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Are beekeepers conservation-friendly? A study on attitudes and values toward animals among small-scale farmers

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ABSTRACT

Affective and aesthetic values attributed to nature are primary motivations that can influence both human attitudes and economic valuation towards biodiversity. The expression of these values, however, depends on direct contact and positive experiences with nature. In this sense, research on activities that favor beneficial human-nature interactions, such as beekeeping, can contribute to understanding the factors (including affective and aesthetic) that influence both attitudes and economic valuation towards biodiversity. Our research was carried out at Sítio Xixá, a rural locality originally covered by Atlantic Forest in the state of Pernambuco, Brazil. We investigated attitudes toward a variety of locally known animals and their economic value among two groups of small-scale farmers: keepers and nonkeepers of stingless bees. We assumed that keepers of stingless bees would cite more affective-aesthetic attitudes toward animals and would be more willing to pay for animal conservation than nonbeekeepers. The data were collected via semistructured interviews. Beekeepers cited more affective-aesthetic attitudes than nonbeekeepers did. On the other hand, beekeepers were less willing to pay for animal conservation than nonbeekeepers were. It seems that the expression of affective-aesthetic values directed toward animals tends to occur more frequently in groups of people who maintain activities that favor beneficial interactions with the environment, such as beekeepers. However, these values reflect nonmaterial aspects that people attribute to nature and may not be economically valued by human groups. Therefore, nonmaterial values that human populations attribute to nature, such as those related to affection and aesthetics, should be considered in conservation proposals involving the public.

Keywords: Human Attitudes, Economic Valuation, Meliponini, Emotions, Conservation Biology.

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SIGNIFICANCE STATEMENT

Recently, a larger portion of society has become aware of the important roles played by bees in ecosystems, as well as of the susceptibility of these insects to habitat loss. With this in mind, we aimed to shed light on the possible roles that beekeepers could play in biodiversity conservation, especially for small farmers who keep stingless native bees near tropical forests. We assumed that there would be differences between two particular groups of farmers (beekeepers and nonbeekeepers) with regard to both attitudes and valuation towards biodiversity. The results revealed that beekeepers were more strongly associated with expressing nonmaterial values (e.g., affective-aesthetic), while nonbeekeepers were more strongly associated with material values (e.g., paying to conserve). We argue that the values attributed to nature, be they material or not, must be considered in official initiatives to involve the public in conservation proposals, especially human groups living around protected areas, such as our study area.

INTRODUCTION

The study of human attitudes toward biodiversity has received increasing attention in conservation research (Talukdar and Gupta 2018; Acuna-Marrero et al. 2018; Carmo Loch et al. 2023; Galvão et al. 2024; Rai and Dhakal 2024). This is particularly due to the need to develop effective management strategies, with a view to achieving public support (Dunn et al. 2018; Rodgers and Willcox 2018).

In his pioneering studies, Kellert (1981; 1984; 1985; 1987; 1991; 1993a) investigated different human groups and their attitudes toward diverse animals, thus developing a basic typology that represents the relationship between humans and other animals. This typology is composed of nine attitudes (naturalistic, humanistic, utilitarian, moralistic, ecological-scientific, aesthetic, symbolic, domineering, and negativistic) and continues to be used as a reference in conservation and human-nature interaction studies (George et al. 2016; Zajchowski and Brownlee 2018; Junaedi 2018).

In recent decades, evidence has shown that affect and emotions are important primary motivations that influence human attitudes toward other species (Martín-López et al. 2007; Ballouard et al. 2012; Zhang et al. 2014; Carvalho et al. 2018). The importance of emotions or even the love of nature for the predisposition for environmental conservation has also been discussed theoretically by a variety of authors (Anderson 1996; Soulé 1997; Hunn 2014; Aguiar et al. 2023; Pereira et al. 2023; Toomey 2023, Silva et al. 2024).

In this context, one way to approach the importance of emotions has been the Biophilia Hypothesis proposed by Kellert and Wilson (1993). These authors suggested that human emotional affiliation with nature has been inherited during biocultural evolution; thus, our interactions with nature should be associated not only with the material exploitation of resources but also with cognitive, emotional, aesthetic and cultural development.

On the other hand, various approaches in the area of conservation biology have emphasized the importance of estimating the economic benefit of biodiversity and ecosystem services, aiming especially at reinforcing the cost–benefit aspect of public management and thus assisting in political decision-making processes toward conservation (Costanza et al. 1997; Pascual et al. 2010; Christie et al. 2012).

In this sense, research that uses techniques for the economic valuation of biodiversity to provide information to support conservation programs has received increased amounts of attention (Schutgens et al. 2018). Nevertheless, such works have revealed that human motivations to pay for conservation are sometimes based on nonmaterial valuations of nature, such as affective and aesthetic values (Martin-López et al. 2007; Sattout et al. 2007; Marre et al. 2015). Thus, many studies have stressed the importance of analyzing human attitudes so that the underlying factors that influence the disposition to pay for conservation can be identified (Kotchen and Reiling 2000; Martin-Lopéz et al. 2008; Choi and Fielding 2013). Analyzing both economic valuation and attitudes toward biodiversity together can, therefore, provide greater insights into the willingness of human groups to conserve.

