Wildlife Use by Rural Communities in the Ayapel Wetland, Colombia

Uso de la fauna silvestre por comunidades rurales en la Ciénaga de Ayapel, Colombia

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Abstract

The present exploratory study was conducted in the Ayapel Wetland System, part of the Momposina Depression in the Colombian Caribbean. The main objective was to evaluate wildlife use by rural communities, primarily campesino populations, in the context of biodiversity management and conservation. A mixed-methods approach, widely applied in ethnobiological research, was employed, combining 212 structured surveys, visual tests for species recognition, interviews, and participatory workshops. Results showed that hunting, a practice rooted in antiquity, is categorized into subsistence, commercial, and control hunting, with a total of 33 exploited species recorded: 15 birds, 14 mammals, and 4 reptiles. The predominant use category was food, followed by trade and, to a lesser extent, pet keeping. The discussion highlights that, although hunting remains an important source of protein and income for local communities, this practice, together with drivers such as deforestation and environmental pollution, places considerable pressure on wildlife populations. These findings underscore the need for integrated management strategies that incorporate traditional knowledge and promote sustainable practices to ensure the long-term conservation of this critical wetland system and its biodiversity. Future research should more thoroughly assess the ecological and socioeconomic impacts of wildlife use in the region.

Key words: wildlife; ethnozoology; subsistence hunting; neotropical wetlands; biodiversity management

Resumen

El presente estudio exploratorio se llevó a cabo en el Sistema de Humedales de Ayapel, parte de la Depresión Momposina en el Caribe colombiano. El objetivo principal fue evaluar el uso de la fauna silvestre por comunidades rurales, principalmente poblaciones campesinas, en el contexto de la gestión y conservación de la biodiversidad. Se empleó un enfoque de métodos mixtos, ampliamente utilizado en la investigación etnobiológica, que combinó 212 encuestas estructuradas, pruebas visuales de reconocimiento de especies, entrevistas y talleres participativos. Los resultados mostraron que la caza, una práctica con raíces ancestrales, se clasifica en caza de subsistencia, comercial y de control, con un total de 33 especies explotadas registradas: 15 aves, 14 mamíferos y 4 reptiles. La categoría de uso predominante fue la alimentación, seguida por el comercio y, en menor medida, la tenencia de animales como mascotas. La discusión destaca que, aunque la caza sigue siendo una fuente importante de proteína e ingresos para las comunidades locales, esta práctica, junto con factores como la deforestación y la contaminación ambiental, ejerce una considerable presión sobre las poblaciones de fauna silvestre. Estos hallazgos subrayan la necesidad de implementar estrategias de manejo integradas que incorporen el conocimiento tradicional y promuevan prácticas sostenibles para garantizar la conservación a largo plazo de este sistema de humedales crítico y de su biodiversidad. Se recomienda que futuras investigaciones evalúen con mayor profundidad los impactos ecológicos y socioeconómicos derivados del uso de la fauna silvestre en la región.

Palabras clave: vida silvestre; etnozoología; caza de subsistencia; humedales neotropicales; gestión de la biodiversidad.

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Introduction

In many regions around the world, rural communities have developed deep and enduring relationships with wildlife, using it for food, traditional medicine, and a variety of cultural and spiritual practices (Van Vliet *et al.,* 2018; Budjaj *et al.,* 2021; Asprilla-Perea and Romaña-Romaña, 2022). This ancestral knowledge has enabled these communities to adapt to their environments, but it has also placed increasing pressure on wildlife populations, particularly in ecologically fragile systems (König *et al.,* 2020). In tropical wetlands, which are characterized by high biodiversity and complex ecological dynamics, the use of faunal resources presents a dual challenge: conserving biodiversity while ensuring food security and sustaining human well-being. Understanding the interactions between local communities and wildlife is therefore essential for developing management strategies that reconcile conservation objectives with local socio-environmental needs.

