



Knowledge about bats: implications of popular perception for conservation and prevention of zoonotic diseases

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ABSTRACT

To understand the perceptions and knowledge of a target population is crucial for optimizing conservation efforts. Studies on environmental perception can reveal society's empirical knowledge about bats, which is essential for enhancing environmental and health education. We assessed the impact of local knowledge about bats on the prevention of bat-related zoonoses, as well as on bat conservation and the understanding of the ecosystem services provided by bats. We also examined the effects of age and educational level on local knowledge. Using a semi-structured interview format, we surveyed 111 participants who were passers-by in a public square. Our findings indicate that participants with greater knowledge about bat biology also had a better understanding of zoonosis prevention and the importance of bats, though this knowledge did not extend to bat conservation. There was no correlation between responses regarding the importance of bats and those concerning conservation, nor between conservation responses and zoonosis prevention. Educational attainment and age did not influence knowledge of about bats. We conclude that possessing knowledge about bats alone is insufficient to motivate practical actions for bat conservation.

Keywords: Brazil, Chiroptera, empirical knowledge, ethnoconservation, interview, mammals.

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SIGNIFICANCE STATEMENT

In this study is shown the knowledge about bats is not enough to awaken practical actions for bat conservation. Also, higher educational level is related to zoonotic and importance knowledge about bats. Age was not, and neither of them was related to conservation attitudes. More comprehensive knowledge is enough to improve conservation. There is complexity of relationship between perceptions, and attitudes towards conservation.

INTRODUCTION

Although bats represent relevance to the ecosystem services and economy, previous studies found that, in general, the perception of people about bats is negative (Teixeira and Papavero 2012; Aziz *et al.* 2017). This negative perception increased after the SARS-CoV-2 pandemic in 2020, since the origin of the virus was attributed to bats. This caused direct impacts (such as the killing of bats) and indirect impacts like the destruction of roosts, felling of trees that provided resources for bats, and even the distortion of bat biology, producing a terrifying image associated with disease transmission (Ejotre *et al.* 2022; Straka and Voigt 2022).

To understand the popular perception of bats can be an important tool to know the processes leading the population to attitudes that can put bats at risk, such as killing bats for fear or considering these animals as pests. To understand the popular perception and knowledge presented by the target population is the first step toward optimize conservation efforts. Due to bats importance to the environment, humans should do what they can to help protect bats, assisting and supporting conservation program, preserving the environment and avoiding killing them.

Besides, empirical knowledge about these animals can be a risk not only to bats, but also to human population itself due to the potential for improper handling of bats, resulting in bites and pathogens transmission, for example. Successful conservation will be important to alter people's negative perception of these mammals, promoting the value of bats (e.g. Raymundo and Caballes 2016; Zhao 2020).

There are fundamental differences in people's perceptions of the value of species due to local cultures and experiences (Bowen-Jones and Entwistle 2002; Kingston 2016). These perceptions are usually affected by age, education level, gender, social position, and geographic region (Kingston 2016; Patrício *et al.* 2016; Aziz *et al.* 2017; Castilla *et al.* 2020). Usually the perception, feelings or reaction to bats is more positive with higher level of education and age (Castilla *et al.* 2020; Hassan *et al.* 2020).

Thus, the present study aimed to assess the populations' knowledge about bats and associate what leads to these perceptions. We evaluated A) the implications of local knowledge about bats on the prevention of related zoonoses, as well as on conservation of those

animals; B) the general acknowledgement and understanding of ecosystem services performed by bats; and C) the effect of age and educational level on the local knowledge. We expected people with more knowledge about bats to be more cautious about zoonoses, aware of the conservation of the group, and with a better understanding of the environmental services provided by bats. We expected older people with higher education levels to be more knowledgeable about bats, the ecosystem services provided by these animals, as well as about the prevention of bat-related zoonoses, especially rabies, than youngsters. We also expected those people to present better attitudes that contribute to bat conservation, like not killing them and spread right information.

MATERIAL AND METHODS

Data were collected at Central Seropédica Square (22°44'42.8" S, 43°42'04.4" W) (Additional File 1) on October 7, 2015, and October 28, 2017. This municipality hosts the Federal Rural University of Rio de Janeiro, and it has been undergoing a deruralization process in recent years; however, it is still considered a semi-rural region. Passers-by were approached and invited to participate. There was no preference for sex or age for the selection of passers-by. Researchers received previous conduct training to not interfere with the participants' responses. When a group was approached, each researcher interviewed a single person at a time, so that there was no interference in data collection.

A semi-structured interview was conducted to obtain data, including a form with 24 questions, which has already been broadly used by the authors (e.g., Patrício *et al.* 2016; Lourenço *et al.* 2018; Pinheiro *et al.* 2018; Gavinho *et al.* 2025), for the analysis of this study we use eight closed (yes or no) and 10 open questions (Additional File 2). Questions in the questionnaire were grouped in four blocks, considering: the type of knowledge of the participants about the biology of bats (B1), the prevention of zoonoses (B2), the conservation (B3), and the importance of bats (B4). The UFRRJ Ethics Committee authorized the research procedures (protocol 689/2017, process 23083009268/2015-24).

To analyze participants' responses, key items were extracted from each open answer. The qualitative analysis was based on the triangulation method in

which each key item is discussed by the authors and classified for inclusion in a category and receives a score (Silva *et al.* 2014; Marcondes and Brisola 2014). Each item of the answer received a numerical value (1, 0, -1). The answer items considered scientifically correct were assigned a value of one (1), those considered incorrect received a negative point (-1), and zero (0) was given for questionable items or when the participant did not know or did not answer the questions. After assigning values to each item, we summed the points of all answers in each block so that each participant obtained a score for each thematic block (Figure 1). Items considered in each category of questions and the score for each item are found in the Additional File 3.

We performed Spearman rank correlations among the score of bat biology (B1) and knowledge about the prevention of zoonosis (B2), conservation (B3), and importance of bats (B4), following Schlegel (2025). We also carried out correlations between conservation (B3) and the prevention of zoonosis (B2), as well as among conservation (B3) and the importance of bats (B4). Using multiple linear regression, we analyzed whether the participants' knowledge, expressed as the sum of scores for each block, was related to age and level of education. We performed this analysis following Silva (2022), checking the model fit, normality, and homoscedasticity. For level of education, we considered the minimum number of years of study (Additional File 4).

RESULTS

Of the 111 participants, 56 were female, aged 7 to 70 years old (mean 30.76 ± 14.17), and 55 were males, aged 8 to 76 years old (mean 31.41 ± 19.53). The education level comprised one illiterate participant, 32 participants with complete or incomplete basic education, 41 with complete or incomplete high school, 29 with complete or incomplete higher education, and eight participants who did not answer (Additional File 4). Therefore, we obtained from zero to 16 years of study (mean 11.17 ± 3.53 ; $n = 91$).