In general, research on activities that favor beneficial human-nature interactions has contributed to the empirical analysis of the various factors (including affective and aesthetic) that influence human attitudes toward biodiversity (Zhang et al. 2014; Silva-Andrade et al. 2016; Carvalho et al. 2018; Vanderstock et al. 2022; Moreno-Rubiano et al. 2023; Teixeira et al. 2024). For example, in previous research, we found that emotional and aesthetic criteria were the most salient motivations for adopting stingless beekeeping as a small-scale activity among farmers in northeastern Brazil (Carvalho et al. 2018). Even so, such previous works have not addressed economic valuation as an additional element that can assist in decision-making for conservation.

In this paper, we aimed to investigate attitudes toward a variety of locally known animals and their economic value among small-scale farmers, with a special interest in comparing two particular human groups:

those that kept stingless bees and those that did not. For this purpose, we considered the following questions: 1) Do farmers who keep stingless bees and those who do not differ in the kinds of attitudes they have toward locally known animals? 2) Do the two groups of farmers differ in their economic valuation of locally known animals?

We hypothesized that farmers who kept stingless bees would express more nonmaterial attitudes toward nature and be more willing to pay for its conservation than farmers who did not keep stingless bees.

MATERIAL AND METHODS

Study area

The research was carried out at a rural locality called Sítio Xixá (07°35'5.96" S, 35°24'57.66" W), located in the municipality of Timbaúba in the state of Pernambuco, Brazil (Figure 1). The municipality covers an area of 292,984 km^2 and is located in the Mata Norte region. The estimated population of the municipality is 53,825 inhabitants, 14% of which live in rural zones, while the others live in urban zones (IBGE 2010). The native vegetation is composed of semideciduous and deciduous seasonal forests varying to dense montane ombrophilous. The climate is tropical with a dry season; the mean annual temperature varies from 22 to 26°C, and the mean annual rainfall is 1073 mm. According to Fundação SOS Mata Atlântica (2017), the municipality has approximately 12% of its original Atlantic Forest remaining.

The rural activities in the region are mainly based on the sugarcane (*Saccharum officinarum* L.) agroindustry, along with the production of other crops, such as banana (*Musa* spp.), manioc (*Manihot esculenta* Crantz), beans (*Phaseolus vulgaris* L.) and corn (*Zea mays* L.). Livestock is also noteworthy.

Part of Sítio Xixá is located within the wildlife refuge "Matas de Água Azul", which is an officially protected area belonging to category IV (habitat/species management area) in the IUCN (Dudley 2008). This conservation unit has a total area of approximately 38 km^2. Having been recently created (Decree n°40.551 of the year 2014), the refuge is still being implemented, so it lacks a management plan (Pernambuco 2014).

According to Secretaria de Saúde Municipal (Timbaúba 2018), Sítio Xixá has 367 residents and 105 families. The main source of family income is the cultivation of bananas. It is also common, although to a lesser extent, to maintain a variety of agricultural

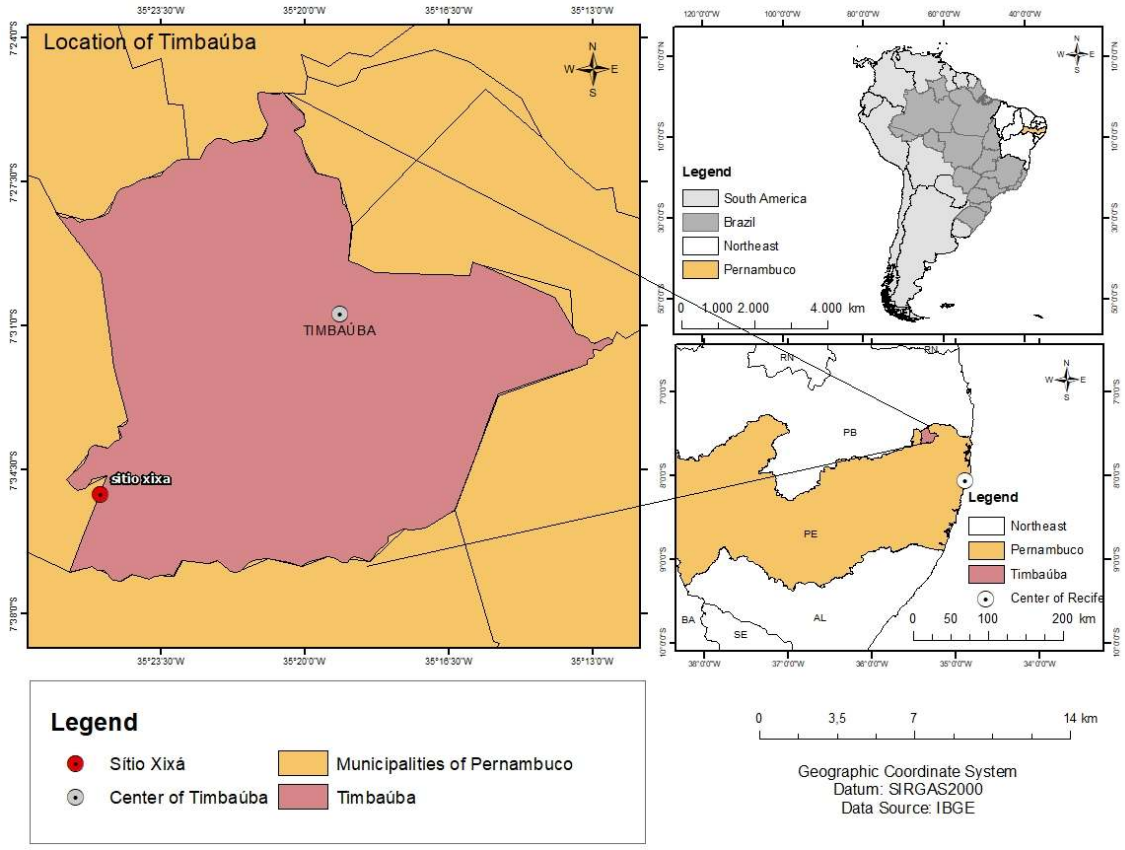

Figure 1. Geographic location of the study area.

