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Exploring biological and cultural factors influencing wildlife relevance for students of a rural school of central Argentina

Axel G. Chiosso[1,*] and Daniela M. Tamburini[1,2,*]

ABSTRACT

In the present work, we analyze how biological and cultural factors influence the importance of wildlife for rural high-school students in the Argentine Dry Chaco. Through free-listings and interviews, students identified a total of 51 species of wild animals, and highlighted mammals as the most prominent. We observed a negative correlation between Cognitive Salience and the Ecological Relevance Index (rs: -0.48), indicating that the least easily sighted species were the most prominent. On the other hand, Cognitive Salience was positively correlated with Positive Value Cultural index (rs:0.56) and Integral index (rs:0.75), the latter including the negative value of animals. Among the positive contributions (63.1%), material value was the most significant, accounting for 49%, compared to non-material value at 8.6% and regulatory value at 5.5%. On the other hand, for the negative contributions, the damage caused to domestic animals was highlighted (23.2%). The results suggest a complex network of biological and cultural factors that are modeling the cognitive salience and local perceptions of young people over wild animals, empathizing the need to integrate local ecological knowledge into conservation strategies in the Dry Chaco and beyond.

Keywords: Cultural Value, Cognitive Salience, Nature's Contributions to People.

1 Centro de Ecología y Recursos Naturales Renovables (FCEFyN- UNC), Av. Vélez Sarsfield 1666, Córdoba, PB, 5000, Argentina.
2 Instituto de Investigaciones Biológicas y Tecnológicas (CONICET- UNC), Calle Interna 1740, Córdoba, PB, 5000, Argentina.
* Corresponding author ✉. E-mail address: AGC (axel.chiosso@mi.unc.edu.ar), DMT (daniela.tamburini@unc.edu.ar)

SIGNIFICANCE STATEMENT

Understanding the relevance of wild animals, requires integrating biological attributes with cultural perceptions. Young people, often overlooked in ethnobiology, are a key group in contexts of rural–urban migration and loss of ecological knowledge. Based on the of Nature's Contributions to People (NCP) framework, we analyze how young school students in Argentina dry Chaco perceive wildlife, demonstrating how cultural values and ecological aspects influence the animals that students consider most important. Understanding these dynamics provide a unique opportunity to get more inclusive, equitable, and responsive conservation policies.

INTRODUCTION

Socio-ecological perceptions are defined as a symbolic-interpretative process of human societies in relation to wildlife and natural environments, forming a valuable corpus of Local Ecological Knowledge (LEK) (Berkes et al. 2000; Aguilar Curachi et al. 2017). This provides information about the direct and indirect contributions provided by nature to people (NCP), that is, all those material, non-material and regulating values that influence in different ways the quality of life of people (Díaz et al. 2018). To study the values through which people attribute meanings and importance to wildlife, a first step is to recognize that internal models of reality or cognitive systems are particular to each individual, and are constructed through the assignment of meanings to particular elements of the environment that are associated with biological needs and emotions (feelings and values), as well as their socio-cultural and historical context (Nolan and Robbins 2001; Nolan et al. 2006). Likewise, the positive and negative individual experiences that people have with animals will condition the interpretation of emotional stimuli evoking new feelings (joy, sadness, anger, fear, disgust) and, therefore, the reason for liking or disliking certain animals (Jacobs 2009). There is evidence highlighting that prejudices and negative perceptions associated with people's cultural beliefs towards some animals is an important factor influencing cognitive information processing, shaping people's attitudes and decision-making processes (Nolan et al. 2006; Ceríaco 2012; Kansky and Knight 2014; Gomes et al. 2017; Sacristán et al. 2018).

One way to analyze the impact of cultural and biological factors on the meaning and importance of wildlife for a specific group of people is to address Cognitive Salience, which refers to the place of different elements of nature in human cognition (Sutrop 2001). Studying it is of great interest, since when something is cognitively salient, it contributes to shaping people's perception, memory, and decision-making (Caduff and Timpf 2008). Thus, Cognitive Salience implicitly includes motives and those aspects of external stimuli that capture a person's attention, such as biological factors (morphological, ecological, and behavioral attributes of animals) and their cultural relevance (Hunn 1999). These factors will influence the likelihood that a particular domain of animals will be culturally recognized. Therefore, to understand the reasons behind the place of each animal in the human mind, it would be ideal to separately measure the effect of a set of mutually influencing causal variables, such as the Cultural Value (CV) and the Ease of Observation (EO) of each animal species. Cultural Value refers to the importance of species to a given cultural group (Reyes-García et al. 2006), while Ease of Observation -measured in terms of the ecological attributes of animals (Zamudio and Hilgert 2018; Wajner et al. 2019)- can be understood as an index of the probability of meaningful encounters between people and a set of species, as a function of their abundance and distribution (Hunn 1999).

This type of research is of transcendental relevance in the academic, socio-cultural and public policy-making spheres, given that ethnozoological studies usually focus on groups of adults, overlooking the multiple ways in which children and young people understand and value nature (Beery and Lekies 2021). Although studies have been carried out in the region on the relationship between people and wildlife, young people have not been taken into account. These social actors are beginning to be addressed as a key and distinctive cultural group in the field of ethnobiology, characterized by a body of knowledge, which is generally not usually shared with adults (Johanson 2010; Gallois et al. 2017). Despite it has been highlighted that children and young people have a strong tendency and emotional affection for adorable, attractive and useful animals, which mainly include pets and domestic animals, followed by fauna (native and exotic) of mammals and birds (Kellert and Berry 1987; Nates et al. 2010; Campos et al. 2013; Torres and Medina 2014), in rural contexts there is also a wide utilitarian valuation of fauna, which is extremely important when they begin to develop work and family responsibilities that have to do with their consumptive use (Gallois et al. 2017; Gallois and Reyes-García 2018). Recognizing how relevance towards wildlife develops during this life stage can significantly enrich our understanding of human attitudes and behaviors in a specific context.

Within this framework, we set out to analyze the biological and cultural factors that influence how the importance of wildlife is perceived and constructed by young high school students. Our overall goal was to analyses the relationship between cultural value, ease of observation and cognitive salience of wildlife species in rural students of the Dry Chaco, central Argentina. We pose the following working question, supported on people's local ecological knowledge of wildlife: are the most prominent animals the most culturally valuable and easy to observe?

MATERIAL AND METHODS

Study location

The work was carried out in the rural locality of Chancaní (Pocho Department), located in the southernmost portion of the Dry Chaco ecoregion (Burkart et al. 1999), west of the Province of Córdoba (Argentina) (Figure 1).