Only four participants had never heard of bats. Most of the participants heard about bats ($n = 107$) (Figure 2A) and have seen bats ($n = 109$) (Figure 2B). Eighty-six participants were aware of at least one place where bats live (Figure 2C). Ninety-three participants reported knowing what bats eat (Figure 2D). Sixty participants answered that bats attack humans (Figure 2E). Among the participants who answered how bats could cause diseases ($n = 101$) (Figure 3A), most said unaware ($n = 40$), by biting ($n = 16$) or through the saliva ($n = 5$) (Figure 3B). Most participants would go to a healthcare unit if bitten by bats ($n = 74$) (Figure 3C). Sixteen participants re-

ported having already killed bats (Figure 2D). Fifty-three participants reported that they would scare a bat away if found in the house (Figure 3E). Most participants considered bats important to the world ($n = 84$) (Figure 3F).

The sum of the scores of participants regarding the knowledge about bat biology (B1) ranged from zero to 15 points (mean = 8.18 ± 3.12 , median = 8) (Figure 4A); regarding the prevention of zoonoses (B2) from -2 to 6 (mean = 2.11 ± 1.63 , median = 2) (Figure 4B); regarding the conservation of bats (B3) from -3 to 4 (mean = 2.10 ± 1.64 , median = 3) (Figure 4C), regarding the importance of bats to the world (B4) from -1 to 3 (mean = 1.17 ± 1.26 , median = 2) (Figure 4D) and the sum of the score that shows the knowledge about bats ranged from zero to 23 (mean = 13.56 ± 4.8 , median = 14) (Figure 4E).

Those participants who know more about the biology of bats also know more about the prevention of zoonoses ($r_s = 0.30$, $p = 0.001$; Figure 5A) and the importance of bats ($r_s = 0.34$, $p = 0.0002$ - Figure 5B), but not about their conservation ($r_s = -0.04$, $p = 0.6132$). Prevention of zoonoses and the importance of bats was positively correlated ($r_s = 0.22$, $p = 0.01$ - Figure 5C). There was no significant relationship between the knowledge of bats and both age and years of study. The model was significant ($F = 5.392$, $p = 0.001$, $DF = 87$), but neither age ($p = 0.329179$), years of study ($p = 0.317912$), nor the interaction between age and years of study ($p = 0.208574$) were significant.

DISCUSSION

By presenting the popular perceptions of passers-by on a square in an urban-rural region, we showed that those who have more knowledge about the biology of bats have also more information about zoonoses and their means of prevention. We also found that although the knowledge about bat biology is related to a better understanding of their importance, this did not directly entail better practices for the conservation of bats (in this study, we considered don't kill bats how practice of conservation). Thus, assuming that more comprehensive knowledge is enough to improve conservation might be misleading, or not always a simple cause-effect relationship. Our analyses also highlighted the complexity of the relationship between knowledge, perceptions, and attitudes towards conservation. Although here we consider conservation solely as not killing bats, we understand that conservation goes far beyond just not killing. The act of killing is a direct and incisive attitude that reflects not only the (lack of) knowledge about bats but also the feelings and principles that generate an attitude.

The knowledge presented by the target audience about bats seems to be related to the participants' ex-

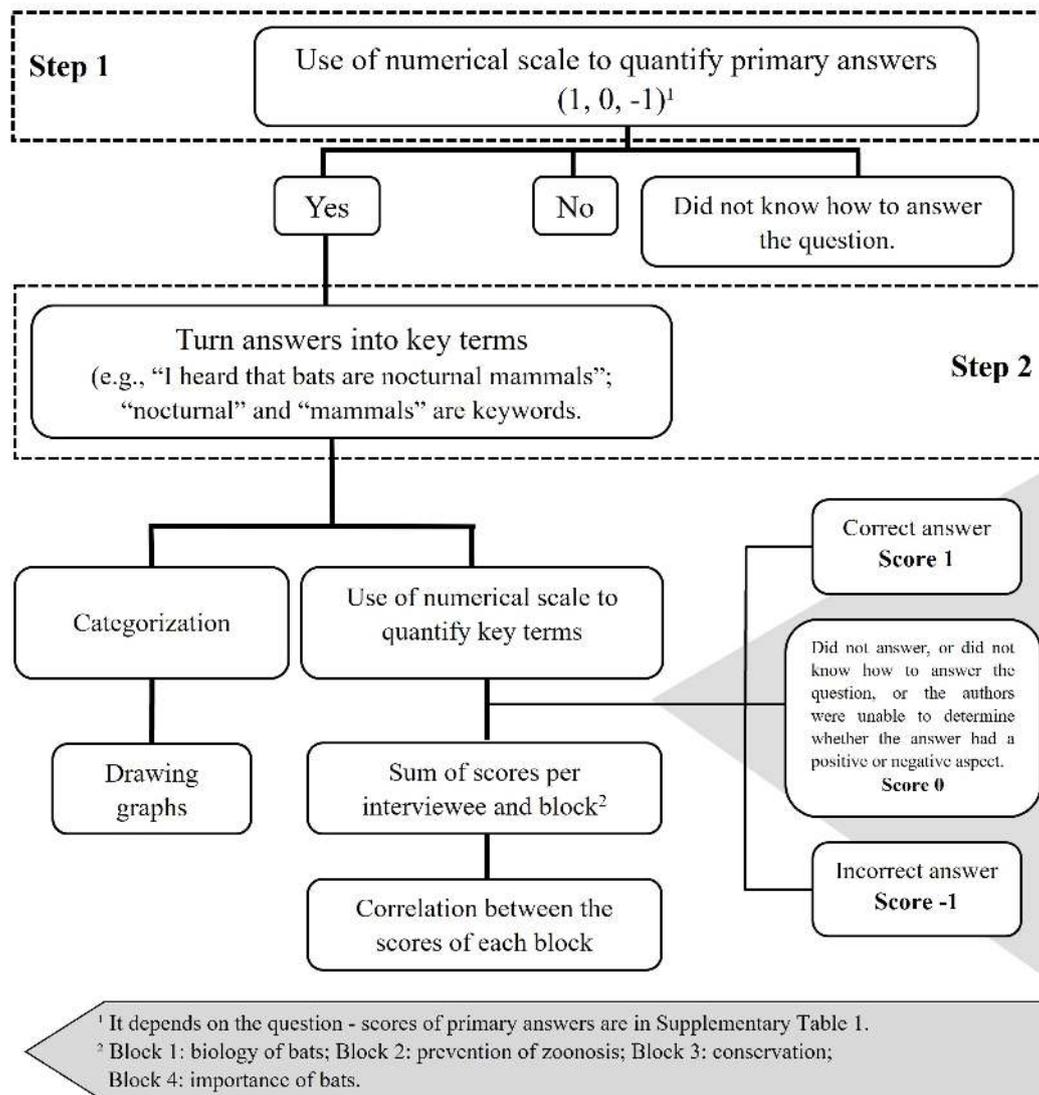


Figure 1. Flowchart of the methods, showing the step by step used to analyze the responses of the participants about bats, obtained through semi-structured interviews in the municipality of Seropédica, state of Rio de Janeiro, Brazil, on October 7, 2015, and October 28, 2017.