crops to supplement income or for own consumption. Financial aid from government programmes also represents an important source of family income. Family production is further increased by raising animals such as cattle, goats, pigs, and bees. Among young residents, salaried work is also common in cutting sugarcane, as is temporary work in cities.

Data collection

Sítio Xixá was chosen as the study area due to the presence of families of small-scale farmers, 47.6% of which kept stingless bees (tribe Meliponini). Field research was conducted between January and September 2018. Initial contact with local farmers was intermediated by a technician from the municipality. Beekeepers were subsequently selected by intentional sampling using the snowball technique (Bailey 1994), which resulted in a total of 54 beekeepers. Nonbeekeepers were then selected with the goal of reaching the total number of families in the study area. The final sample consisted of 43 nonbeekeepers and 54 beekeepers, who together (n = 97) represented 88.6% of the families of Sítio Xixá. Families whose heads of household were not at home or who did not feel comfortable responding to the interview were not included in the sample.

From a socioeconomic point of view, the studied farmers (beekeepers and nonbeekeepers) represented a relatively homogeneous group. The use of beekeeping was an important difference between the groups of farmers under study. The majority (88.9%) of the beekeepers were men, and their ages ranged from 27 to 82 years. The reported income of the informants was concentrated between one and two times the minimum wage (between approximately US264*andUS* 503). For the level of formal education, 42.6% were illiterate, and only three individuals had completed high school. Among nonbeekeepers, the majority (83.7%) were men, with ages ranging from 22 to 81 years. The reported income was also concentrated between one and two times the minimum wage. For the level of formal education, 51.2% were illiterate, and only three nonbeekeepers had completed high school.

The objectives and procedures of the research were clearly explained to all informants prior to data collection, and only those who provided consent were confirmed. This research was approved and authorized by Comissão Nacional de Ética em Pesquisa (CONEP) through Plataforma Brasil and Comitê de Ética em Pesquisa of the Universidade de Pernambuco (CEP-UPE) (Protocol CAAE 54357515.7.0000.5207). Authorization to carry out the research was also granted by Agência Estadual de Meio Ambiente (CPRH), the agency responsible for managing protected areas in the state of Pernambuco (Process N°: 002434/2017).

The data were collected via individual semistructured interviews (Albuquerque 2014). The interviews aimed to determine the attitudes and economic valuations that each informant attributed to 18 species of locally occurring animals. The animals to be studied were selected by means of a pretest in which 11 informants (six beekeepers and five nonbeekeepers) were asked about the local animals they liked best (biophilic) and the ones they liked least (biophobic). After that, 18 species of animals with the highest frequency of citation were selected, and photographs of these animals were taken to the field for informant recognition and subsequent scientific identification. These 18 animal species included six with biophilic tendencies, six with biophobic tendencies, and six with ambiguous characteristics (Table 1). We considered animals with an ambiguous character those for whom there was no consensus among the informants about whether the animal was loved or hated; sometimes, this lack of consensus existed in the speech of the same informant. Bees were not considered for analysis due to biases that could cause bias in the group of beekeepers.

To determine attitudes, each informant was questioned about the 18 selected species of animals. The interview included an image of each species followed by the question "Do you like this animal? Yes or no? Why?". All the reasons cited by the informants were taken into consideration in the analysis; thus, each informant could express more than one attitude toward each animal.

The respondents were then asked about their willingness to pay for the conservation of the same species of animal according to the method of Contingent Valuation (Mitchell and Carson 1989). This method proposes a hypothetical market in which individuals reveal their willingness to pay for the conservation of a given species. In the case of this research, we used a single-bound dichotomous question to ask the following question: "Let's imagine that this species is in danger of extinction. Some government institutions would, then, create a conservation plan for the species. If this plan included voluntary contributions to raise funds to help with the conservation projects for the species, would you contribute? How much between R0*andR*50.00 (in US dollars, between US$0 and US$10.26)?

Data analyses

Attitudes

Responses were categorized after Kellert's basic typology (1993b; 2012). The nine basic attitudes suggested by this typology were grouped into six categories of analysis for the purposes of this study:

Table 1. Species of locally known animals selected for study.