The Chaco ecoregion covers 1.1 million km^2 in

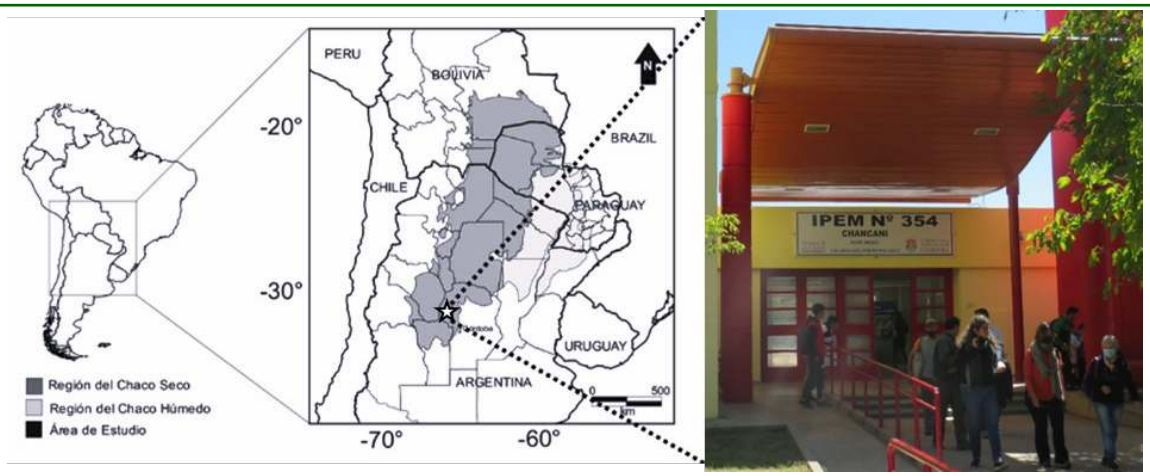

Figure 1. Location of the study area in the Dry Chaco region, west of Provincia of Córdoba (Argentina). The IPEA N° 354 attended by the surveyed students is in the rural locality of Chancaní (taken and modified from Tamburini and Cáceres 2017).

South America. In Córdoba, the southernmost part of Chaco is represented by xerophytic forests (highland and lowland) (Cabido et al. 2003), characterized by a temperate climate, with absolute maximum and minimum temperatures of about 42°C and -6°C, and average annual precipitation of 480 mm concentrated in the warmer months (Cabido et al. 2003). Chaco forests are home to a rich and varied diversity of species, among the most representative groups of fauna are the Armadillos such as *Chaetophractus villosus* and *C. vellerosus*, *Cabassou chacoensis*, and *Tolypeutes matacus*. The presence of the Puma (*Puma concolor*) and the Pampas Fox (*Lycalopex gymnocercus*), the Collared Peccary (*Pecari tajacu*) and the Chacoan Peccary (*Catagonus wagneri*) are also important. In addition, a great variety of bird species inhabit the forests and grasslands such as the Black-legged Seriema (*Chunga burmeisteri*) and the Black Woodpecker (*Dryocopus schulzi*). Among the reptiles are the Argentine Boa (*Boa constrictor occidentalis*), the Rattlesnake (*Crotalus durissus terrificus*) and an important variety of lizards, including the Red Tegu (*Salvator rufescens*) (Torrella and Adámoli 2006).

However, the ecoregion has been a global focus of deforestation (Da Ponte et al. 2022; Gasparri and Grau 2009), with a huge conversion of natural ecosystems into pastures and croplands, especially during the last century (Baumann et al. 2017). In Cordoba, climatic limitations have not allowed the advance of the agricultural frontier, however, the impacts of anthropic activities such as firewood extraction and livestock farming are present. Wildlife also suffers great pressure from habitat loss, unsustainable hunting, which now renders the Chaco a global hotspot of defaunation (Altrichter 2005; Periago et al. 2015). Among the species affected is the Chacoan Peccary (*Catagonus wagneri*) which is endemic to the Chaco region and in danger of extinction (Torres et al. 2023).

From a social point of view, Chancaní with 572 inhabitants, is part of the Pocho Department, characterised by its low rural population density (1.7 inhabitants per km^2), being one of the poorest departments in Córdoba (INDEC 2022). The inhabitants are Spanish-speaking mestizo peasants (also called *campesinos*), living in families with an average of four or five members, most of whom are children or teenagers. Chancaní has a health center, a primary school and an agro-technical secondary school which is attended by students from Chancaní and neighboring villages, because it is the only one in the region. For the students who come from far away, the school functions as a student residence receiving food and lodging.

Rural families live in the forest with a subsistence economy based mainly on livestock production, mainly goats, firewood extraction, honey production and hunting (Cáceres et al. 2015; Silvetti 2020). In general, these diversified forest harvests tend to use family labor, involving children and adolescents in daily tasks (Tapella 2012; Amaya and Díaz 2016). Wildlife constitutes an important resource, which complements their diets and represents an alternative source of food for those families with fewer resources (Cáceres et al. 2015; Tamburini and Cáceres 2017).

Data collection

The research was carried out at the Secondary Level Educational Center IPEA N° 354 of Chancaní. During the 2022 academic year, a cohort of eight students, comprising both first- and second-year enrollees,

participated in the study. In 2023, the study included 11 students from the first-year cohort. Cumulatively, the total sample size was 19 participants, all within the age range of 11 to 13 years. Most of the students were born and raised in Chancaní and nearby rural areas, however a small number of them came to Chancaní at an early age.

The presentation of the work and the communication of the research objectives took place during the first visits to the institution (both in the 2022 and 2023 approaches). Also, each student received a written informed consent notice for the purpose of obtaining the authorization of their parents, ensuring that their participation followed the prescriptions of the Code of Ethics of the Latin American Society of Ethnobiology (SOLAE Ethics Committee et al. 2018).

Different activities were carried out, including semi-structured interviews, for which each student was given a tool called a "field notebook". This allowed us to collect information about the vertebrate species present in the region, different assessments about them and the biological and cultural factors that influence their perception. During the classroom activities, the identity of the species of animals mentioned by the students in the "field notebooks" were clarified when necessary, using specific bibliography and photos (Cabrera 2009; Narosky and Yzurieta 2010; Torres and Tamburini 2018). In addition, a brief socio-cultural characterization of the young people was made based on questions related to the activities carried out by the family and their participation in them.