perience, such as when they report human constructions such as bat shelters and the frugivorous feeding habit. Other studies also reported the predominance of bat sightings in human constructions, having fruits and blood as food (Patrício *et al.* 2016; Reid 2016). These results suggest that cities and villages host the most common interaction events between bats and humans, shaping their knowledge and perceptions. That seems to be the case in this study area, where a wooded environment predominates, with houses with backyards and many farms that reflects the proximity and experience of the interviewees with bats. Seropédica

hosts at least 31 species of bats (Bolzan *et al.* 2010), with 50% of these records being insectivorous species and 30% being frugivorous species. Some of these frugivorous species are highly abundant in anthropized areas, such as *Carollia perspicillata* (Linnaeus, 1758) and *Artibeus lituratus* (Olfers 1818), which can often be seen flying and feeding on fruits from urban tree plantations (Novaes and Nobre 2009; Ortêncio-Filho and Reis 2009). In other cases, for example, locals with caves or bridges with large bat colonies, the popular perceptions of bats reflect the valuation of ecosystem services and ecotourism (e.g. Castilla *et al.* 2020).

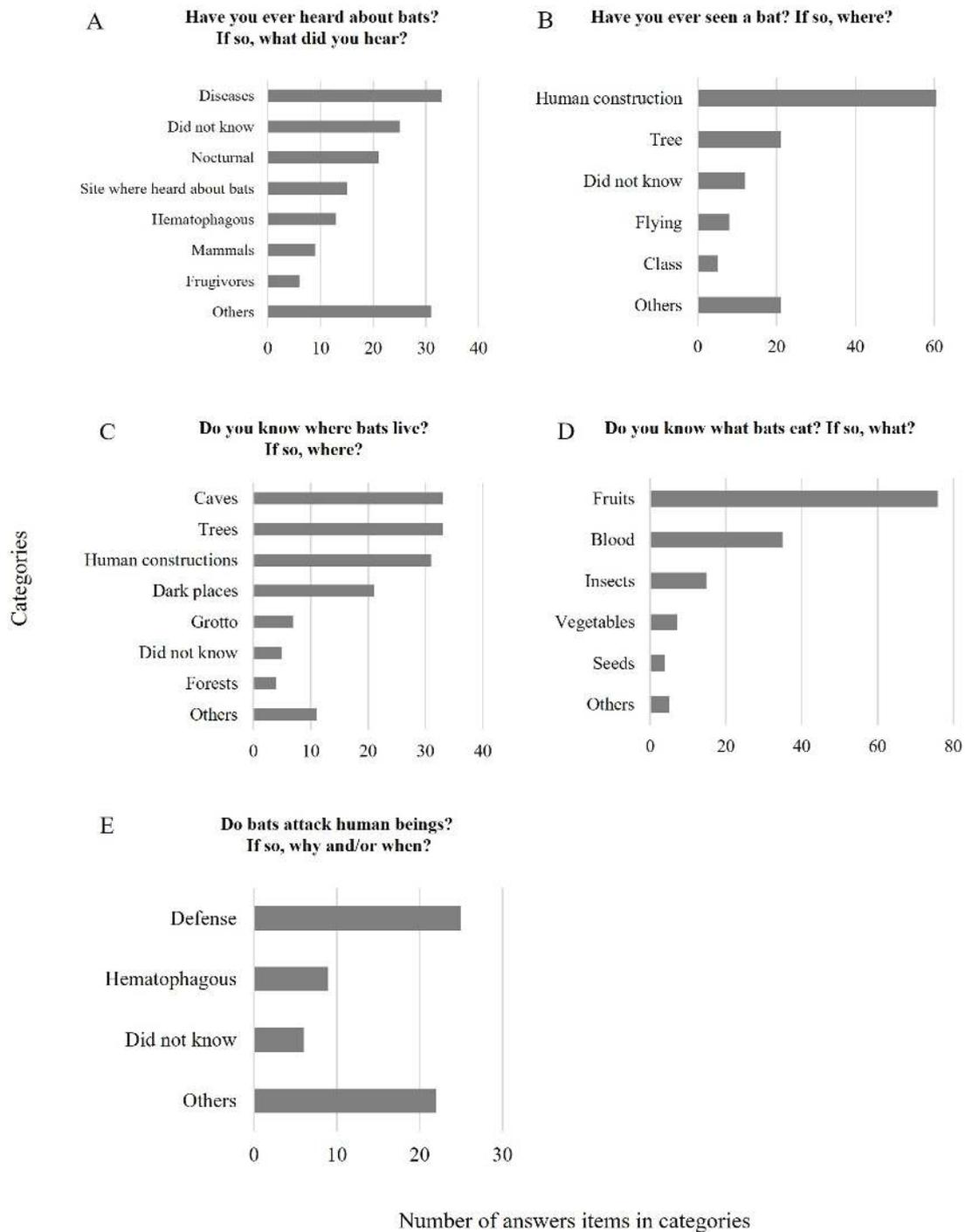


Figure 2. Categories of the items of positive answers to the questions in block 1 on the biology of bats, obtained through semi-structured interviews in the municipality of Seropédica, state of Rio de Janeiro, Brazil, on October 7, 2015, and October 28, 2017.

A profile of the participants was drawn from the first block who showed a basic and restricted knowledge of the main characteristics of bats, related to their experiences and probably, knowledge obtained by the media (Capparros and Magalhães-Júnior 2015; Pinheiro

et al. 2018). Besides, the general knowledge about bats is sometimes intertwined with the concept of disease or pest, which makes it difficult to associate these animals with positive aspects that lead to their conservation. Other perception studies have also shown a