Species of animals	Local name	Local tendency	Conservation status (IUCN 2019)	Native/exotic; Domestic/Wild
Canis lupus familiaris Linnaeus, 1758	Cachorro	Biophilic	NE	Exotic;Domestic
Equus caballus Linnaeus, 1758	Cavalo	Biophilic	NE	Exotic;Domestic
Bos taurus Linnaeus, 1758	Boi	Biophilic	NE	Exotic;Domestic
Dasypus novemcinctus Linnaeus, 1758	Tatu verdadeiro	Biophilic	LC	Native;Wild
Saltator coerulescens Vieillot, 1817	Sabiá-gonga	Biophilic	LC	Native;Wild
Ramphastos vitellinus Lichtenstein, 1823	Tucano	Biophilic	VU	Native;Wild
Spilotes pullatus Linnaeus, 1758	Caninana	Biophobic	LC	Native;Wild
Rupornis magnirostris Gmelin, 1788	Gavião	Biophobic	LC	Native;Wild
Cerdocyon thous Linnaeus, 1766	Raposa	Biophobic	LC	Native;Wild
Rhinella marina Linnaeus, 1758	Sapo	Biophobic	LC	Native;Wild
Atta cephalotes Linnaeus, 1758	Saúva	Biophobic	NE	Native;Wild
Mesoclemmys tuberculate Luederwaldt, 1926	Cágado	Biophobic	LC	Native;Wild
Felis catus Linnaeus, 1758	Gato	Ambiguous	NE	Exotic;Domestic
Gallus gallus domesticus Linnaeus, 1758	Galinha	Ambiguous	NE	Exotic;Domestic
Sus scrofa domesticus Erxleben, 1777	Porco	Ambiguous	NE	Exotic;Domestic
Eira barbara Linnaeus, 1758	Papa-mel	Ambiguous	LC	Native;Wild
Sapajus libidinosus Spix, 1823	Macaco-prego	Ambiguous	LC	Native;Wild
Athene cunicularia Molina, 1782	Coruja buraqueira	Ambiguous	LC	Native;Wild

affective-aesthetic, negativistic, materialistic, moralistic, ecological-scientific, and symbolic (Table 2).

The number of citations for each category was used to compare attitudes between the two groups of farmers, considering all the animals. The normality of the data was tested using the Shapiro–Wilk test. The Mann–Whitney U test was used to assess the significance of differences in the number of individual citations for each attitude between the two groups of farmers. This test was performed using Statistica software version 13.3 (Statistica 2017), and a significance level of 5% ($p < 0.05$) was used.

Economic valuation

To determine which of the two groups of farmers would pay the highest total value for the conservation of all animals, the total, average and median sum of the amounts willing to be paid by each informant for all species were calculated.

To differentiate the two groups of farmers according to who would pay the highest and lowest amounts, the values cited by the informants were categorized into four ranges: zero (R$ 0.00), ten (R$ 1 – 10.00), thirty (R$ 11 – 30.00) and fifty (R$ 31– 50.00).

The number of citations for each range was used to compare the economic valuation of the two groups of farmers, considering all the animals. The normality of the data was tested using the Shapiro–Wilk test. The Mann–Whitney U test was used to assess the significance of the differences in the number of individual citations in each range between the two groups of farmers. This test was performed using Statistica software version 13.3 (Statistica 2017), and a significance level of 5% ($p < 0.05$) was used.

Attitudes and economic valuation considering groups of animals

Simple correspondence analysis (ACS) was used to assess the two types of associations between the data. First, we explored the associations between the attitudes mentioned by farmers and the selected animal groups (those related to biophilia, biophobia and ambiguity). Second, the associations between the economic valuations mentioned by farmers and the same

Table 2. Categories for analyzing attitudes toward local animals formulated from the responses of the informants during semistructured interviews.

Responses of informants	Basic attitude	Reference Kellert (1993b; 2012)	Categories for analysis in this study
"Pet", "It is good to have around", "I like to see it"	Naturalistic	Satisfaction in direct contact with nature	Affective-aesthetic
"I have affection for it", "I love it", "I adore it"	Humanistic	Emotional attachment, love of nature	Affective-aesthetic
"It is pretty", "It is a beautiful animal"	Aesthetic	Physical appeal and beauty of nature	Affective-aesthetic
"I am afraid of it!", "Disgust", "Kills my animals", "Eats the chickens and chicks"	Negativistic	Fear, aversion, alienation from nature	Negativistic
"It serves a purpose", "Provides me money", "Generates income for the family"	Utilitarian	Practical exploitation and material of nature	Materialistic
"I want to keep it in my home"	Dominionistic	Conquest, physical control, mastery of nature	Materialistic
"Left by God", "It's a piece of nature and so must be liked", "An animal that does not harm anyone"	Moralistic	Spirituality and ethical concern with nature	Moralistic
"It has a function in nature", "It is important because it eats pests"	Ecological -scientific	Systematic study of function and relationships in nature	Ecological-scientific
"Its song calls the rain", "Its song announces death"	Symbolic	Use of nature for metaphorical expressions	Symbolic

groups of animals were selected. The analyses were then applied to the two groups of farmers (beekeepers and nonbeekeepers) separately. The Statistical Analysis System software version 8 (SAS 1999) was used to perform this analysis.

RESULTS

Attitudes

The beekeepers cited significantly (U=872.5, p=0.03) more affective-aesthetic attitudes toward the animals chosen for this study than did the nonbeekeepers (Table 3). This result confirmed our first assumption.

The two groups of farmers also differed significantly with regard to moralistic (U=715.5, p=0.001), ecological-scientific (U=804.5, p=0.009) and symbolic (U=867.5, p=0.03) attitudes, which were cited more by the beekeepers than by the other farmers studied (Table 3).