Free lists of ethno-species were recorded in the field notebooks using the prompt: *"Mention 10 wild animals that you know."* Free listing, a widely employed elicitation technique, asks participants to enumerate items belonging to a defined cultural domain—in this case, wild animals (Bernard 2006; Sutrop 2001). These data were subsequently used to calculate the Cognitive Salience Index (S) for each species cited at least three times (Sutrop 2001) (Figure 2a). Domestic animals, invertebrates, and broad taxonomic categories (e.g., "birds," "snakes") were intentionally excluded. The S-index ranges from 0 (lowest salience) to 1 (highest salience), and the three species with the highest values were designated as "items of high importance" (Chaves et al. 2019).

On the other hand, students were asked to record in another Table (also included in the field notebook) those wild animals that they know and observe in their daily day, having to record an individual valuation in terms of whether these animals are beneficial, harmful or neither (neutral), and give a justification for their answer. We classified this information into three categories: material NCP (food and feed, materials and assistance, etc.), non-material NCP (hedonic considerations, inspiration, species intrinsic value and pleasure of seeing them) and regulating NCP (the role of the species in the ecosystem) (IPBES 2017; Díaz et al. 2018) (Figure 2b). From these categories, we calculated three indices of cultural value for those animal species with a previously estimated S index: Positive (PCV) in which only positive appraisals of the species were included; Negative (NCV) calculated with only these appraisals (e.g. predation on livestock, dangerousness of snakes); finally Integral (ICV) was calculated including all appraisals recorded for each animal species that was mentioned at least three times by the total number of students (Figure 2b) (Reyes-García et al. 2006; Tamburini et al. 2021). These indices ranged from 0 (animals of no cultural importance) to 1 (of great cultural relevance). Vertebrate species that did not have positive or negative ratings and were categorized as Neutral NCP were not included in the estimation of CV indices. In addition, in the same Table, each student was asked to record the sighting site for each species, and to mention four wild animals that they had noticed a decrease in abundance in the last year. In this way, a specific value was assigned to each site where the animals were sighted in relation to the proximity to the dwelling "Sighting site" (SS) (Campos et al. 2021), as well as to the number of times they were mentioned by the students as having perceived a reduction in their abundance during the last year "Reduced Perceived Abundance" (RPA) (Figure 2c). For the SS category (modified from Wajner et al. 2019), it was considered as an assumption that animals that share spaces with people are more likely to be observed (e.g., in the domestic environment). The RPA category, on the other hand, assumed that animals with a reduction in their perceived abundance over the last year will be less likely to be seen (Figure 2c). This information was used to estimate an Ecological Relevance Index (ERI) for each ethnospecies, based on the concept of the Ease of Observation (EO) of the animals (Zamudio and Hilgert 2018; Wajner et al. 2019). For the construction of the ERI, the formula proposed by Wajner (2019) modified was used. This index contemplates the morphological, behavioral and ecological qualities of animals that influence whether they are more likely to be sighted by local people, focusing our work only on ecological attributes (abundance and perceived distribution). The ERI ranged from 0 (animals difficult to observe) to 1 (easier to observe). This index was calculated considering only the ethno-species analyzed in the Cognitive Salience and Cultural Value indices. Thus, the higher the value of SS and RPA, the higher the probability of encounters between juveniles and animals, and thus the ERI. Students completed the field notebooks at home and, after a period of between one and three months, they were delivered to the school. The correspondence between the vernacular names of the wild animals indicated in the field

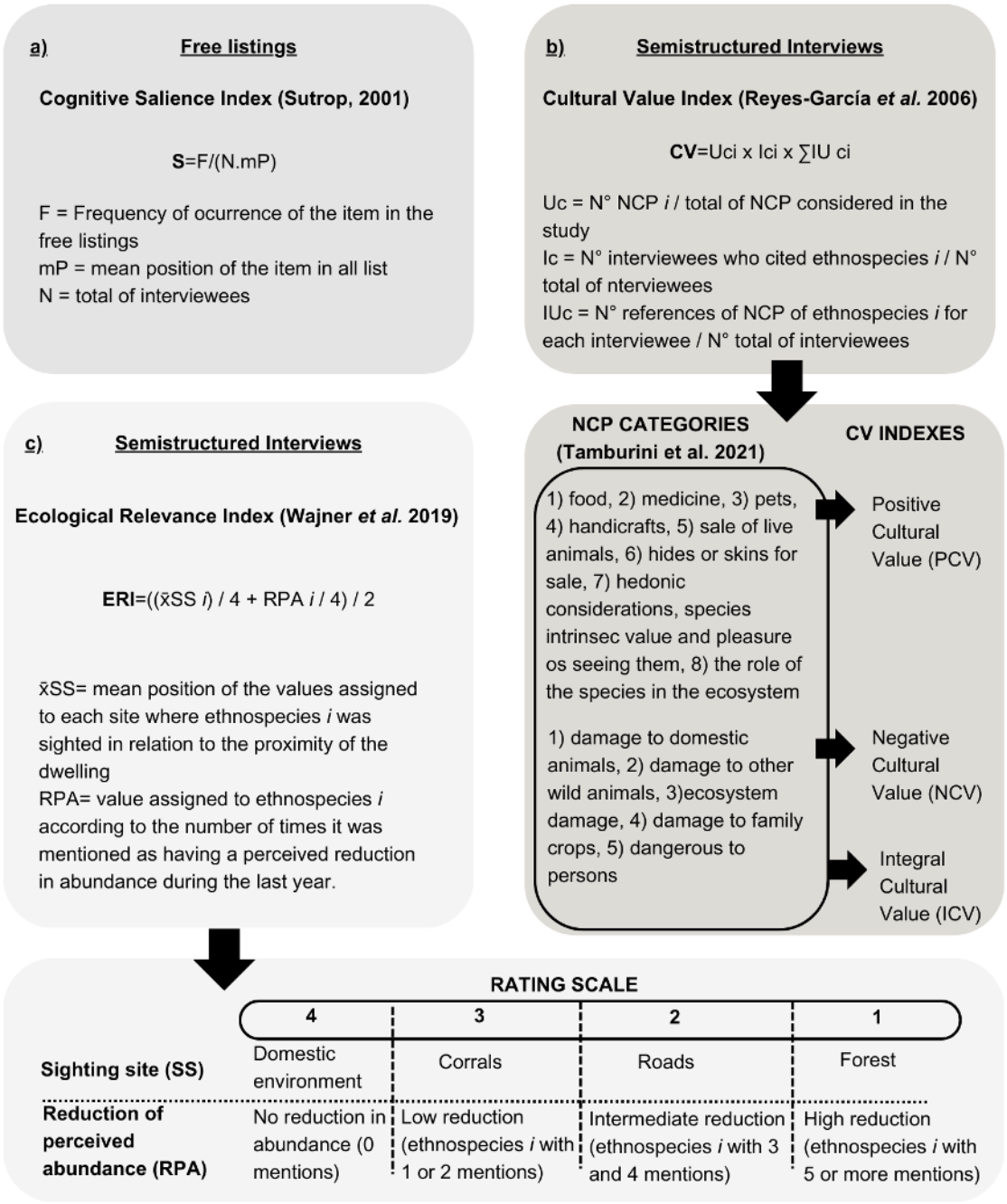

Figure 2. Work scheme implemented to calculate: a) Cognitive Salience, b) three Cultural Value indexes (positive, negative or both), c) Ecological Relevance Index (ERI) from Sighting Site (SS) and Reduction of perceived abundance (RPA) (taken and modified from Tamburini et al. 2021).

notebooks and their scientific nomenclature was based on the identification (by the students) of scientific illustrations of existing vertebrates in Chancaní (Bonino et al. 2012), as well as consultation with specialists.