The Ayapel Wetland Complex is an aquatic ecosystem that supports a wide diversity of fish, amphibians, birds, and mammals (Carrizoza, 2009). However, the intensive use of these faunal resources has resulted in overexploitation, a phenomenon that remains insufficiently studied in the region (Millennium Ecosystem Assessment, 2005; Duque-Quintero *et al.,* 2012). Unsustainable wildlife use, combined with inadequate agricultural practices, has accelerated biodiversity loss, particularly affecting species associated with aquatic habitats (Junk *et al.,* 2013; Villadiego-Lorduy *et al.,* 2022). In this context, research is urgently needed to elucidate the dynamics of wildlife use and to inform the design of management strategies aimed at mitigating the ecological impacts of human activities (Mitsch and Gosselink, 2007). This need becomes increasingly urgent when considering the crucial evolutionary and cultural roles that wild fauna have played in human societies (Santos-Fita *et al.,* 2012).

In tropical regions, recognised for their high biological diversity, rural and Indigenous communities have long relied on wildlife for multiple purposes, including food, medicine, tools, clothing, ornamentation, and religious or mythological practices (Gómez-Herrera *et al.,* 2023a; Milner-Gulland and Bennett, 2003; Van Vliet *et al.,* 2017). Historically, subsistence hunting has served as the main strategy for obtaining these resources, primarily to meet the basic needs of hunters and their families (Fa *et al.,* 2005; Ojasti, 2000).

The use of wildlife dates back to prehistoric times, as evidenced by cave paintings depicting hunting scenes (Alves and Van Vliet, 2018; Alves *et al.,* 2018). Today, hunting remains a key component of local economies, providing alternative sources of food and income (Lescuyer and Nasi, 2016). However, hunting is not solely driven by dietary needs; it also reflects a complex interplay of socioeconomic, cultural (religious, identity-related, medicinal, and folkloric), political, and ecological factors. Therefore, a comprehensive understanding of this socio-ecological system is essential for developing effective conservation and sustainable management strategies (Alves *et al.,* 2019).

In Colombia's Caribbean region, hunting primarily targets mammals, birds, and reptiles, raising significant concerns regarding its impact on local biodiversity (David-López *et al.,* 2016; Gómez-Herrera *et al.,* 2023a; Gómez-Herrera *et al.,* 2023b; Racero-Casarrubia *et al.,* 2014). In this context, urgent action is needed to implement management strategies that reconcile ecosystem conservation with the well-being of local communities. Achieving this balance requires a thorough understanding of human–wildlife interactions that integrates the sociocultural dynamics of each territory (Robinson *et al.,* 2022).

Accordingly, the objective of this study was to identify the wild species hunted by local communities surrounding the Ayapel Wetland Complex, documenting their uses, capture methods, hunting motivations, and community perceptions. The research was guided by the following hypotheses: (1) The sociodemographic characteristics of hunters influence the number of species and individuals hunted; (2) The frequency and type of traditional uses of wildlife vary among localities; and (3) The tools used for hunting affect the diversity of species captured.

Materials and methods

Study Area

The Ayapel Wetland System is located in the lowlands of the Colombian Caribbean, in the southwestern sector of the Momposina Depression, northern Colombia. This wetland ecosystem, covering approximately 55,000 ha, has been designated a Ramsar site due to its ecological and socioeconomic importance. Owing to its geomorphological and hydrological characteristics, it is closely associated with the La Mojana subregion (08°19'15"N, 75°03'02"W; Figure 1).