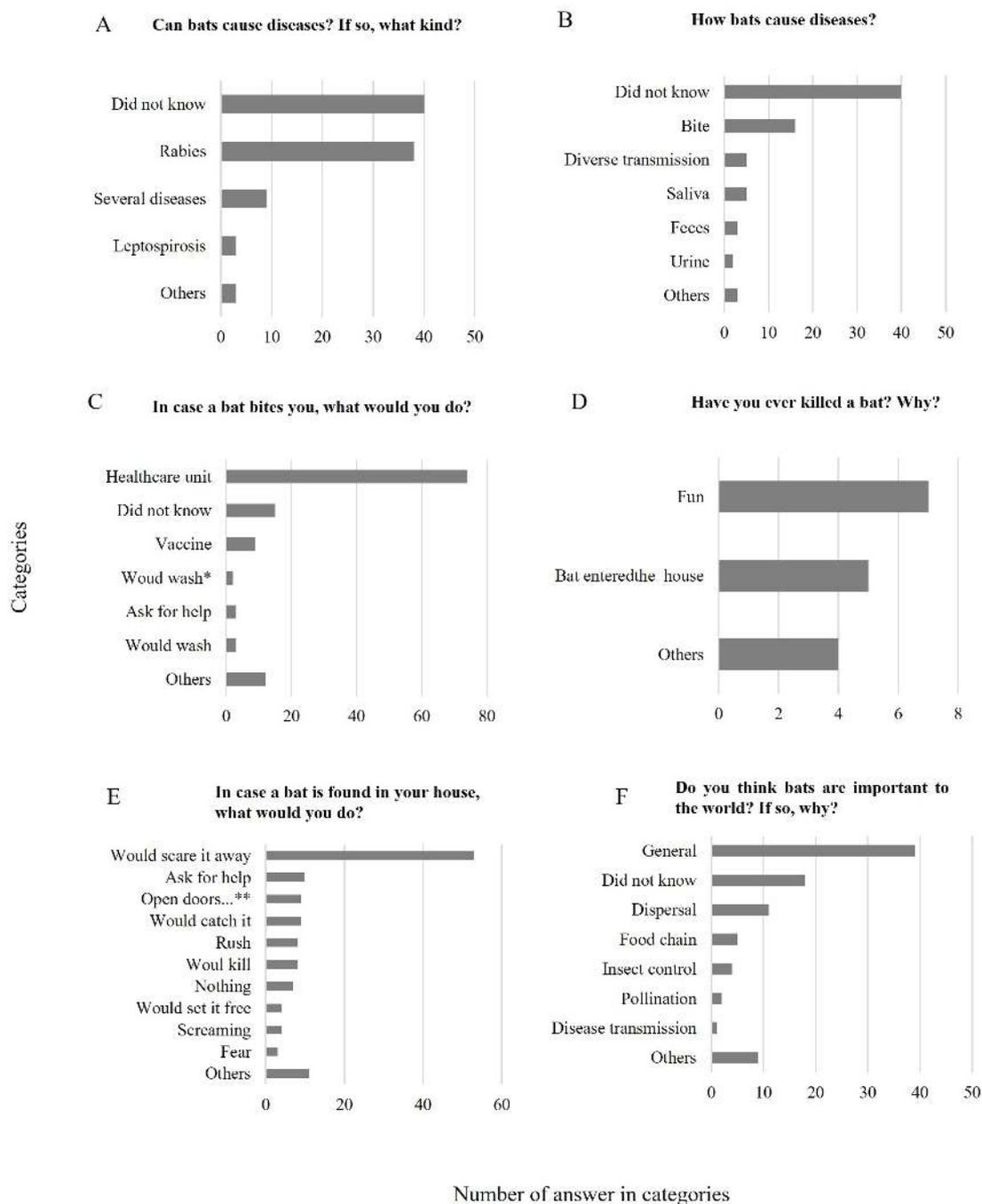


Figure 3. Categories of the items of positive answers obtained through semi-structured interviews applied to evaluate the knowledge of the people regarding bats, in the municipality of Seropédica, state of Rio de Janeiro, Brazil, on October 7, 2015, and October 28, 2017, for questions of the block 2 on prevention of zoonoses (A-C), block 3 on conservation of bats (D, E), of the block 4 on the ecological importance of bats (F).
*Would wash - Healthcare unit; ** Open doors and windows and let the bat go out.

strong association of bats with diseases (e.g., Arandas et al. 2011; Patrício et al. 2016; Reid 2016; Hassan et al. 2020). Vaccination campaigns related to rabies and the dissemination of information on the risks of bites

or scratches by bats promote the increase of this bat-disease association (Capparros and Magalhães-Júnior 2015). Media is the main responsible for the broadcasting of bats associated with zoonoses, especially ra-

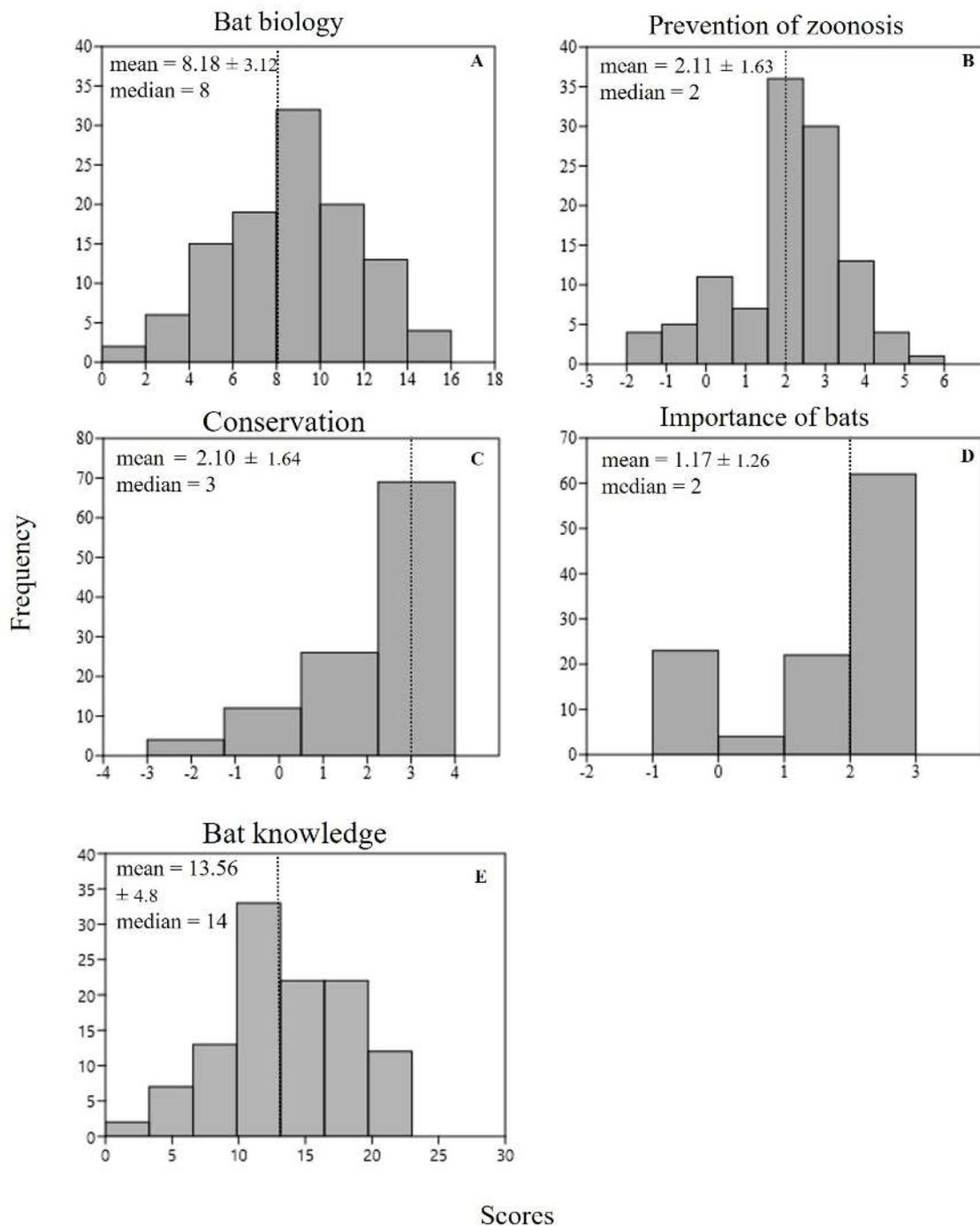


Figure 4. Histograms of the scores of the four blocks obtained through semi-structured interviews applied to evaluate the knowledge of the people regarding bats, in the municipality of Seropédica, state of Rio de Janeiro, Brazil, on October 7, 2015 and October 28, 2017, for block 1 on bat biology (A) block 2 on prevention of zoonosis (B), block 3 on conservation(C), block 4 on importance of bats (D) and the sum of score shows the knowledge about bats (E).