Analyses

With the data obtained from all the indexes estimated in the study (Figure 2), a non-parametric correlation analysis (Spearman's coefficient) was performed using the Infostat program (Di Rienzo et al. 2008). In this way, a table was constructed highlighting the "p" values of statistical significance and the Spearman co-

efficients (rs) for all the correlations of the variables analyzed.

RESULTS

Eight complete field notebooks were obtained during 2022 and 11 in 2023, with ages between 12 and 13 years old. Among the students surveyed, 54.5% come from families involved in activities related to rural work, taking advantage of the resources and spaces provided by the forest. These activities include obtaining firewood, collecting honey from beehives and extensive goat and sheep raising; and they would not need the collaboration of their children, who are only relegated to domestic chores at home (83.3%). The students identified a total of 51 wild ethno-species, which were grouped into four taxonomic classes: 23 birds, 17 mammals, nine reptiles and two amphibians (Table 1). It should be noted that, among the mammals and birds mentioned, three exotic species were included, the Wild boar (*Sus scrofa*), the European Hare (*Lepus europaeus*) and the House Sparrow (*Passer domesticus*), while no fish species were mentioned due to the absence of permanent watercourses in the area.

Cognitive Salience and Cultural Value

In the free listings, a total of 32 wild animals were mentioned; of these 16 were named three or more times (Table 2, Figure 3), these being representatives of two taxonomic classes, mammals (87.5%), followed by reptiles (12.5%). Of these species, 12 were valued for their benefits, mainly related to the importance of their meat for family food and the sale of hides (11 mammals and one reptile) and seven for the damage they cause in greater proportion to domestic animals (five mammals and two reptiles) (Table 1).

When we analyzed the highest values obtained for the first three Cognitive Salience items, which ranged from 0.3 to 0.18, we found that the most prominent species were medium and large mammals, including the Puma, Geoffroy's Cat (*Leopardus geoffroyi*) and the Southern three-banded Armadillo (*Tolypeutes matacus*) (Figure 3 and Table 2).

Regarding the positive and negative evaluations of the ethnospecies used to estimate the CV (Figure 2b), 41 wild species stood out, of which only 17 obtained three or more mentions (Table 2). Of the animal ratings with three or more mentions, 62.6% were related to the positive NCP of wildlife, while 37.4% of the NCP were negative (Table 1).

Ethno-species with the highest PCV ranged from 0.13 to 0.08 and included medium and large mammals noted primarily for their food value, including Puma, followed by Large Hairy Armadillo (*Chaetophractus villosus*), Chacoan Cavy (*Dolichotis salinicola*) and Viscacha (*Lagostomus maximus),* and thirdly Southern three-banded Armadillo (Table 2). The young people who make consumptive use of wildlife (58.8%), recognized that the tastiest animals were the Southern three-banded Armadillo (29.4%), Large Hairy Armadillo (23.5%), Collared Peccary (*Pecari tajacu*) (17.6%), Wild boar (11.8%), Viscacha (5.9%), Screaming Hairy Armadillo (*Chaetophractus vellerosus*) (5.9%) and Puma (5.9%). As an example, one student reported: "*Puma meat is very healthy*" (L. M, August 2023). On the other hand, among the ethnospecies with a high NCV (0.12-0.07), the Wild boar stood out in first place, followed by the Puma and the Pampa Fox, mainly pointed out for the damage they cause to domestic animals (Table 2). Regarding these animals, the students reported: "*The Wild boar damages pig breeds by crossing with them*" (B. R, August 2023), "*The Puma eats goats, sheep and calves*" (L. M, August 2023) and "*The Pampa Fox eats hens, chickens, etc.*" (K. O, August 2023). Finally, the estimated values of the ICV calculated with all positive and negative NCPs show the Puma in the first place (0.24), followed by the Wild boar (0.17) and the Viscacha (0.11) (Table 2). In our work we observed positive and significant correlations between the variables Cognitive Salience and PCV (rs:0.56, p=0.01) and ICV (rs:0.75, p=0.0002) (Table 3).

Table 1: Total of wild animals cited by students in the field notebooks according to the different NCP categories.

Scientific name	Common names	Positive[1]	Negative[2]	Neutral[3]
MAMMALS				
Chaetophractus vellerosus	Screaming Hairy Armadillo	F (5)		
Chaetophractus villosus	Large Hairy Armadillo	F (10); N (1)		
Didelphis albiventris	White-eared opossum		DA (1)	
Dolichotis salinicola	Chacoan Cavy	F (7); N (1); R (1)		
Galictis cuja	Little Grison			0 (1)
Herpailurus yagouaroundi	Jaguarundi			0 (1)
Lagostomus maximus	Viscacha	F (7); HS (2); R (1)	ED (1)	
Lama guanicoe	Guanaco			0 (1)
Leopardus geoffroyi	Geoffroy's Cat	P (1); HS (1); R (1)	DA (1); DW (3)	0 (2)
Lepus europaeus	European Hare	F (3); HS (1)		
Lycalopex gymnocercus	Pampa Fox		DA (9)	
Mazama gouazoubira	Gray Brocket	F (4)		
Pecari tajacu	Collared Peccary	F (3)	DC (1)	
Puma concolor	Puma	F (5); H (1); HS (1)	DA (9)	
Sus scrofa	Wild boar	F (6); HS (1)	DA (2); ED (1); DC (1); DP (1)	
Tamandua tetradactyla	Southern Tamandua	R (1)		0 (1)
Tolypeutes matacus	S. three-banded Armadillo	F (8); N (1)		
BIRDS				
Amazona aestiva	T.-fronted Parrot	S (1)	DC (1)	
Ardea alba	Great Egret			0 (1)
Athene cunicularia	Burrowing Owl			0 (1)
Caracara plancus	Southern caracara		DA (2)	
Chunga burmeisteri	Black-legged Seriema	F (1); N (2)		
Colaptes melanochloros	Green-barred Woodpecker	N (1)		
Coragyps atratus	American Black Vulture			0 (1)
Cyanocompsa brissonii	Ultramarine Grosbeak	P (1); S (1); N (1)		0 (1)
Eudromia elegans	Elegant Crested Tinamou	N (1)		
Falco peregrinus	Peregrine Falcon		DA (1); DW (1)	
Furnarius rufus	Rufous Hornero	R (1)		0 (1)
Milvago chimango	Chimango Caracara		DA (1)	
Myiopsitta monachus	Monk Parakeet		ED (2); DC (1)	
Nothoprocta cinerascens	Brushland Tinamou	N (1)		0 (2)