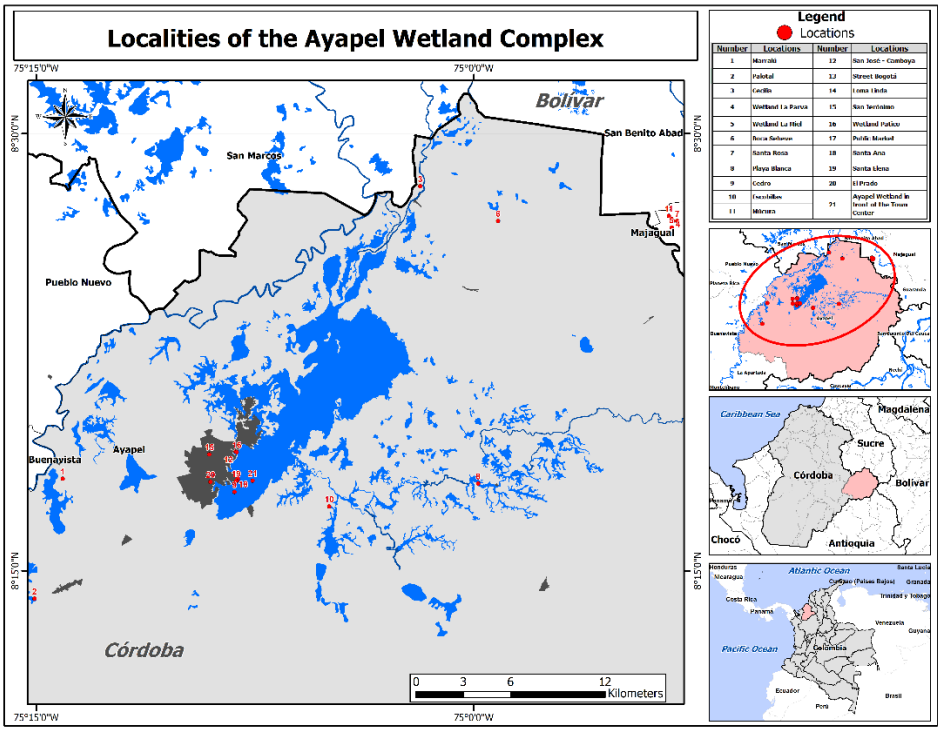

Figure 1. Geographic location of the study area and sampling sites within the Ayapel Wetland Complex, Córdoba Department, Colombia.

Methods

The study was conducted between February 2007 and July 2009 using a non-probabilistic snowball sampling approach (Albuquerque *et al.,* 2014). To identify key hunters in each locality, initial visits were made to the Ayapel Municipal Government and the local police station. These first contacts facilitated the identification of individuals socially recognised as expert hunters who regularly obtained wildlife resources using firearms, traps, and trained dogs for food or other purposes.

From these initial interviews, additional hunters were recommended, allowing a progressive expansion of the sample until representative coverage was achieved. Prior to data collection, the research objectives, methodology, and scope were explained to each participant, and informed consent was obtained to ensure voluntary participation in surveys and participatory workshops.

Data on hunting practices and wildlife use were collected through structured surveys, open-ended interviews, and participatory workshops (Annex 1). Surveys included questions on the hunters' sociodemographic profiles (age, sex, education level, and place of residence), hunting motivations, animal uses, capture frequency by species, tools used, and perceptions regarding wildlife use and conservation.

For species identification, a visual recognition test was implemented using high-resolution photographs of reptiles, birds, and mammals occurring in the region. Participants were asked to identify each species by its common name and indicate whether it was still present in the area. The identification process was supported by the authors' expertise in the wildlife of the Córdoba Department.

As the study involved local communities, it complied with the ethical standards established by the International Society of Ethnobiology's Code of Ethics. For the taxonomic identification of species with utilitarian use, the following references were used: the Reptile Database for reptiles, Restall (2006) for birds, and the Mammal Diversity Database (2023) for mammals.

The information collected was analysed both qualitatively and quantitatively, integrating different analytical approaches following the framework proposed by Marques (1991). Identified species were categorised by use (food, pets, trade, and recreation), and hunting motivations and perceptions were evaluated. For the age variable, hunters were grouped into three age ranges: young (18–30 years), adult (31–60 years), and older adults (≥ 60 years). The data were organised in a structured Microsoft Excel database.

To test for statistically significant differences in the number of

species and individuals hunted among the three age groups, normality and homoscedasticity were assessed using the Shapiro–Wilk and Levene tests, respectively. Since the variables did not meet these assumptions, the non-parametric Kruskal–Wallis test was applied. To test the hypothesis that the frequency of wildlife use varies among the studied localities, normality and homoscedasticity were again assessed. When assumptions were not met, the Kruskal–Wallis test was again applied. When significant differences were found, a post hoc Dunn test with Bonferroni correction was used.

Additionally, a PERMANOVA (Permutational Multivariate Analysis of Variance; Anderson, 2001) was conducted to evaluate significant differences in species composition based on the types of hunting tools used. All statistical analyses were performed using RStudio 4.4.2 (Posit, 2024), employing the packages vegan (Oksanen *et al.,* 2022), ggplot2 (Wickham, 2016), ggstatsplot (Patil, 2021), and tidyverse (Wickham *et al.,* 2019). A significance level of $p < 0.05$ was used for all tests), and tidyverse (Wickham *et al.,* 2019), with $p < 0.05$ considered statistically significant.