No significant differences were found between the two groups of farmers regarding negativistic (U=1140.0, p=0.88) or materialistic (U=1037.5, p=0.37) attitudes (Table 3).

Both groups of farmers had a high frequency of affective-aesthetic and negativistic citations, while ecological-scientific and symbolic attitudes were the least mentioned by both groups (Table 3).

Economic valuation

The group of nonbeekeepers had the highest total value for disposition to pay for the conservation of the animals, as did the group with higher mean and median values (Table 4).

The two groups of farmers differed among the valuation ranges. The number of beekeepers differed significantly (U=801.0, p=0.009) from that of nonbeekeepers in the 'zero' range; this difference was more frequent among the former (Table 5). In other words, the group of beekeepers had the largest number of refusals to pay for the conservation of the given species of animals. The reasons given among the beekeepers for not being willing to pay were as follows: (1) would not pay, but the animal deserves to be conserved (69.3%), and (2) the animal does not deserve to be conserved (30.7%). The reasons given by the nonbee-

Table 3. Number of citations and medians referring to attitudes toward animals by the two groups of farmers.

Attitudes	B(n=54)		NB(n=43)		p value
	N (%)	Med.	N (%)	Med.	
Affective-aesthetic	483 (32.4)	9	316 (31.3)	7	0.03*
Negativistic	299 (20.0)	6	244 (24.1)	5	0.88
Materialistic	272 (18.2)	5	229 (22.7)	5	0.37
Moralistic	284 (19.0)	5	149 (14.7)	3	0.001*
Ecological-scientific	126 (8.4)	2	67 (6.6)	1	0.009*
Symbolic	28 (1.9)	0	5 (0.5)	0	0.03*

B = beekeepers; NB = nonbeekeepers; N = absolute frequency; % = relative frequency; Med. = median * Significant differences at the 5% level

Table 4. Total, mean and median values relative to the disposition to pay for the conservation of animals by the two groups of farmers.

	Total value	Mean	Median	Min.	Max.
B(n=54)	13,210.00	244.60	217.50	25.00	650.00
NB(n=43)	13,495.40	313.80	235.00	0.00	900.00

Values in Brazilian reais (R$) B = beekeeper; NB = nonbeekeeper

keepers were as follows: (1) the animal does not deserve to be conserved (47.4%), (2) the animal does not pay, but the animal deserves to be conserved (45.2%), and (3) the animal is indifferent (7.4%). The denials to pay for conservation by both groups of farmers were attributed to animals that tended to trigger biophobic reactions.

No significant differences were found between the two groups of farmers for the valuation ranges of 'ten' (U=1159.0, p=0.99), 'thirty' (U=991.0, p=0.21) and 'fifty' (U=1147.5, p=0.92) (Table 5).

The results of this analysis contradicted our second assumption. Beekeepers had a lower average disposition to pay for species conservation than nonbeekeepers and had the largest number of refusals to pay for the conservation of the animals.

Both groups of farmers had a high frequency of citation for the 'ten' valuation range (Table 5). In other words, most of the informants in both groups were willing to pay the lowest amounts (between R1.00*and*R10.00) for the conservation of the animals.

Attitudes and economic valuation considering groups of animals

For each SCA, two dimensions were projected onto two-dimensional plots. In total, four different analyses were carried out, and for each of them, the two dimensions together explained 100% of the total variance in the data (Figure 2a, b, c and d). These high percentages indicate the adequacy of the analysis for explaining the variation in the data in two linear combinations.

Regarding attitudes in the group of beekeepers, biophilic tendencies were strongly associated with affective-aesthetic attitudes; animals with ambiguous tendencies were close to the center of the graph, which represents no or weak associations; and biophobic tendencies were strongly associated with negativistic attitudes and less associated with moralistic and ecological-scientific attitudes (Figure 2a).

Regarding attitudes in the group of nonbeekeepers, animals with biophilic tendencies were strongly associated with materialistic attitudes and less strongly associated with affective-aesthetic attitudes; animals with ambiguous tendencies were close to the center of the graph; and animals with biophobic tendencies were strongly associated with negativistic attitudes (Figure 2b).

Symbolic attitudes were excluded from this analysis due to the low frequency of citation of this attitude in both groups of farmers.

Regarding economic valuation in the group of beekeepers, the biophilic tendencies of the animals were

Table 5. Number of citations and medians for valuation ranges regarding the disposition to pay for the conservation of animals by the two groups of farmers.

Ranges of economic valuation	B(n=54)		NB(n=43)		p value
	N (%)	Med.	N (%)	Med.	
Zero	257 (26.4)	5	135 (17.4)	2	0.009*
Ten	365 (37.5)	5	309 (39.9)	6	0.99
Thirty	212 (21.8)	4	165 (21.3)	2	0.21
Fifty	138 (14.2)	1	165 (21.3)	1	0.92

B = beekeepers; NB = nonbeekeepers; N = absolute frequency; % = relative frequency; Med. = median * Significant differences at the 5% level

strongly associated with the 'fifty' valuation range and less associated with the 'thirty' valuation range; the ambiguous tendencies of the animals were close to the center of the graph; and the biophobic tendencies of the animals were strongly associated with the 'zero' valuation range (Figure 2c).