Continued on next page

Table 1 – continued from previous page

Scientific name	Common names	Positive[1]	Negative[2]	Neutral[3]
Passer domesticus	House Sparrow	N (1)		
Patagioenas maculosa	Spot Winged Pigeon			0 (1)
Pseudoseisura lophotes	Brown Cacholote		DA (3)	
Thraupis bonariensis	Blue-and-yellow Tanager	P (1); N (1)		
Vanellus chilensis	Southern Lapwing			0 (2)
Vultur gryphus	Andean condor	N (1); R (1)		
Xolmis irupero	White Monjita			0 (1)
Zenaida auriculata	Eared Dove		DC (1)	0 (2)
Zonotrichia capensis	Rufous-Collared Sparrow	N (1)		
REPTILES				
Boa constrictor occidentalis	Argentine Boa	HS (1)	DA (2); DP (1)	
Bothrops diporus	Lancehead Snake		DP (2)	
Chelonoidis chilensis	Chaco Tortoise			0 (1)
Crotalus durissus terrificus	S. American Rattlesnake		DP (1)	
Homonota spp.	S. American Marked Gecko		DP (1)	
Micrurus pyrrhocryptus	Argentinian Coral Snake		DP (1)	
Salvator merianae	Black and white Tegu	HS (1)	DA (4)	
Salvator rufescens	Red Tegu			0 (2)
Xenodon semicinctus	Falsa Arg. Coral Snake		DP (1)	
AMPHIBIANS				
Leptodactylus/Boana/Physalaemus	Indeterminate frog	R (1)		
Rhinella arenarum	Toad	R (1)		
Total mentions		**95**	**56**	**22**

Summary of each category (%):
Positive: F=39.7%, M=0%, P=2%, H=0.7%, S=1.3%, HS=5.3%, N=8.6%, R=5.3%
Negative: DA=23.2%, DW=2.6%, ED=2.6%, DC=3.1%, DP=5.3%

Legend: Wild fauna was categorized by scientific name and common name, as well as in relation to the NCP categories identified for each of them. The ethnospecies are presented in alphabetical order in each taxonomic group. The number of mentions for each NCP category analyzed is presented in parentheses.
[1]**Positive NCP:** Food (F), Medicine (M), Pets (P), Handicrafts (H), Sale of live animals (S), Hides or skins for sale (HS), Non-material (N) and Regulating (R).
[2]**Negative NCP:** Damage to domestic animals (DA), Damage to other wild animals (DW), Ecosystem damage (ED), Damage to family crops (DC) and Dangerous to persons (DP).
[3]**Neutral NCP:** Value Neutral (0).

Cognitive Salience and Ecological Relevance of wild animals

The calculated ERI ranged from 0.25 (animals that were seen in the bush and have been mentioned 5 or more times by the students as suffering a reduction in abundance), to 0.78 (animals that were observed in the domestic environment, corrals and bush, and have not been mentioned because of a reduction in abundance). In our work, a negative and significant correlation was observed between S and ERI (rs: -0.48, p=0.04) (Table 3), where it can be seen that four ethnospecies: Geoffroy's Cat (*Leopardus geoffroyi*), Gray Brocket (*Mazama gouazoubira*), European Hare and Ultramarine Grosbeak (*Cyanocompsa brissonii*) do not fit the general trend among the variables analyzed (Figure 4). Another negative correlation was also found between PCV and ERI (rs: -0.53, p = 0.02) (Table 3). Thus, it was highlighted that the most prominent ethnospecies and those contributing positive NCPs were not those with the highest ease of observation (ERI).

DISCUSSION

In general, in Latin America, children and youth in rural contexts maintain a strong connection with nature that is reflected in their local knowledge of wildlife (Gallois and Reyes-García 2018; Bermudez et al. 2022; Pérez-Flores and López-Martínez 2025). However, ethnographic work related to perceptions of nature focuses on adult human groups. Here we present an approach that extends traditional approaches that evaluate wild species of interest to local communities. We analyze the perspectives of young students from a rural school in the Argentinean Dry Chaco to elucidate the relationship between, cognitive salience, cultural value and ecological relevance, based on the study of indices. We believe this framework can better align conservation and sustainable development objectives in the Chaco region, a global hot spot of deforestation and defaunation (Baumann et al. 2017; Moreno et al. 2024).

In the Chaco region of western Córdoba Province, young students valued wildlife primarily for its material contributions, rather than for its non-material or regulating ones (Table 1). This could be related to the fact that the satisfaction of basic needs (such as food) constitutes a relevant factor in people's cognition, although this group of students does not declare to consume wildlife on a regular basis. Meanwhile, among the negative NCPs, the harm caused to domestic animals was highlighted (Table 1). This trend, also observed in the group of adult stakeholders in Chancaní (Tamburini et al. 2021), could indicate a conditioning of the evaluations of young people transmitted by their parents or other adults, since young people in general do not participate in rural activities (like repairing fences), being relegated to domestic tasks in the home or areas close to the house (such as firewood collection, etc.). From this situation we can infer that the communication of shared experiences in homes and the beliefs ingrained and transmitted in the locality of Chancaní may be an extremely important factor conditioning the values held by students, which could promote a perceived risk of threat above the real risk. Likewise, we observed that many other species are recognized as members of the forest without a defined role (Neutral NCP) (Table 1). As mentioned by Tamburini (2016), the presence of these animals in the forest would be of importance to this group of students and would only be part of the list of species in the region.