Results

A total of 209 hunters from ten localities surrounding the Ayapel Wetland participated in the study. Most respondents were men (n = 201; 96 %), whereas only eight participants were women (4 %). Among respondents, 89 % reported having no formal education, 5 % had completed primary education, and 6 % had attended secondary school. Hunter participation varied among localities: the urban centre (CU = 77), Marralú (Ma = 28), and Las Escobillas (Es = 22) recorded the highest numbers of participants, whereas Múcura (Mu = 2) and Santa Rosa (SR = 2) had the lowest (Figure 2a). Participants were classified into three age groups: adults (n = 134), youth (n = 39), and older adults (n = 36) (Figure 2b).

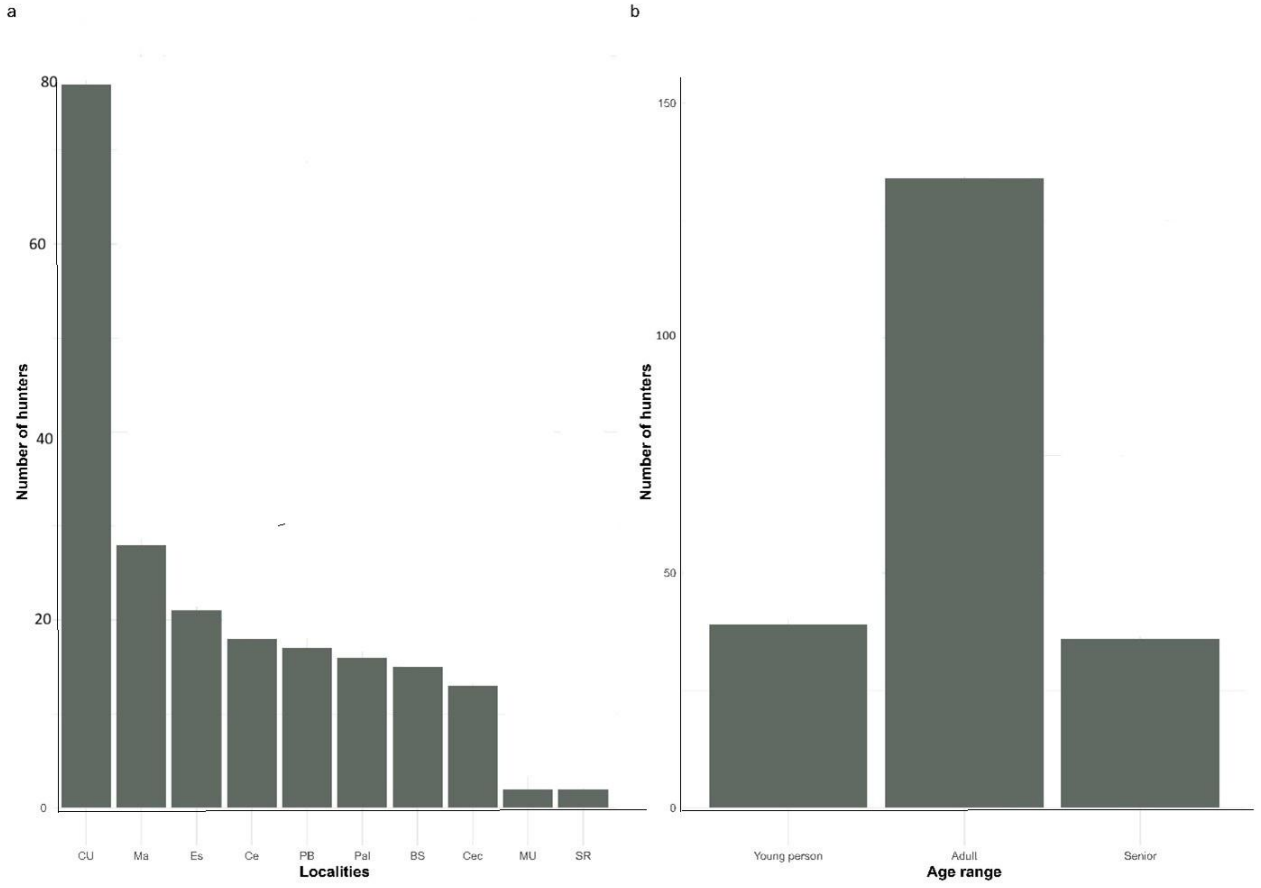

Figure 2. Distribution of surveyed hunters by locality and age group. a) Number of participants per locality evaluated in the study area. b) Classification of surveyed hunters into three age groups: youth (18–30 years), adults (31–60 years), and older adults (60 years and over).

Regarding hunting motivation, 41 % of hunters reported practicing commercial hunting. Subsistence hunting was equally frequent (41 %). A portion of the meat from animals hunted for food was also sold, providing supplementary income to cover basic household needs (17 %).

A small number of participants (1 %) engaged in control hunting, targeting species perceived as threats to humans or domestic animals. Despite the prevalence of hunting, hunters believe that the decline of wildlife in the Ayapel Swamp is not solely due to hunting, but also to other environmental and anthropogenic factors affecting its populations, including deforestation and pollution.

Four categories of use were recorded involving 30 species of wildlife (14 mammals, 12 birds, and 4 reptiles; Table 1). The primary use reported was food consumption, with a distribution of 42 % for reptiles, 33 % for mammals, and 25 % for birds. Commercial hunting was the second most frequent use (43 % in reptiles, 33 % in mammals, and 24 % in birds). The third type of use was as pets, which was more common for mammals (43 %), followed by reptiles (30 %) and birds (27 %).