bies viruses (Capparros and Magalhães-Júnior 2015), the most cited disease. But most participants who answered that bats transmitted diseases were unable to

say which one. Although part of the participants knew about rabies, a third of them could not elucidate the mode of transmission. Arandas *et al.* (2011), in the

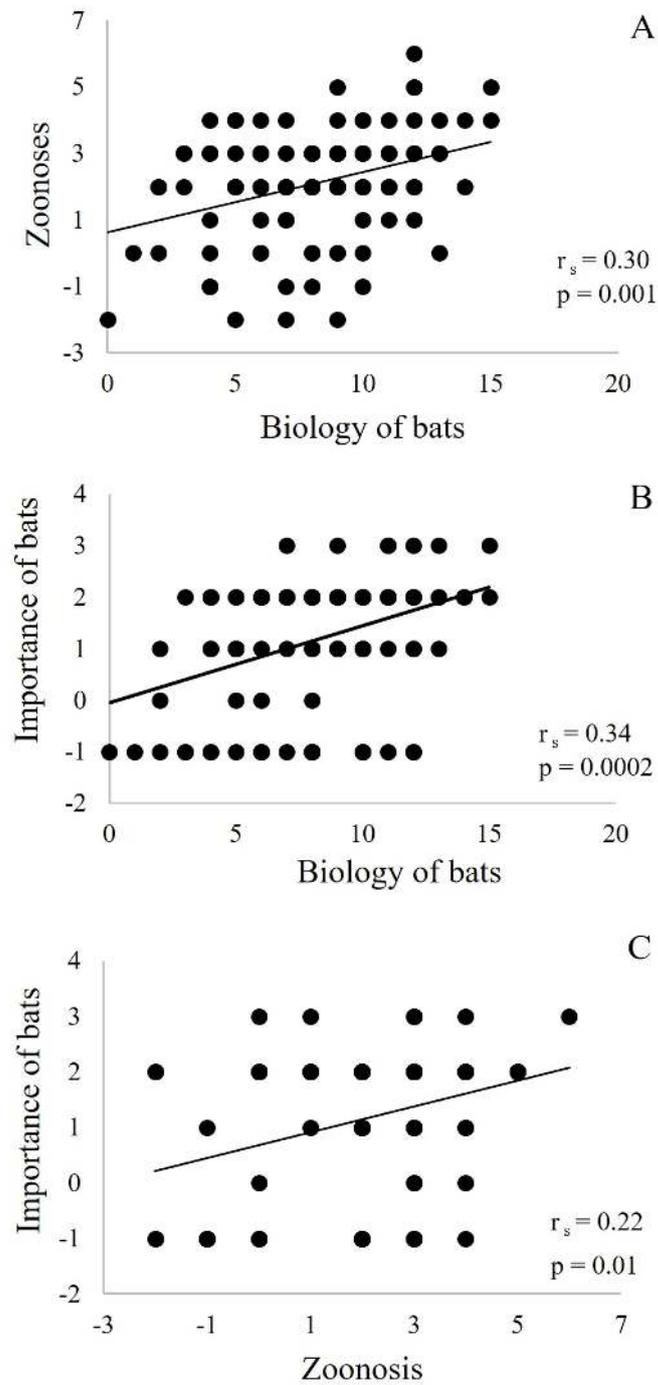


Figure 5. Significant relationship (Spearman's correlation) regarding the participants' answers obtained through semi-structured interviews regarding bats in the municipality of Seropédica, state of Rio de Janeiro, Brazil, on October 7, 2015, and October 28, 2017.

state of Pernambuco, Brazil, found a similar pattern with few respondents indicating any disease. These results are worrisome since bats are already generally associated with several diseases, but this association

is not often illustrated with the real risks that these animals may bring to the human population. The dissemination of zoonotic information is always necessary, although how the information is communicated needs

to be comprehensively assessed beforehand (see MacFarlane and Rocha 2020). It is essential to highlight the low prevalence of the rabies virus in bats, even in those that feed on blood. The alleged origin of SARS-CoV-2 transmission from bats in China has already caused impacts that resulted in bat massive killings (SNFFS 2020; Zhou *et al.* 2020). Due to the extension of the news currently broadcasted in the media, it is likely that in the next perception surveys, we would have reports of COVID-19 as one of the main diseases caused by bats. Despite the lack of knowledge of participants about diseases or mode of transmission, it did not prevent most from understanding the need to look for a healthcare unit in case of accidents with bats. Although this procedure may not be specific for accidents with bats, it may be an attitude for accidents with other wild animals, it portrays the popular knowledge of the relationship of animals with the transmission of diseases, although there is no real knowledge of the risks and pathogens.

Although the questions regarding the conservation block can be restrictive in terms of their representation (Figure 4; Supplementary material 2), the answers represent attitudes towards events that are possible to occur in the study area. Because many bat species coexist with people in urban and rural areas, this association can be harmful for bat conservation because it can trigger a killing behavior (Raymundo and Caballes 2016; Voigt *et al.* 2016; Aziz *et al.* 2017). The greatest direct threat to synanthropic bats is humans (Voigt *et al.* 2016). In other studies, were reported that the most cited methods of colony control and management were mechanical and chemical methods that lead to the death of bats (Vilar *et al.* 2016; Aziz *et al.* 2017; Durán 2023). Almost 15% of respondents have already killed at least one bat, showing their contempt for the group.

We found a relationship between knowledge of bat biology and the understanding of their importance for the maintenance of ecosystems. However, the knowledge of bat biology and importance is not reflected in actions for bat conservation, in this study, considered to have no kill and no intention to kill bats. Although most participants acknowledged the importance of bats for the ecosystem balance, less than half of them were able to cite a practical example of this importance indicating an aspect to be reinforced. There are several benefits of bats to the environment and the economy. Bats play an essential role in the ecosystem in terms of pest control, plant pollination and dispersal (Kunz *et al.* 2011). Most of the respondents agreed that bats are important for nature, however, they also showed reluctance in supporting bat protection (see Aziz *et al.* 2017; Hassan *et al.* 2020).