Cognitive Salience and Cultural Value

In our research, the three most prominent mammals (highest S indices) -Puma, Geoffroy's cat and Southern three-banded Armadillo- occupied prominent positions in the cultural value lists, based on a system of multiple positive and negative valuations, as contemplated in the ICV (Figure 3). These antagonistic interactions are consistent with those reported by Tamburini et al. (2021) for adult local inhabitants of the same region. For them, both the animals used for material purposes at present (e.g., food) and in the past (e.g., sale of hides), as well as the role of carnivores in negative interactions with people by preying on domestic livestock, were those with the highest Cognitive Salience index.

Our data on the first place occupied by the Puma in the S-index, agree with previous research conducted in rural localities of the Province of Córdoba, where they observed that the Puma was also an ethnospecies of high Cognitive Salience and valued mainly in negative terms, but also positive by adult people (Wajner et al. 2019; Tamburini et al. 2021), who often hunt them in retaliation to predation by domestic livestock (Quiroga et al. 2016; Tamburini and Cáceres 2017), and in those cases, their meat is exploited and valued for being "clean" (Tamburini et al. 2021). This does not lead us to think that learning acquired from indirect experiences transmitted by adults could play a fundamental role in the construction of socio-ecological perceptions in young people. Likewise, in a study conducted by Nates et al. (2010) with primary and secondary school students in rural localities of the province of San Juan (Argentina), they observed that this species was the most liked wild and native animal, classified as a "charismatic mammal". These perceptions of attraction and appreciation of carnivorous animals due to their size and beauty (Deustua Aris et al. 2008) could evidence that phenotypic relevance (given mor-

Table 2. List of wild animals with their respective estimated index values.

Scientific name	Common name	S	PCV	NCV	ICV	ERI
Puma concolor	Puma	0,3	0,13	0,09	0,24	0,25
Leopardus geoffroyi	Geoffroy's Cat	0,23	0,03	0,04	0,07	0,58
Tolypeutes matacus	S. three-banded Armadillo	0,18	0,08	0	0,05	0,39
Chaetophractus villosus	Large Hairy Armadillo	0,14	0,12	0	0,07	0,38
Sus scrofa	Wild boar	0,13	0,06	0,12	0,17	0,5
Lycalopex gymnocercus	Pampa Fox	0,13	0	0,07	0,03	0,52
Pecari tajacu	Collared Peccary	0,12	0,01	0	0,01	0,5
Dolichotis salinicola	Chacoan Cavy	0,08	0,12	0	0,07	0,57
Salvator merianae	Black and white Tegu	0,08	0	0,02	0,02	0,5
Mazama gouazoubira	Gray Brocket	0,08	0,01	0	0,01	0,25
Chaetophractus vellerosus	Screaming Hairy Armadillo	0,06	0,01	0	0,02	0,58
Lagostomus maximus	Viscacha	0,05	0,12	0,01	0,11	0,52
Boa constrictor occidentalis	Argentine Boa	0,04	0,01	0,02	0,01	0,57
Conepatus chinga	Molina's Hog-nosed Skunk	0,04	0	0	0	0,63
Didelphis albiventris	White-eared opossum	0,03	0	0	0	0,63
Lepus europaeus	European Hare	0,02	0,01	0	0,01	0,25
Myiopsitta monachus	Monk Parakeet	0	0	0,02	0,01	0,78
Pseudoseisura lophotes	Brown Cacholote	0	0	0,01	0	0,75
Cyanocompsa brissonii	Ultramarine Grosbeak	0	0,02	0	0,01	0,5

Table 3. Non-parametric correlations between variables for the 19 ethnospecies analyzed.

Variables	S	PCV	NCV	ICV	ERI
S	1	0.1*	0.2	0.0002*	0.04*
PCV	0.56	1	0.95	0.00005**	0.02*
NCV	0.31	0.01	1	0.05*	0.72
ICV	0.75	0.79	0.46	1	0.08
ERI	-0.48	-0.53	0.09	-0.42	1

Legend: Below the main diagonal are the Spearman correlation coefficients (r_s) and above, the "p" values of statistical significance for the different combinations of variables. Significant correlations: * $p \leq 0.05$, ** $p \leq 0.001$.
References: Cognitive Salience (S), Positive Value Cultural index (PCV), Negative Value Cultural index (NCV), Integral Value Cultural index (ICV), Ecological Relevance Index (ERI).