Table 1. Species and use categories of wildlife used by local inhabitants of the Ayapel wetland complex in the department of Córdoba, Colombia. F (food), T (trade), P (pet), R (recreation).

Species Of Wildlife	**Common Name**	**Use Category***			
		F	T	P	R
Anas discors Linnaeus, 1766	Barraquete	■	■	■	■
Anas platyrhynchos Linnaeus, 1758	Pato real	■	■		
Brotogeris jugularis Statius Muller, 1776	Perico	■	■	■	
Cairina moschata Linnaeus, 1758	Pato silvestre	■	■	■	
Chauna chavaria Linnaeus, 1766	Chavarrí	■	■		
Crax alberti Fraser, 1852	Paujil	■	■		
Dendrocygna autumnalis Linnaeus, 1758	Pisingo	■	■	■	■
Eupsittula pertinax Linnaeus, 1758	Cotorracarisucia		■	■	
Mycteria americana Linnaeus, 1758	Collongo	■			
Ortalis garrula Humboldt, 1805	Guacharaca	■	■	■	
Penelope purpurascens Wagler, 1830	Pava congona	■	■	■	
Phalacrocorax brasilianus Humboldt, 1805	Pato yuyo	■	■	■	
Bradypus variegatus Schinz, 1825	Perezoso	■	■		
Coendou sp. Thomas, 1899	Puercoespín	■	■		
Cuniculus paca (Linnaeus, 1766)	Guartinaja	■	■	■	
Dasyprocta punctata (Gray, 1842)	Ñeque	■	■	■	
Dasypus novemcinctus (Linnaeus, 1758)	Armadillo	■	■	■	
Hydrochoerus hydrochaeris isthmius (Linnaeus, 1766)	Chiguiro	■	■	■	
Lontra longicaudis (Olfers, 1818)	Nutria	■	■		
Notosciurus granatensis von Humboldt and Bonpland, 1811	Ardilla	■	■	■	
Odocoileus virginianus (ODE von Zimmermann, 1780)	Venado	■	■		
Panthera onca (Linnaeus, 1758)	Tigre		■		
Pecari tajacu (Linnaeus, 1758)	Saíno	■	■		
Saguinus oedipus (Linnaeus, 1758)	Mico tití		■	■	
Sylvilagus brasiliensis (Linnaeus, 1758)	Conejo	■	■	■	
Trichechus manatus manatus Linneo, 1758	Manatí	■			
Boa constrictor Linnaeus, 1758	Boa		■	■	
Caiman c. fuscus (Cope, 1868)	Babilla	■	■		
Trachemys callirostris (Gray, 1856)	Hicotea	■	■		
Iguana iguana (Linnaeus, 1758)	Iguana	■	■		