Our research showed that years of study and age were not related to knowledge about bats. In gen-

eral, the increase in education level or age should promote better knowledge and positive attitudes towards bats, but that idea doesn't seem true (e.g., Patrício *et al.* 2016). Experiences and accumulation of knowledge in years of study or through the media can differ among age groups. Older people, even if educated, can show beliefs and have been exposed to legends and myths that could not be clarified and remedied later (Kingston 2016). On the other hand, younger people live in the age of communication, with easy access to information, films, cartoons, and news (Pineiro *et al.* 2018), which can be a facilitator to access information about bats. Positive information and good experiences with animals seem to reduce fears, beliefs, and negative emotions in children more easily than in adults, whose values are already well-established (Prokop *et al.* 2009; Kingston 2016). Seropédica is a university city, with many students from different areas of knowledge, which contributes to the 26% of participants with higher education. This high level of education, in addition to the 37% of participants with high school education, contributed to the findings, which, although they relate bats to diseases, do not have legend cited. Involvement with bat conservation was unrelated to any other blocks or independent variables tested and a gap that remains to be answered in future studies is related to what can promote changes in human behavior in the region.

Understanding differences in how people relate to wildlife may promote more proactive thinking about conservation challenges and solutions (Raymundo and Caballes 2016). The intention towards conservation attitudes comes from the environmental knowledge together with the affective component (Kingston 2016). Besides, zoonosis dissemination actions, though necessary, bring a negative image of bats. As a means of transforming and aggregating the whole community for conservation actions, it is necessary to achieve not only environmental knowledge but also the affective component. Generating knowledge about ecosystem habits and services provided by bats can lead to a greater interest of the population in adopting positive attitudes towards these animals and a consequent reduction in their rejection (Prokop *et al.* 2009; Aziz *et al.* 2017).

The data in this study come from the experience of each of the participants, from a reflection before a curious question, reflecting on their own knowledge about bats. The interview questions serve as a hook to reflect on bats and express feelings, values, patterns, and knowledge. Many of the responses refer to individual, subjective perceptions based on personal opinions and feelings, not scientific facts. This subjectivity is what makes humanity unique and should be considered in conservation strategies (Kingston 2016; Habel *et al.* 2021). There are several motivations for environmen-

tal conservation; giving economic value to ecosystem services may be a good strategy, but it may end up emphasizing anthropocentric attitudes and thoughts that escape the preservation of species or the environment itself. Since the understanding of the role of these components in the ecosystem is limited to human knowledge (whether empirical or scientific). Thus, it is necessary to create “environmental awareness” respecting that we live in a web of interactions and that it is also necessary to preserve what we have not yet given economic value to. Fagan *et al.* (2018) found that perceived severity of threats to bats was also an important factor influencing support for bat management. It’s necessary to pass the information that effects of anthropogenic pressures such as habitat loss and degradation, invasive species, and climate change put bats at risk, other animals, species, and the ecosystem (Frick *et al.* 2019). To generate emotional appeal, Kingston (2016) reports that anthropomorphizing bats, that is, projecting human characteristics on them, may be valid. Emphasizing real biological characteristics of the group, such as fur, parental care, and that pups nurse, like all mammals, as well as humans, can favor a more affectionate view. The visualization of bats, their diversity, and beauty also favor this set of affective values.

We conclude that having knowledge about bats is not enough to awaken practical actions for bat conservation. The perception of participants resulted from experiences, but did not include factors that stimulate affection, respect and, thus, the conservation behavior.

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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 conflicts of interest.

CONTRIBUTION STATEMENT

Conceived of the presented idea: ECL
Carried out the experiment: ECL
Carried out the data analysis: ECL
Wrote the first draft of the manuscript: ECL, LMC, DADJ, MCP, JLL, KMF.

Review and final write of the manuscript: ECL, LMC, DADJ, MCP, JLL, KMF.

Supervision: ECL, LMC, DADJ, MCP, JLL, KMF.

FUNDING DECLARATION

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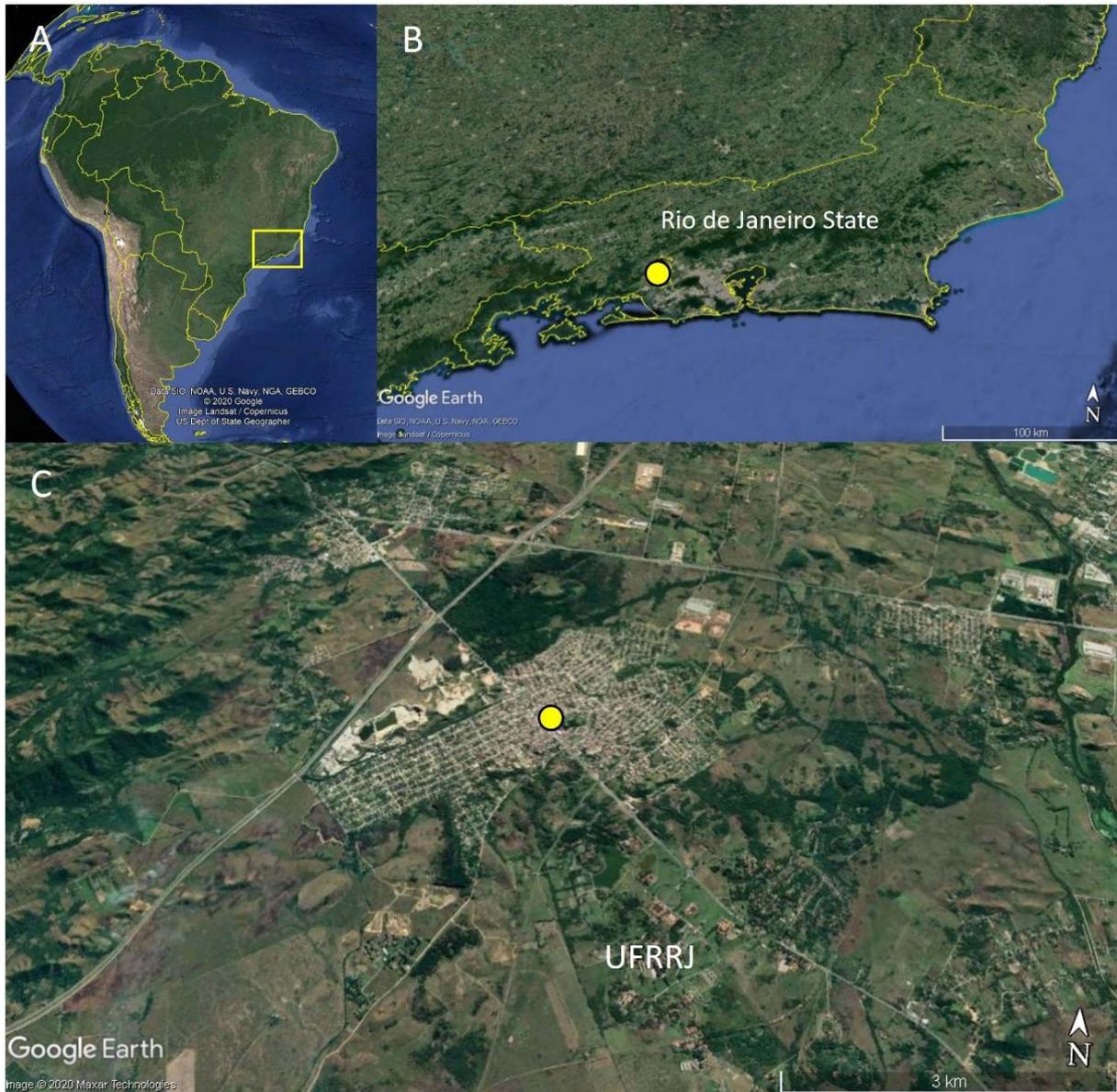
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Additional Files



Add File 1. Localization where the data was collected through semi-structured interviews applied to evaluate the knowledge of the people regarding bats: A - Brazil; B - Rio de Janeiro State with detail of Seropédica; C – municipality of Seropédica with Central Seropédica Square.