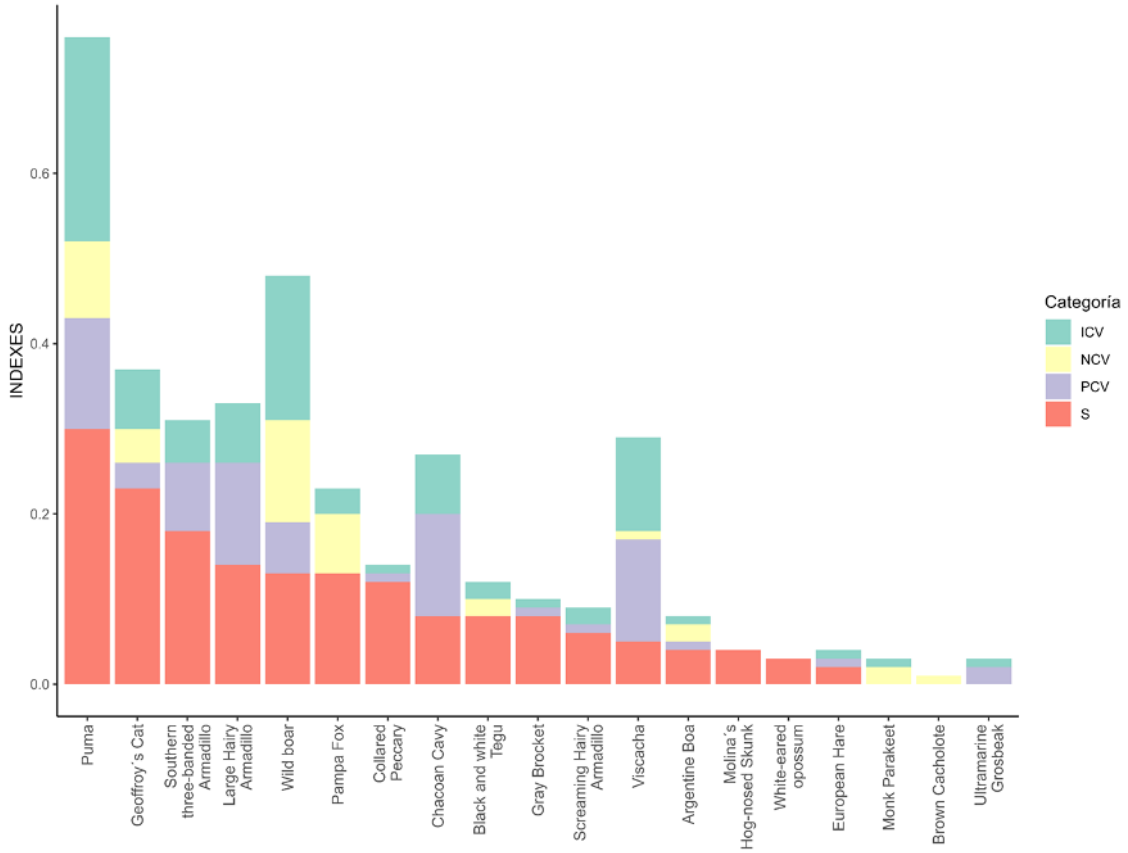

Figure 3. Cognitive Salience Index and cultural value of ethnospecies from the rural locality of Chancaní. The values of the S index were ordered in decreasing order for each ethnospecies analyzed. References: Cognitive Salience (S), Positive Value Cultural index (PCV), Negative Value Cultural index (NCV), Integral Value Cultural index (ICV).

phological attributes of the animals) (Hunn 1999), not measured in our work, could have a relevant effect on the first place occupied by the Puma in the Cognitive Salience index.

On the other hand, and despite the fact that Geoffroy's Cat was highlighted in second place in the S index (Figure 3), in other studies conducted with adults it was not considered an ethnospecies of great Cognitive Salience for adults in rural localities in arid environments of Argentina (Campos et al. 2021; Moreno et al. 2022), although its importance was recognized in the past for the sale of hides in the locality of Chancaní (Tamburini et al. 2021). As mentioned by Tamburini and Cáceres (2017), wildlife valuations can change over time, influenced by regulatory frameworks that restrict and/or prohibit their traditional uses, changes in species abundance, and local community interests. Thus, the decrease in demand and economic value of skins, due to strict regulations, could have increased the abundance of Geoffroy's Cat as currently perceived by students (Figure 4). Consequently, it is possible that these animals may have begun to cause conflict on a more recurrent basis by preying on poultry. From the perspective of young people, this species is beginning to be valued not for its economic usefulness (since the sale of hides is regulated, being practically nonexistent and reported by only 14.9% of the students), but rather for the damage they can cause to local communities (42.9% highlighted the damage they cause to domestic animals and 14.9% to other wild animals).

These two feline species cannot be categorized as exclusively positive or negative, underscoring the diversity of nature's contributions to people (NCPs) and the multiple ways in which human–non-human relationships are constructed. Such values also shape people's behaviors and attitudes toward nature. Individuals perceive, interpret, judge, and engage with nature in markedly different—and at times conflicting—ways, particularly in relation to perspectives such as conservation (Díaz et al. 2015).

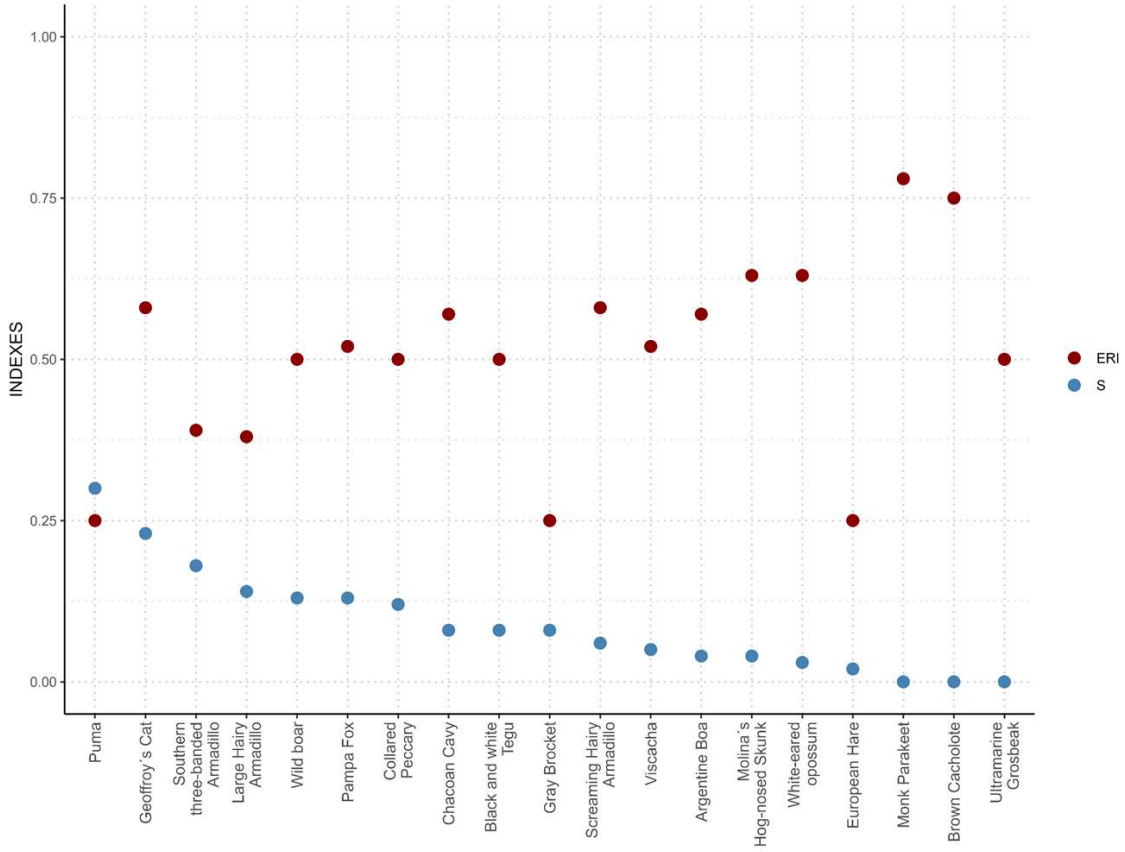

Figure 4. Relationship between the Sutrop Index (S) and Ecological Relevance (ERI) of ethnospecies. The ethnospecies represented on the x-axis were ordered in decreasing order in relation to their S values.

Finally, the Southern three-banded armadillo, which ranked third in the S-index, was valued exclusively for the benefits it provides (Figure 3 and Table 3). This species, along with other armadillos, is among the most frequently consumed by local people, owing to its ease of capture and relative abundance (Tamburini and Cáceres 2017). Moreover, it is highly appreciated for its meat, especially among the youth of Chancaní, reflecting similar patterns documented in other areas of the Chaco region where these species occur (Altrichter 2006; Camino et al. 2017).