Across all localities, the most frequent use of wildlife was for food, followed by trade. The highest frequencies of consumption were recorded in Cecilia and the Urban Center, while Múcura and Santa Rosa had the lowest. In terms of wildlife used for trade, the Urban Center, Las Escobillas, Marralú, and Boca Seheve showed the highest values. Pet use was reported in only three localities (Boca Seheve, Las Escobillas, and the Urban Center), all with low frequency, while recreational use was observed only in Cedros and the Urban Center (Figure 3). The overall frequency of wildlife use was consistent across localities, with no significant differences ($H = 8.4492$; $df = 12$; $p = 0.7491$). However, the frequency of use varied significantly among use categories ($H = 32.318$; $df = 3$; $p < 0.05$). A Dunn post hoc test with Bonferroni correction confirmed that all pairwise comparisons between use categories were statistically significant ($p.adj < 0.05$).

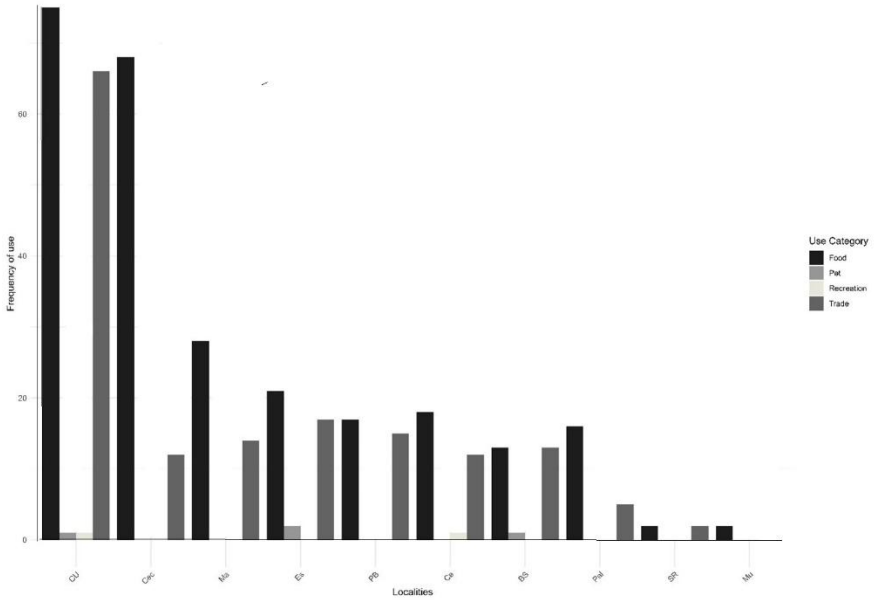

Figure 3. Frequency of wildlife use in each locality adjacent to the Ayapel Wetland Complex, Córdoba Department, Colombia.

Across the 10 evaluated localities in Ayapel, a total of 32.682 wild terrestrial vertebrates were reported hunted, distributed across 31 species. Among reptiles, *Trachemys callirostris* (n = 9,567; 29%) and *Caiman crocodilus fuscus* (n = 6,093; 18%) had the highest hunting frequencies. For mammals, *Hydrochoerus hydrochaeris isthmius* (n = 3,896; 11%) was the most hunted species (figure 4). Among birds, *Dendrocygna autumnalis* (n = 5,352; 16%) showed the highest frequency.

