring are born	Question: Do you know what time of year this animal has offspring?										
All year round	3	5	2	13	26	3	20	3	1	4	3
Winter (cold season)	2	6	2	5	5	6	10	7	7	12	5
Summer (hot season)	0	0	1	2	2	0	0	1	0	6	0
I don't know	145	139	145	130	117	141	120	139	142	128	142
Times per year offspring are born	Question: Do you know how many times a year this animal has offspring?										
1 time	14	21	14	5	2	20	12	13	16	17	9
1 - 2 times	0	0	0	1	0	0	1	0	0	0	1
2 times	8	8	6	10	9	7	9	7	6	13	5
2 - 3 times	1	3	1	7	14	3	8	2	1	3	5
4 – 6 times	0	0	0	6	14	0	8	0	1	1	2
I don't know	127	118	129	121	111	120	112	128	126	116	128
Number of puppies per litter	Question: How many puppies are born?										
1 puppy	4	4	6	2	1	10	13	5	7	7	0
1 – 2 puppies	6	5	3	7	6	8	11	5	6	5	2
1 – 3 puppies	3	4	0	1	6	3	3	1	1	4	4

Continued on next page

Behavioral ecology	**Mammal species**										
	L. tig	*H. yag*	*P. can*	*K. rup*	*G. spi*	*C. tho*	*C. jac*	*C. sem*	*T. tet*	*E. sex*	*D. alb*
1 – 4 puppies	1	2	0	2	4	0	0	0	0	1	0
2 puppies	15	9	8	10	14	15	31	21	13	23	10
2 - 5 puppies	7	4	4	5	15	9	11	6	2	7	3
3 puppies	3	1	1	4	2	1	4	1	1	2	1
3 – 5 puppies	3	3	0	11	12	3	3	2	2	1	4
4 puppies	1	3	0	2	4	7	2	0	3	4	4
4 – 6 puppies	3	5	2	1	6	2	0	1	0	0	5
5 – 7 puppies	1	1	0	1	2	0	1	0	1	1	5
8 – 10 puppies	0	0	0	0	0	0	0	0	0	0	4
I don't know	103	109	126	104	78	92	71	108	114	95	108
Parental care											
Who takes cares	Question: Do you know who takes cares of the offspring?										
The mother	85	82	67	86	93	108	92	90	82	84	87
The father	0	1	0	1	0	0	2	0	0	0	0
The parents	12	13	14	11	16	5	28	10	8	14	3
The group	0	0	1	0	0	0	1	0	0	0	1
Nobody	0	0	0	2	0	0	0	1	0	0	1
I don't know	53	54	68	51	41	37	28	49	60	52	58
How taken cares	Question: Do you know how offsprings are to taken care of?										
Breastfeeding	38	34	25	37	40	39	23	27	24	35	19
Feeding	5	6	2	1	2	5	10	0	2	4	1
Protection	5	7	4	6	8	13	1	6	4	8	1
Carries offspring on Its back	0	3	0	0	0	1	48	1	6	1	4
Carries offspring in a pouch (marsupium)	0	0	0	0	0	0	1	1	1	0	22
I don't know	104	103	123	106	100	98	75	118	118	104	103

DISCUSSION

The Local Ecological Knowledge of two communities on the behavioral ecology of mammals was accessed herein. As expected, conspicuous behaviors by the mammals led to higher LEK, presumably because they enabled greater observation by people, corroborating our first hypothesis. Silvano and Begossi (2002) found that fishermen provided more information about the habitat of fish than about their reproduction, since reproduction would occur in a more cryptic manner. Similarly, interviewees in the present study knew more about the different habits of mammals (conspicuous) compared to aspects of reproduction and parental care (in most species a cryptic pattern). Therefore, interviewees seem again to present greater knowledge about behaviors that they can observe more easily. The descriptive results corroborate this pattern, in which conspicuous behavioral aspects (such as activity period, social organization, habitat use, and feeding), were mentioned as more easily observed in daily life and seem to generate less uncertainty ("I don't know") among respondents. On the other hand, cryptic behaviors, such as reproductive aspects and parental care, which occur seasonally and in more protected locations, were more uncertainty among respondents. This indicates that the LEK may be particularly efficient in describing more visible behaviors, however, more limited for less visible behaviors. This reinforces the importance of complementary approaches when seeking a broader understanding on the behavioral ecology.