Add File 2. Questions in the form using in this study.

Biology of bats (Block 1)

- 1) Have you ever heard about bats? If so, what did you hear?
- 2) Have you ever seen a bat? If so, where?
- 3) Do you know where bats live? If so, where?
- 4) Do you know what bats eat? If so, what?
- 5) Do bats attack human beings? If so, why and/or when?

Prevention of zoonoses (Block 2)

- 6) Can bats cause diseases? If so, what type of disease and how?
- 7) In case a bat bites you, what would you do?

Conservation of bats (Block 3)

- 8) Have you ever killed a bat? If so, why?
- 9) In case a bat is found in your house, what would you do?

Ecosystem services (Block 4)

- 10) Do you think bats are important to the world? If so, why?

Add File 3. Notes regarding the participants' answers obtained through semi-structured interviews in the municipality of Seropédica, state of Rio de Janeiro, Brazil. Categories in bold and respective key terms of answers. In parentheses the number of participants who used each key term.

Block 1	
1. Have you ever heard about bats?	Score
Yes: Yes (107).	1
No: No (4).	0
1.1. What?	
Diseases: Diseases (17), rabies (15), zoonosis (1).	1
Nocturnal: Nocturnal (13), eat/feed at night (3), sleep during the day (3), live in the dark (1), hunt at night (1).	
Hematophagous: Hematophagous (5), suck blood (5), drink blood (1).	
Mammals: Mammal (6), flying mammal (1).	
Frugivores: Eat fruit (4), some spread fruits (1), frugivores (1).	
Others: Bites (2), live in caves (3), anatomy (1), feeding habit (1), bat shape (1), tree (1), attack to protect itself (1), different species (1), make nests in houses (1), do not attack (1), natural pollinators (1), wild (1), several problems (1), night vision (1), important for forests (1), do not harm (1), do not have contact (1).	
Could not answer: Did not answer (24), do not remember (1).	
Site where heard about bats: School (3), television (3), movies (2), several places (1), Animal Planet (1), Discovery Kids - Kratt brothers (1), zoo (1), media (1), family (1), class (1).	0
Others: Batman (1), lives with them (1), superficially (1), heard they exist (1), scream loud (1), does not seen many where he/she lives (1), no reason (1).	
Hematophagous: Suck blood and kills (1), suck blood, only white bats (1).	
Mammals: Mammals, there are six species in Brazil (1), mammals and non-mammals (1)	-1.
Others: Venom (1), three species (1), dangerous (1), sting (1)	.
2. Have you ever seen a bat?	
Yes: Yes (109).	1
No: No (2).	0
2.2. Where?	
Tree: Tree (9), a tree near home (1), home tree (1), bamboo forest (1), sleeping on the tree (1), at home, on the mango tree (1), at home, on the beach almond tree (1), forest, banana tree forest (1), mulberry tree (1), beach almond tree (1), sleeping on the tree (1), flying on the trees (1), branch (1).	
Class: Parasitology class (3), class (1), laboratory (1).	
Human construction: House (38), backyard (4), roof (4), close to home (3), farm (2), roof lining (2), church (1), school (1), home terrace (1), small farm (1), nests at mother's house (1), dead, at home (1), roof slab (1), in the bedroom (1).	1
Flying: Flying (5), passing by on the terrace (2), flying fast (1).	
Others: Work (2), zoo (2), street (2), neighborhood (1), fell beside (1), cave (1), movie (1), woods (1), killed on the street (1), nature (1), at work, between Seropédica and Japeri (1), when the participant lived in São Paulo (1), Rio Claro (1), dark street (1), Sepetiba (1), UFRRJ (2), several places (1).	

Did not know: Did not answer (12).	0
3. Do you know where bats live?	
Yes: Yes (86).	1
No: No (25).	0
3.1. Where?	
Trees: Trees (28), coconut trees (2), hollow trees (1), banana trees (1), tree roosts (1).	
Caves: Caves (33).	
Human constructions: Abandoned houses (7), roofs (6), roof lining (5), houses (3), ceiling (3), old houses (2), roof tile gaps (1), galleries (1), basement (1), buildings (1), old piping (1).	1
Dark places: Dark places (18), darkness (33). Grotto: Grotto (7).	
Forests: Forests (3), woods (1).	
Others: Closed place (2), depends on the species (1), quarry sites (1), deserted places (1), hollow places (1), where they can hang (1), stones (1).	1
Did not know: Did not answer (4), does not know (1).	0
Others: Damp place (2), dry leaves (1).	0
4. Do you know what bats eat?	
Yes: Yes (93).	1
No: No (18).	0
4.1. What?	
Fruits: Fruits (73), Beach almond (2).	
Blood: Blood (34), hematophagous (1).	
Insects: Insects (15).	1
Vegetables: Vegetables (2), vegetarian (1), flower (1), leaves (1), sap (1).	
Others: Carnivore (1), milk when small (1), nectar (1), small mammals (1).	
Seeds: Chestnut (1), seeds (3).	
Fruits: red fruits (1).	0
Others: Mollusks (1), did not answer (1).	
5. Do bats attack humans?	
Yes: Yes (60).	1
Did not know: Did not answer (1).	0
No: No (50).	-1
5.1. If so, why and/or when?	
Defense: Defense (12), when feeling threatened (4), protection (2), some species, to defend themselves (1), when you do not take care (1), when you touch (1), when you mess with them (1), maybe when under pressure (1).	
Hematophagous: Hematophagous (1), those who suck blood to feed (1), for blood (1), because they like blood (1), to eat (1), looking for blood (1), when they are hungry (1), some eat fruit and others blood (1).	
Others: Accidentally (1), depends (1), depends on the situation (1), has been attacked while playing (1), fear (1), bites (1), non-recurring (1), only under stress (1)	1
Did not know: Did not answer (3), does not know (3).	