Regarding economic valuation in the group of nonbeekeepers, the animals with biophilic tendencies were strongly associated with the 'fifty' valuation range, the animals with ambiguous tendencies were associated with the 'thirty' valuation range, and the animals with biophobic tendencies were associated with the 'zero' valuation range (Figure 2d). The results of this analysis demonstrated some important differences between the two groups of farmers regarding their attitudes and economic valuations of the groups of animals studied. Among beekeepers, moralistic and ecological-scientific attitudes were associated (although weak, in relative terms) with biophobic tendencies. Among nonbeekeepers, materialistic attitudes were strongly associated with biophilic tendencies. The willingness to pay for conservation of animals with ambiguous tendencies was greater among nonbeekeepers.

DISCUSSION

Attitudes

Affective-aesthetic attitudes

Beekeepers cited more affective-aesthetic attitudes than nonbeekeepers did (Table 3). This finding suggests that the expression of such attitudes toward animals tends to occur more frequently in groups of people who maintain activities that provide beneficial interactions with nature than in those who do no such activities.

The expression of emotions in human–animal interactions has been widely studied due to the proximity and regularity of these interactions, either as direct contact with an occasional animal or as more frequent and continuous direct contact. For example, Ballouard et al. (2012) examined the influence of a snake-handling experience in the field on the attitudes of children and found that positive emotions and willingness to protect these animals increased considerably among the studied children after the experience of direct contact with snakes. Similarly, Prokop and Fancovicova (2016) analyzed the effect of a school activity involving the handling of gastropods on students' attitudes toward these animals and other animals that usually cause aversion in humans (e.g., snakes and bats). The authors demonstrated that students who had direct contact with gastropods had reduced negative emotions toward these animals as well as toward other animals considered to be biophobic.

Prokop and Tunnicliffe (2010) analyzed the influence of direct and continuous contact with pets by comparing the attitudes of children who kept pets at home with those who did not own pets. Children who maintained continuous contact with pets had more positive attitudes toward animals that were considered biophilic (e.g., rabbits and squirrels) as well as those considered biophobic (e.g., rats and wolves).

The examples discussed thus far in this item show the effect that direct and/or regular contact with animals has on the manifestation of positive emotions directed toward certain components of fauna, whether they are considered biophilic or biophobic. More broadly, other authors have studied the effects of the degree of contact with nature in general (and not only with certain animals) on the expression of biophilic values directed toward animals (Román et al. 2023). For example, Zhang et al. (2014) analyzed emotional attitudes directed toward wild animals by children by comparing students from rural and urban schools in China. The degree of contact with nature was measured by student involvement in