In addition to the visibility of the behaviors themselves, LEK also appears to be influenced by the informants' own life context. The results show that informants who carry out rural activities, have lived in the region for longer and more frequently encounter the species have greater knowledge about the behavioral ecology of mammals, corroborating our second hypothesis. For example, research areas such as Psychology or Education have already brought up that contextualized experience promotes better understanding of reality, unlike knowledge acquired through reports of others or simple reading (e.g., Koning and Tabbers 2011; Ballantyne and Packer 2016). Thus, people who observe animals in their natural environment better understand some ecological aspects of native species, as contact seems to generate a greater level of familiarity (Gandolfo and Hanazaki 2014; Sampaio et al. 2018). When accessing LEK to detect populations of an endangered primate species, Turvey et al. (2016) found that residents who performed work related to the forest were more likely to identify the species they were studying (Hainan gibbon, *Nomascus hainanus*). Similarly, Miard et al. (2017) found that occupation influences the LEK, allowing people who performed rural activities to be more able to correctly identify slow lorises (*Nycticebus menagensis*). As observed in our study, Afriyie and Asare (2020) found that the residence length was one of the factors that influenced knowledge when accessing the LEK to detect estimates of mammal numbers in a nature reserve in Kogyae (Ghana). It is important to mention that while one could notice a higher frequency of "I know" answers by "younger" residents the same occurred by 40-60 years of residence. Although these patterns were not statistically significant in our study, it suggests the need for further exploration. While more confident and/or boldness by younger residents (e.g., Prims and Moore 2017) could have elicits more "I know" answers, an increase of "I know" answers by 40-60 years old residents might have been due to a greater number of such individuals engaged in rural activities. In this case it appears that the combination of longer residence time and rural occupation may promote the accumulation of direct experiences with species and enhance LEK (also see Iniesta-Arandia et al. 2015). Future studies could address these patterns throughout a methodology specifically developed and/or focused on these questions added to a more a representative sample size.

Regarding the frequency of people's encounters with mammals, the results once again reinforce the importance of contact in forming knowledge. When seeking to obtain data on the distribution and abundance of mammal species, Afriyei and Assare (2020) argue that sightings were the main indicator of local knowledge and perception. In addition to corroborating this research, the present study shows that it is essential to have greater contact with the animals for people to learn about the behavior of a given species, as it improves knowledge of specific behavioral characteristics. In this sense, although not statistically significant, it is important to note that the group of interviewees who declared never having seen any of the species ("never saw") appears in the graph closer to the lower axis ("I don't know"), even among residents with longer length of residence. This pattern suggests that length of residence alone does not guarantee direct encounters with local fauna. One possible explanation is that the absence of encounters with a species may be related to ecological factors, such as restricted spatial distribution of the species in the region or reduced population levels (Torrents-Ticó et al. 2021). For a further understanding future studies could specifically address such variables. What seems clear to us is that LEK depends on the frequency of people's encounters with species, as we observe lower levels of knowledge when individuals have never had direct contact, and higher levels of knowledge when they have had frequent direct contact, regardless of how long they have lived in the area. In this sense, when a person has a rural occupation, lives longer in the locality and encounters animals more frequently, they have more opportunities to observe animals in nature and thus learn about their behavior. People with this profile can act as partners by sharing and contributing to the construction of knowledge about mammal behavioral ecology.

In addition to highlighting how sociocultural factors can influence LEK on the behavioral ecology of mammals, the results open space to reflect considering bridging LEK and Behavioral Ecology of mammals. When considering LEK on the behavioral ecology of mammals, it is important to recognize that its contribution occurs, to a greater degree, in relation to more visible behaviors. This pattern highlights the need to consider the context of observation and the type of interaction between humans and fauna, in addition to reinforcing the need to promote dialogue between different forms of knowledge. On the other hand, Behavioral Ecology can support the appreciation and importance of local knowledge, especially in contexts that involve the loss of biodiversity. This two-way street can promote a more equitable approach between these two knowledge systems.