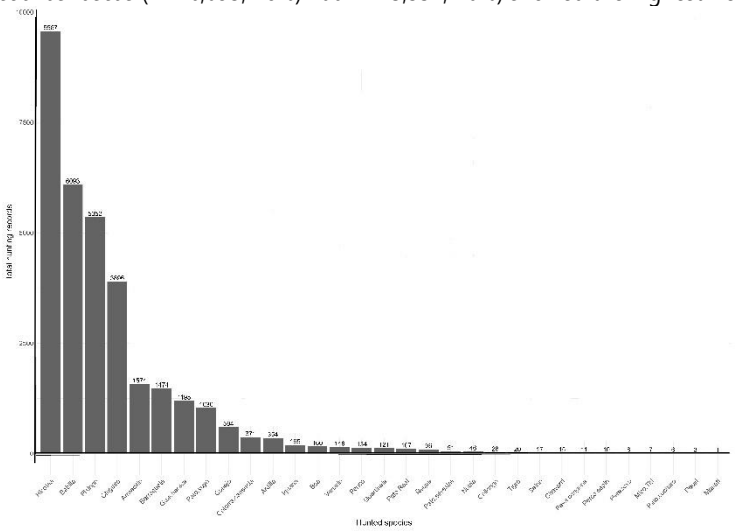

Figure 4. Total hunting record frequency for each species reported by hunters in Ayapel Wetland Complex, Córdoba Department, Colombia.

Comparing the number of species hunted across age groups, no significant differences were found (H = 1.6678; df = 2; p = 0.4343), indicating similar hunting diversity across age categories (figure 5). In terms of the number of individuals hunted, young hunters (median = 120) captured more animals compared to adults (median = 77.5) and older adults (median = 52.5), although this difference was not statistically significant (H = 4.6908; df = 2; p = 0.10) (figure 6).

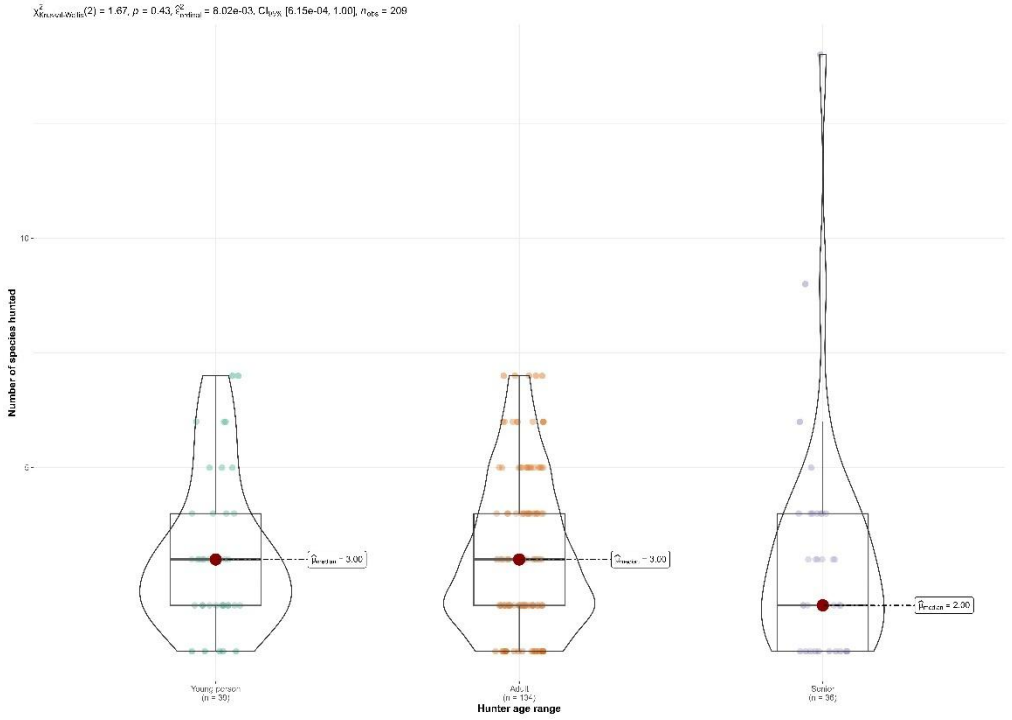

Figure 5. Comparison of the number of species hunted by age group in rural communities of the Ayapel Wetland, Colombia.