Others: in movies (1).	0
Defense: When with a puppy (1), when we enter their territory (1)	
Hematophagous: Search for food and if it does not find, suck blood (1).	
Others: Aggressive (1), when at their habitat (1), nocturnal animals (1), angry (1), attack when angry (1), large population and little food (1), bite the neck (1), do not attack by day (1), when you live near bats (1), if it is angry (1), only in Malaysia (1).	-1
Block 1	
6. Can bats cause diseases?	Score
Yes: Yes (101).	1
Does not know: Does not know (2).	0
No: No (8).	-1
6.1. If so, what type and how?	
Rabies: Rabies (37), rabies and others (1).	
Bite: Bite (16).	
Saliva: Saliva (3), eating infected fruit (1), licking (1).	
Feces: From feces (1), feces with diseases (2).	
Leptospirosis: Leptospirosis (3).	
Urine: Urine (2).	
Several diseases: Cryptococcosis (1), rat disease (1), fungal diseases (1), respiratory diseases (1), Ebola (2), diseases (1), other diseases (1), several (1).	
Others: rarely (1), sucking blood (1).	1
Did not know: Did not answer (17), does not know (23).	
Others: Other diseases (1), not in case they were vaccinated (1).	0
Diverse transmission: Water (1), contact (1), touching (1), blood transfusion (1), sting (1).	-1
7. In case a bat bites you, what would you do?	
Healthcare unit: Doctor (33), healthcare unit (32), hospital (7), FIOCRUZ (1), would try to find out if it transmits diseases (1).	
Ask for help: Would call someone (3), specialized help (1).	
Vaccine: Rabies vaccine (6), take vaccines (2), take serum (1).	1
Would wash – healthcare unit: Would wash and go to the healthcare unit (1), clean the place and get medical help (1).	
Others: Rush (2), despair (2), whining (1), screaming (1), would bite back (1), would think I would die (1), seek a specialist in zoonosis or google (1).	0
Did not know: Does not know (13), did not answer (2).	
Would wash: Wash fast (1), would wash (1), wash with water and soap (1).	
Others: Would press to prevent reaching the blood (1), buy medicine at the pharmacy (1), would kill the bat (1).	-1
Block 3	
8. Have you ever killed a bat?	Score
No: Would not kill bats (94).	1
Did not answer: Did not answer (1).	0
Yes: Yes (16).	-1
8.1. Why?	
Others: Accident (1), did not answer (1).	0

Fun: Bamboo stick (1), fun, childhood (1), as a child, for fun (1), fun (1), trying to remove it with bamboo (1), game (1), as a child (1).
Bat entered the house: Terrace (1), bat entered the house (1), they were flying inside the house (1), bat inside the house, with bamboo (1), bat was in the living room (1) -1
Others: Fear (1), transmits diseases (1).

9. In case a bat is found in your house, what would you do?

Would scare it away: Scare away (31), would put it outside (6), would chase away with a broom (5), would try to put it outside (2), turn on the light to scare away (1), find a way to make it go out (1), some way to remove it (1), would scare it (1), turn off the lights outside and turn on those inside the house (1), would wait for the bat to leave (1), would throw bat out (1), would remove (1), would scare away with a towel (1).

Ask for help: Would call the mother (4), would call someone (1), would call firefighters (1), would call the father (1), ask for help (1), would ask someone (1).

Open doors and windows and let the bat go out: Would open the door and let the bat go out (4), open the window and wait for the bat to get out (1), would open the door (1), would open the window and put it outside (1), would turn off the lights and open the doors (1). 1

Nothing: Would leave it there (2), would let it leave (2), nothing (2), would not touch (1).

Others: Would not kill (2), close the door (1), close the entrances (1), if not used to bats, would take it out (1), would not hurt it (1).

Would set it free: Would set it free (4).

Would catch it: Would take an insect net or towel to throw it out (1), would remove it with a box (1).

Rush: Run (8).

Screaming: Screaming (3), scandal (1).

Fear: Would not enter the house (1), would leave the house (1), would be afraid (1).

Others: Unlikely having bats at home (1), if used to it, would stay (1), would take care of them (1), does not know (1), did not answer (1). 0

Would kill: Would kill (5), would try to kill (2), would throw it away (1). -1

Would catch it: Catch it with a plastic bag and take it to rehab (1), would catch for you (1), would take it to Zoonosis Control Center (1), would catch it and return it to nature (1), try to remove (1), remove it (1), would try to catch and remove (1).

Ask for help: Call someone to kill (1).

Block 4

10. Do you think bats are important to the world? Score

Yes: Yes (84). 1

Do not know: Does not know (3), did not answer (1). 0

No: No (23). -1

10.1. Why?

General: All animals are important (10), nature balance (3), ecosystem (3), nature control (2), balance (2), has some function (2), it does something (1), each species has its importance (1), belongs to nature (1), ecosystem, they are integrated with other things in nature (1), they are part of the ecosystem balance (1), important for ecological relationships, ecosystem balance (1), because they are animals (1), for the environment (1), if it is in the world, it is important (1), if they are in nature (1), if it exists, it matters (1), otherwise it would not exist (1), all beings have important roles (1), all have a function (1), everything in nature is important (1), everything matters (1), everything has a purpose (1).

Dispersal: Seed disperser (7), spread seeds (2), seed and fruit dispersal (1), feces disseminate fruits (1).

Food chain: Food chain (5).	
Insect control: Insect control (4).	1
Pollination: Pollination (1), pollinators (1).	
Disease transmission: Disease transmission (1).	
Others: Eat things that harm us (1), eat at night (1), eat seeds (1), God made (1), for medicine (1), plant proliferation (1), a little (1).	
Did not know: Did not answer (8), does not know (10).	
Others: Depends on the species (1), maybe (1).	0

Add File 4: Data of interviewee, separate for female and male (F/M) regarding bats in the municipality of Seropédica, state of Rio de Janeiro, Brazil, on October 7, 2015 and October 28, 2017. * Number of participants who did not respond or were not entered into the accounts of the years of study.

Years class	Basic education									High school			Higher education				No answer	Total F/M	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			16
7-14	0/0	1/0	1/1	0/1	0/0	1/0	3/0	0/1	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	1/0	7/3
14-21	0/0	0/0	0/0	0/0	0/0	0/0	0/0	1/0	0/1	1/0	1/5	0/0	1/4	4/0	0/0	0/0	0/0	1/1	9/11
21-28	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1	0/0	0/5	8/2	0/0	0/0	2/0	1/0	11/8
28-35	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1	0/0	0/0	0/0	0/0	6/2	0/0	0/0	0/0	1/3	1/0	8/6
35-42	1/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1	0/0	2/5	1/0	0/0	0/0	2/1	1/0	7/7
42-49	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1	0/1	0/0	3/0	1/0	0/0	0/0	1/0	0/0	5/2
49-56	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1	0/0	0/0	1/0	0/0	0/0	0/0	0/0	4/3	5/4
56-63	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	2/0	0/0	0/0	0/2	0/0	0/0	0/0	0/0	0/3	2/5
63-70	0/0	0/0	0/0	0/0	0/1	0/0	0/0	0/0	0/0	0/1	0/0	0/0	0/1	0/0	0/0	0/0	0/1	1/2	1/6
70-77	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1	0/0	0/0	0/0	0/0	0/0	0/0	0/2	0/0	0/3
No answer	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	1/0	1/0
Total	1/0	1/0	1/1	0/1	0/1	1/0	3/0	1/2	0/1	3/4	1/8	0/0	13/19	14/2	0/0	0/0	6/7	11/9	56/55