ACKNOWLEDGMENTS

We would like to thank the residents of the communities of Ribeira and Sítio Alto da Boa Vista, located in the Ribeira district (Cabaceiras – PB) for their availability and for sharing their knowledge. We would like to thank Prof. Geraldo Baracuhy and the Baracuhy Biological Field Station for their logistical support in conducting this study. We would also like to thank the Foundation for Science and Technology Support of the State of Pernambuco (FACEPE) for granting a master's research scholarship to the first author of this manuscript. This work was carried out with the support of the Coordination for the Improvement of Higher Education Personnel - Brazil (CAPES) - Financing Code 001, through the Postgraduate Support Program (PROAP).

DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

CONTRIBUTION STATEMENT

Conceived the present idea: TMS, MFDF, AS, NS.
Carried out data collection: TMS.
Carried out the data analysis: TMS, MFDF.
Wrote the first draft of the manuscript: TMS.
Review and final write of the manuscript: TMS, MFDF, AS, NS.
Supervision: MFDF, NS.

REFERENCES

Afriyie JO, Asare MO (2020) **Use of Local Ecological Knowledge to detect declines in mammal abundance in Kogyae Strict Nature Reserve, Ghana**. Environmental Management 66:997–1011. doi: 10.1007/s00267-020-01372-8.

Albuquerque UP, Cunha LVFC, Lucena RFP, Alves RRN (2014) **Methods and techniques in ethnobiology and ethnoecology.** Humana Press, Springer Protocols, p. 1–37/199.

Albuquerque UP, Ludwig D, Feitosa IS, Moura JMB, Golçalves PHS, Silva RH, Silva TC, Golçalves-Souza T, Ferreira-Júnior WS (2021) **Integrating traditional ecological knowledge into academic research at local and global scales.** *Regional Environmental Change* 21(45):1–11. doi: 10.1007/s10113-021-01774-2.

Alves RRN, Gonçalves MBR, Vieira LS (2012) **Hunting, use and conservation of vertebrates in the Brazilian semi-arid region.** Tropical Conservation Science 5(3):394–416.

Alves RRN, Lopes SF (2018) **The role of ethnozoology in animal studies.** In: Alves RRN, Albuquerque UP (orgs.) Ethnozoology: Animals in Our Lives, 1st ed. Elsevier, p. 467–479.

Ballantyne R, Packer J (2016) **Visitors' Perceptions of the Conservation Education Role of Zoos and Aquariums: Implications for the Provision of Learning Experiences.** Visitor Studies 19(2):193–210. doi: 10.1080/10645578.2016.1220185.

Berkes F (1993) **Traditional ecological knowledge in perspective**. In: Inglis JT (ed) Traditional Ecological Knowledge: Concepts and Cases, 1st ed. International Program on Traditional Ecological Knowledge/IDRC, pp. 1–10.

Borgatti SP, Halgin DS (2013) **Elicitation techniques for cultural domain analysis.** In: Schensul JJ, Lecompte MD (eds) Specialized Ethnographic Methods: A Mixed Methods Approach. AltaMira Press, Lanham, p. 80–116.

Borges AKM, Adams VM, Alves RRN, Oliveira TPR (2025) **Integrating local ecological knowledge into systematic conservation planning for seahorse conservation.** *Conservation Biology* 39:

e70027. doi: 10.1111/cobi.70027.

Braga-Pereira F, Morcatty TQ, El Bizri H, Tavares AS, Mere-Roncal C, González-Crespo C, Bertsch C, Rodriguez, CR, et al. (2021) **Congruence of local ecological knowledge (LEK) based methods and line-transect surveys in estimating wildlife abundance in tropical forests.** *Methods in Ecology and Evolution* 13: 743–756.