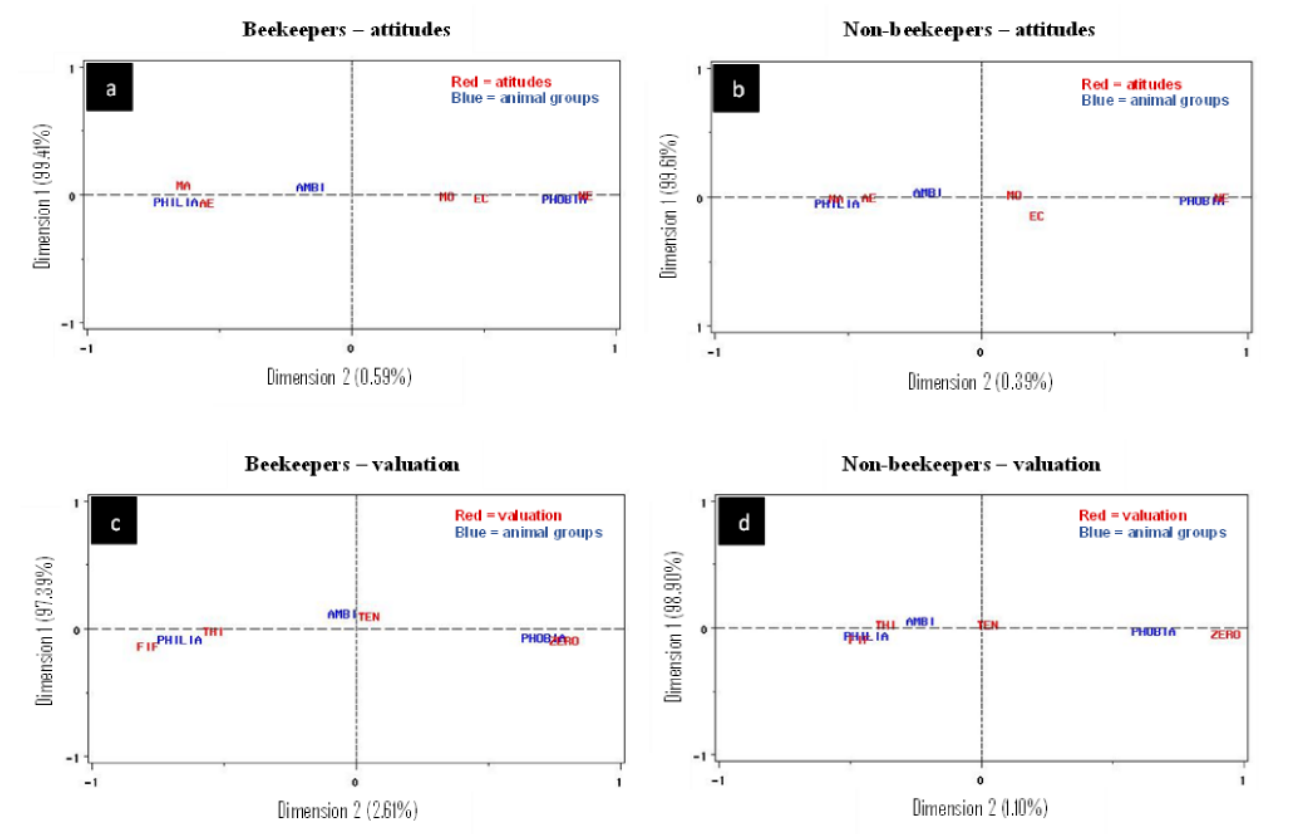

Figure 2. Two-dimensional plots generated by SCA between the attitudes mentioned by farmers and the selected animal groups (a, b) and between the economic valuations mentioned by farmers and the selected groups of animals (c, d). Attitudes in red: AE = affective-aesthetic; NE = negativistic; MA = materialistic; MO = moralistic; EC = ecological-scientific. Groups of animals in blue: PHILIA = animals with biophilic tendency; PHOBIA = animals with biophobic tendency; AMBI = animals with ambiguous tendency. Economic valuation in red: ZERO = R$ 0.00; TEN = R$ 1.00-10.00; THI = R$ 11.00-30.00; FIF = R$ 31.00-50.00.

outdoor activities that were maintained in their daily lives. In this situation, the students of rural schools had greater contact with nature, which was positively related to biophilic attitudes and negatively related to biophobic attitudes toward animals.

Among the farmers of Sítio Xixá, both of the studied groups (beekeepers and nonbeekeepers) commonly have direct and continuous contact with animals and nature because both occupy rural locations because agriculture is the main source of income. However, it is important to consider that beekeepers maintain beneficial interactions with the environment through bee management, which differs from other local agricultural activities and usually involves the use of pesticides (e.g., banana cultivation) and the slaughter of animals (e.g., raising cattle and pigs). Beekeeping provides concrete examples of positive human-environmental interactions through the conservation of native pollinators and encourages the maintenance and promotion of plant diversity to provide food resources to bees (Maderson and Wynne-Jones 2016; Chanthayod et al. 2017; Geisa and Hilgert 2019). Therefore, this activity is commonly recognized for its potential contribution to sustainable forest management (Park and Youn 2012). Thus, this human–bee interaction can favor affective and aesthetic attitudes toward bees (Carvalho et al. 2018) and influence attitudes toward other locally occurring animals, as evidenced by the present study.

The relationship between biophilia and bees has also motivated studies regarding potential educational implications. Cho and Lee (2017) analyzed the biophilic values of bees for students in South Korea through an environmental education programme involving expository classes and lectures on aspects of the biology and ecological importance of these insects, as well as observations and direct contact with honey, wax and bees themselves. After the implementation of the environmental program, there was increased affinity and biophilia toward bees, as well as a feeling of connection with nature, among the students. The authors of this study discussed the importance

of environmental education programs involving partner insects, especially bees, which appear to be good mediators of the stimulation of biophilic values toward nature.

It seems that the expression of biophilic values is not only associated with direct and regular contact with animals and other elements of nature but also associated with those contacts that involve the maintenance of activities with potential beneficial coexistence with nature, as is the case with beekeeping, among other activities (Soga et al. 2023). From a similar perspective associated with human–bird interactions, Silva-Andrade et al. (2016) analyzed the perceptions and attitudes toward birds of two groups of farmers, one who maintained conventional production techniques (e.g., monocultures and mechanized agriculture) and one who maintained agroecological techniques (e.g., minimization of external inputs and diversification in production). The agroecological farmers identified more bird species and had more favorable attitudes toward their conservation than did the conventional farmers. The agroecological farmers also demonstrated greater "sensitivity" to nature, as evidenced by a greater citation frequency for "beauty" of vocalization and plumage and the pleasure of contemplating these animals. The authors concluded that the adoption of certain types of agricultural practices has important implications for local ecological knowledge and attitudes toward conservation. This trend is similar to what we observed in Sítio Xixá, where farmers who performed different agricultural practices demonstrated different attitudes (including affective-aesthetic) toward certain components of the fauna and their conservation.

Other attitudes

Our analysis revealed that moralistic, ecological-scientific, and symbolic attitudes were more often cited by beekeepers than by nonbeekeepers (Table 3). These attitudes were related mainly to positive aspects of the human-animal relationship, such as concerns about animal ethics (generally based on Christian values), the ecological importance of the species, and their use in symbolic representations. This result seems to reinforce the tendency for more frequent expressions of positive attitudes toward animals by groups of people who maintain direct, continuous, and beneficial contact with nature.

Similarly, Kellert and Westervelt (1983) and Bjerke et al. (1998) investigated the attitudes toward animals of two groups of adolescents who differed in their degree of regular contact with pets. The results of both surveys revealed that teenagers who cared for pets had more moralistic, ecological-scientific, and humanistic attitudes toward animals in general, while those without pets were more associated with utilitarian and negativistic attitudes.

The present study revealed no significant differences between beekeepers and nonbeekeepers in terms of materialistic and negativistic attitudes (Table 3). This suggests that the number of citations of such attitudes toward animals tends to be similar between beekeepers and nonbeekeepers, although the SCA has identified some differences in these same attitudes between the two groups of farmers considering selected animal groups (Figure 2). For example, materialistic attitudes were more strongly associated with biophilic animals among nonbeekeepers (Figure 2b), while among beekeepers, this same group of animals was more strongly associated with affective-aesthetic attitudes (Figure 2a).