On the other hand, it is interesting to note that Puma, Viscacha and Wild boar were the species that young people valued the most, occupying the first places in the ICV, although the latter two species did not have high values in Cognitive Salience. In contrast to these results, Tamburini et al. (2021) observed in their work that the Viscacha was the most cognitively salient ethnospecies, with the highest PCV values due to its use as a food source and, to a lesser extent, the utilitarian value of its skin, its role in the ecosystem and its medicinal uses, even though it is currently not very abundant (Torres 2018). In our research Viscacha was widely appreciated for its food value, followed by the utilitarian value of its skin (Table 1). Thus, the important value that this animal had in the past, safeguarded in the memories and social memory of adults, could have crystallized, from the intergenerational transfer of knowledge and values of nature, in the younger generations attributing a high value to this animal (Tamburini and Cáceres 2017; Tamburini et al. 2021). This fact could indicate that the memories transmitted by adults are not enough to condition the most cognitively salient species in young people.

Our results highlight the relevance that intergenerational transmission of knowledge and values, as well as symbolic learning about wild animals, could have in the construction of socio-ecological perceptions. As children grow older and take on work and family responsibilities, they transform and condition innate universal responses, increasing the variability of context-specific linkages that occur between different animal species and people (Jacobs 2009). It is important to emphasize that the place that each ani-

mal species occupies in the cognition of young people seems to be subject to continuous animal revaluation processes, due to direct and indirect learning and experiences that occur with animals and changes in the socio-cultural contexts that occur throughout the life of each person.

Cognitive Salience and Ecological Relevance of wild animals

The retraction of species abundance is manifested through a decrease in the frequency of findings compared to previous years (Manzano García and Martínez 2017). The causes of this phenomenon are multiple and varied, depending on the study area and the species analyzed (Tamburini 2016; Periago et al. 2017). Research work demonstrates that survey methods based on LEK can be effective and accurate in detecting trends in abundance of large mammals when working with hunter-qualified informants (Dolrenry et al. 2016; Camino et al. 2020). However, they emphasize that this should not be a reason to reject LEK methods for studying wildlife in other stakeholder groups (Camino et al. 2020). Thus, it has generally been seen in the literature that young people in rural and urban areas are often unaware of the loss of local species (Campos et al. 2012; Hermann and Menzel 2013). However, the students surveyed mentioned native wildlife species that are less frequently encountered. This information provides a valuable opportunity to focus wildlife conservation efforts on a local context, which often does not conform to national and international species categorizations (Tamburini 2016).

It is important to note that biological factors, among them ecological and behavioral attributes (abundance and distribution of animals), have a key cultural component, as the distribution of human observers is culturally conditioned (Hunn 1999). In other words, young people's interests, needs, obligations, and preferences for how they spend their time (such as fear of going out at night or preference for the use of electronic devices) will influence meaningful encounters with animals that capture their attention (Hunn 1999; Campos et al. 2013). In our opinion, if sociodemographic and cultural factors are not considered and translated into measurable variables, it would be ideal to measure only perceived abundance and distribution to calculate the ERI, as was done in this study. Otherwise, incorporating morphological and behavioral factors (such as whether animals are migratory, diurnal/nocturnal, their size, and color) could result in high ERI values that do not accurately reflect people's real encounters with the animals. This might be why ethnospecies that are easier to observe, based on their morphological and behavioral traits, don't fully explain each animal's place in people's cognition. Instead, perceived abundance—the biological factor most related to Cognitive Salience in this study—is what truly matters (Wajner et al. 2019; Ortega-Alvarez and Casas 2023). Likewise, it is important to note that real or perceived conflicts occurring in wildlife and productive activities may influence an overestimation of perceived abundance (Flores et al. 2023).

In relation to the ERI, the negative correlation observed between the variable S and PCV could be explained by the attraction of young people to ethnospecies that are more difficult to observe, but which offer direct (material and non-material) and indirect (regulating) cultural benefits (Figure 4 and Table 3). This differs from initial expectations and from what was found in students from seven to 18 years of age in arid environments of the Province of San Juan, where species in threat categories that are more difficult to observe were mentioned infrequently (Campos et al. 2021). In this sense, the preference and concern for animals of great value and cultural use, which have reduced their frequency of findings, could be related to a greater positive emotional meaning provided by their sighting, which, although infrequent, becomes a memorable event (Herzog and Burghardt 1988; Kellert 1993; Nolan et al. 2006).

Our results reveal that the species that are paramount in the thoughts of juveniles are not those that are recurrently observed, challenging the common assumption in studies of ecological salience. In fact, it is common knowledge that through time and in different cultures people have established a strong connection with animals and instilled a strong symbolic value towards them (Walsh 2009). As an example, we can cite the jaguar (*Panthera onca*), which remains alive in the memory of the inhabitants of rural areas of Latin America (Zamboni et al. 2017; Caruso et al. 2020; Malheiro 2020; Álvarez and Zapata-Ríos 2022; Pérez-Flores and López-Martínez 2025), despite the fact that its range and abundance have been drastically affected. Further research is important to understand how the acquisition of symbolic values from the past and changes in animal abundance influence the construction of socio-ecological perceptions. In order to explore these questions, it is necessary to consider in the methodology different age groups and rural localities to be considered.

CONCLUSION

The results suggest a complex network of factors that are modeling the cognitive salience and local perceptions over wild animals for young people in the rural town of Chancaní contributing in a novel way to

the field of juvenile ethnozoology. The understanding of the values of nature is a fundamental step to better comprehend the interlinkages between people and other nature components, encompassing multiple perspectives and understandings of the natural world, such as biodiversity and those perspectives of local communities. It is therefore essential to include the local population (to be more respectful) in the definition of the components of nature of value that are part of their memories (the result of the encounter between the biological and the cultural). This includes the knowledge and know-how to understand nature. Together, they bear witness to a series of memories that make up a historical archive housed in these traditional communities. However, this human memory is threatened by the phenomena of modernity, such as the migration of young people to the city. Safeguarding it requires a process of collective construction that must take place in broader and more inclusive contexts of debate.

The work with young people in the territory demonstrates great opportunities for the Chaco region to plan more effective conservation policies that take into account local knowledge and needs, based on the valuation of their ecological knowledge and considering them as key to achieving fair results in the conservation of biocultural diversity. We emphasize the importance of working with different age groups to delve into how the intergenerational transfer of knowledge and values develops, transforms and influences the cognitive salience of wildlife for people.

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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: AGC, DMT.
Carried out the experiment: AGC, DMT.
Carried out the data analysis: AGC.
Wrote the first draft of the manuscript: AGC.
Review and final write of the manuscript: AGC, DMT.
Supervision: DMT.

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