Camino M, Thompson J, Andrade L, Cortez S, Matteucci SD, Altrichter M (2020) **Using local ecological knowledge to improve large terrestrial mammal surveys, build local capacity and increase conservation opportunities.** Biological Conservation 244:108450, 1–8. doi: 10.1016/j.biocon.2020.108450.

Chaves LS, Nascimento ALB, Albuquerque UP (2019) **What matters in free listing? A probabilistic interpretation of the Salience Index.** Acta Botanica Brasilica 33(2):360–369. doi: 10.1590/0102-33062018abb0330.

Chaves LS, Alves REN, Albuquerque UP (2020) **Hunters' preferences and perceptions as hunting predictors in a semiarid ecosystem.** Science of the Total Environment 726. doi: 10.1016/j.scitotenv.2020.138494.

Danchin É, Cézilly F, Giraldeau L-A (2007) **Fundamental concepts in behavioral ecology.** In: Danchin É, Giraldeau L-A, Cézilly F (eds) Behavioural Ecology: An Evolutionary Perspective on Behaviour. Oxford University Press, Oxford.

Ewart HE, Pasqualotto N, Paolino RM, Jensen K, Chiarello AG (2024) **Effects of anthropogenic disturbance and land cover protection on the behavioural patterns and abundance of Brazilian mammals.** Global Ecology and Conservation 50:E02839. doi: 10.1016/j.gecco.2024.e02839.

Fashing P, Nguyen N, Demissew S, Gizaw A, Atickem A, Mekonnen A, Nurmi NO, Kerby JT, Stenseth NC (2022) **Ecology, evolution, and conservation of Ethiopia's Biodiversity.** PNAS 119(50). doi: 10.1073/pnas.2206635119.

Freire-Filho R, Pinto T, Bezerra BM (2018) **Using local ecological knowledge to access the distribution of the Endangered Caatinga howler monkey (Alouatta ululata)**. Ethnobiology and Conservation 7:10. doi: 10.15451/ec2018-08-7.10-1-22.

Gandolfo ES, Hanazaki N (2014) **Distribution of local plant knowledge in a recently urbanized area (Campeche District, Florianópolis, Brazil).** Urban Ecosystems 17:775–785. doi: 10.1007/s11252-014-0345-4.

IBGE (2022) Instituto Brasileiro de Geografia e Estatística | v4.4.13 [online]. Available via [`https://www.ibge.gov.br/cidades-e-estados/pb/cabaceiras.html`] Accessed 05 September 2025.

Iniesta-Arandia I, del Amo DG, García-Nieto AP, Piñeiro C, Montes C, Martíns-López B (2015) **Factors influencing local ecological knowledge maintenance in Mediterranean watersheds: Insights for environmental policies.** *AMBIO* 44, 285–296. doi: 10.1007/s13280-014-0556-1.

Krebs JR, Davies NB (1996) **An Introduction to Behavioural Ecology**, 3rd ed. Blackwell Scientific Publications, Oxford.

Koning BB, Tabbers HK (2011) **Facilitating understanding of movements in dynamic visualizations: an embodied perspective.** Educational Psychology Review 23:501–521. doi: 10.1007/s10648-011-9173-8.

Lima MSP, Lins-Oliveira JE, Nóbrega MF, Lopes PFM (2017) **The use of Local Ecological Knowledge as a complementary approach to understand the temporal and spatial patterns of fishery resources distribution.** Journal of Ethnobiology and Ethnomedicine 13:30, 1–12. doi: 10.1186/s13002-017-0156-9.

Loiseau N, Mouquet N, Casajus N, Grenié M, Guéguen M, Maitner B, Mouillot D, Ostling A, Renaud J, Tucker C, Velez L, Thuiller W, Violle C (2020) **Global distribution and conservation status of ecologically rare mammal and bird species.** Nature Communications 11:5071. doi: 10.1038/s41467-020-18779-w.

Marske KA, Lanier HC, Siler CD, Rowe AH, Stein LR (2023) **Integrating biogeography and behavioral ecology to rapidly address biodiversity loss.** PNAS 120(15). doi: 10.1073/pnas.2110866120.