Economic valuation

Beekeepers were less willing to pay for animal conservation than nonbeekeepers were (Tables 4 and 5). Nevertheless, the main reason given by the beekeepers for the refusal to pay for the conservation of certain animals did not necessarily imply a lack of interest in their conservation (see section Economic valuation in Results). Although the beekeepers attributed less economic value to the local fauna, most of them recognized the importance of its conservation. This apparent contradiction may indicate that they attribute other types of values that motivate their concern for conservation.

The contingent valuation method was also used by Streever et al. (1998) to examine the economic value attributed to the conservation of different categories of wetlands in Australia. Like our results, these authors found divergences between motivations and willingness to pay for conservation on the part of the interviewees. In that case, the main motivations for conservation were related to nonmaterial aspects, such as the intrinsic value of wetlands and their benefit for future generations. However, the wetland categories related to these main motivations received the lowest economic value from the interviewees. This finding led the authors to emphasize the importance of nonmaterial aspects of nature in human motivations to conserve, even though these aspects were not economically valued in the results of the contingent valuation.

Other research using the contingent valuation method has also emphasized the influence of nonmaterial values, such as intrinsic (Schutgens et al. 2018) and aesthetic (Sattout et al. 2007) values, on the response of disposition to pay for conservation. From this perspective, Kotchen and Reiling (2000) discussed the possibility that this method could be biased against individuals who presented conservation-

friendly attitudes based on nonmaterial aspects because these aspects are difficult to economically value. However, other research has shown that, in many cases, the disposition to pay for biodiversity conservation can be influenced precisely by noneconomic factors, such as affective and ethical factors (Martin-López et al. 2007; Spash 2009).

Thus, to control the potential biases inherent in contingent valuation and to improve the interpretation of responses about the willingness to pay for conservation, many studies have recommended that approaches to economic valuation of nature incorporate the analysis of human attitudes toward biodiversity and the environments studied so that the underlying factors that influence the disposition to pay for conservation can be identified (Kotchen and Reiling 2000; Martin-Lopéz et al. 2008; Choi and Fielding 2013).

In the present study, although the beekeepers were not willing to pay for conserving some animals considered biophobic, they cited more positive moralistic and ecological-scientific attitudes toward the same animals than did the nonbeekeepers (Figure 2a and 2b). Such positions were reflected in phrases such as "I don't give money for the hawk because it eats chicks, but every animal is a piece of nature and can't be ended" or "For this one here (snake), I pay nothing, but it has a function in nature, feeding on insects, so it deserves to live".

It seems that nonmaterial values of nature (which include affective, aesthetic, moralistic and ecological aspects) were the main motivators of the conservation-friendly attitudes beekeepers exhibited toward animals. On the other hand, nonbeekeepers were more influenced by economic values attributed to nature, given their greater willingness to pay for the conservation of animals and their tendency to express nonmaterial aspects less.

CONCLUSION

The two groups of farmers studied — beekeepers and nonbeekeepers — differed with regard to their attitudes and the economic value they attributed to the components of fauna considered in this study. Beekeepers had more affective-aesthetic attitudes toward these animals than nonbeekeepers did, although they were less willing to pay for animal conservation.

In this scenario, the expression of affective-aesthetic values toward animals seems to be related more to groups of people who maintain activities that favor beneficial interactions with the environment, such as beekeeping. These values reflect nonmaterial aspects attributed to nature, which, in some cases, are not economically valued by human groups, as seems to have happened with the beekeepers in our study. Thus, according to our results, beekeepers were more strongly associated with the expression of nonmaterial values toward nature, whereas nonbeekeepers were more strongly associated with the expression of economic values.

In fact, conservation-friendly attitudes and behaviors toward fauna can be driven by nonmaterial values (Stokes 2007; Slagle et al. 2012; Zhang et al. 2014; Acuna-Marrero et al. 2018; Geisa et al. 2021). Therefore, we suggest that nonmaterial values attributed to the elements of nature by human groups should be considered in conservation policies aimed at public support. Nevertheless, the economic value of nature plays an important role, especially if we consider subsidies for conserving endangered species and their habitats (Shogren et al. 1999). Thus, the values attributed to nature, be they economic or not, must be considered when involving the public in conservation proposals. This is especially true in regard to human groups living in areas that became officially protected only a few years ago, such as our study area.

The link between affective-aesthetic attitudes and the economic valuation of biodiversity is clearly applicable to studies of human-animal interactions and their associated emotions (and other nonmaterial aspects) in the conservation of nature. This approach seems to be promising, especially for investigating activities with beneficial interactions with nature, such as beekeeping.

Our data revealed, in part, the complexity of human-animal relationships and provided evidence of an opportune situation for the use of interdisciplinary approaches in which economic, ecological, and emotional aspects, among others, are considered.

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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 have no conflicts of interest to declare.

CONTRIBUTION STATEMENT

Conceived of the presented idea: RMAC, AGCA.
Experiment: RMAC.
Performed the data analysis: RMAC and JKGA.
Wrote the first draft of the manuscript: RMAC.
Review and final writing of the manuscript: RMAC, CFM, RRNA, AGCA.
Supervision: AGCA.

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