Passos-Filho PB, Chaves LS, Carvalho RA, Alves PP, Assunção MM, Prado-Neto JG (2015) **Illustrated fauna in Fazenda Tamanduá.** Ed. Avis Brasilis, 1ª ed., p. 310–341.

Prims JP, Moore DA. (2017) **Overconfidence over the lifespan**. Judgm Decis Mak. Jan;12(1):29-41. PMID: 29861807; PMCID: PMC5978695.

Reibelt LM, Woolaver L, Moser G, Randriamalala IH, Raveloarimalala LM, Ralainasolo FB, Ratsimbazafy J, Waeber PO (2017) **Contact Matters: Local People's Perceptions of Hapalemur alaotrensis and Implications for Conservation**. International Journal of Primatology 38:588–608. doi: 10.1007/s10764-017-9969-6.

Ritzel K, Gallo T (2020) **Behavior Change in Urban Mammals: A Systematic Review.** Frontiers in Ecology and Evolution 8:576665. doi: 10.3389/fevo.2020.576665.

Sampaio MB, De La Fuente MF, Albuquerque UP, Souto AS, Schiel N (2018) **Contact with urban forests greatly enhances children's knowledge of faunal diversity.** Urban Forestry and Urban Greening 30:56–61. doi: 10.1016/j.ufug.2018.01.006.

Silvano RAM, Begossi A (2002) **Ethnoichthyology and fish conservation in the Piracicaba river (Brazil).** Journal of Ethnobiology 22(2):285–306.

Simo F, Fopa GD, Kekeunou S, Ichu IG, Ebong LE, Olson D, Ingram DJ (2020) **Using local ecological knowledge to improve the effectiveness of detecting white-bellied pangolins (Phataginus tricuspis) using camera traps: A case study from Deng-Deng National Park, Cameroon.** African Journal of Ecology, 1–6. doi: 10.1111/aje.12762.

Smith J (1993) **Using ANTHOPAC 3.5 and a spreadsheet to compute a free-list Salience Index.** Cultural Anthropology Methods 5:1–3.

Sousa J, Vicente L, Gippoliti S, Casanova C, Sousa C (2014) **Local knowledge and perceptions of chimpanzees in Cantanhez National Park, Guinea-Bissau.** American Journal of Primatology 76(2):122–134. doi: 10.1002/ajp.22215.

Torrents-Ticó M, Fernández-Llamazares A, Burgar D, Cabeza M (2021) **Convergences and divergences between scientific and Indigenous and Local Knowledge contribute to inform carnivore conservation.** Ambio 50:990–1002. doi: 10.1007/s13280-020-01443-4.

Torres-Junior EU, Valença-Montenegro MM, Castro CSS (2016) **Local Ecological Knowledge about Endangered Primates in a Rural Community in Paraíba, Brazil.** Folia Primatologica 87(4):262–277. doi: 10.1159/000452406.

Torres-Avilez WM, Nascimento ALB, Campos LZO, Silva FSS, Albuquerque UP (2018) **Gênero e Idade.** In: Albuquerque UP, Alves RRN (eds) Introdução à Etnobiologia, 2nd ed. NUPEEA, p. 249–255.

Turvey ST, Bryant JV, Duncan C, Wong MHG, Guan Z, Fei H, Ma C, Hong X et al. (2016) **How many remnant gibbon populations are left on Hainan? Testing the use of local ecological knowledge to detect cryptic threatened primates.** American Journal of Primatology 79:e22593. doi: 10.1002/ajp.22593.

Wayland C, Walker LS. (2014) **Length of residence, age and patterns of medicinal plant knowledge and use among women in the urban Amazon**. *J Ethnobiology Ethnomedicine* 10, 25. doi: 10.1186/1746-4269-10-25.

Zhang L, Guan Z, Fei H, Yan L, Turvey ST, Fan P (2020) **Influence of traditional ecological knowledge on conservation of the skywalker hoolock gibbon (Hoolock tianxing) outside nature reserves**. Biological Conservation 241:1–9. doi: 10.1016/j.biocon.2019.108267.

Received: 13 November 2025
Accepted: 14 August 2025
Published: 11 April 2026