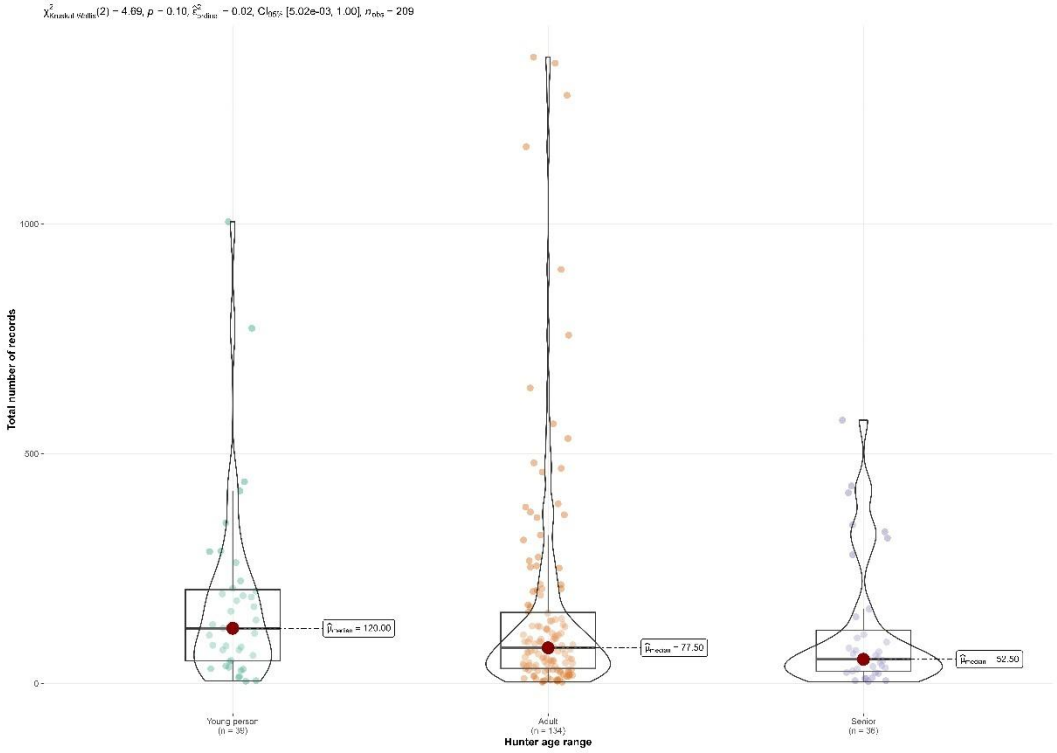

Figure 6. Comparison of total wildlife hunting records by age group in rural communities of the Ayapel Wetland, Colombia.

Respondents reported 19 tools or methods used in hunting, with shotguns, harpoons, spears, and dogs being the most common (Figura 7). Experienced hunters employed a wide array of tools for capturing *T. callirostris*, including dogs, cast nets, hooks, spears, gillnets, seines, and harpoons. A PERMANOVA analysis revealed no statistically significant differences in species composition based on hunting tools used (R^2 = 0.95694; F = 1.3074; p = 0.227).

Discussion

The results of this study reveal the complex interrelationship between hunting practices and wildlife use by rural and urban communities associated with the Ayapel Wetland Complex. These practices, deeply rooted in ancestral traditions, are driven not only by food and economic needs but also by cultural and social factors. The diversity of species exploited and the different hunting modalities identified, from subsistence and commercial to control hunting, highlight the multifunctional role of wildlife in the daily lives of local inhabitants. These findings pose relevant challenges for sustainability and natural resource management, which must be addressed through integrative strategies that balance biodiversity conservation with community well-being.

Mammals were the most frequently mentioned taxon in this study, followed by birds and reptiles, a pattern also reported by Racero-Casarrubia *et al.* (2008) and Chacón and López (2017) in rural areas of Córdoba. The variety of uses assigned to wildlife reflects the breadth of human–faunal interactions in the region. Regarding species distribution by use category, four types were identified: food, trade, pets, and recreation. Reptiles and mammals were the most exploited for food and commercial purposes, while mammals and birds dominated pet use. The food category included the highest number of cited species, consistent with findings in the literature (David-López *et al.,* 2016; Racero-Casarrubia and Ballesteros-Correa, 2019; Gómez Herrera *et al.,* 2023a).

The consumption of mammal and reptile meat is a well-documented pattern in the Caribbean region (De la Ossa and De la Ossa-Locayo, 2011; Gómez *et al.,* 2016c; Tinoco-Sotomayor *et al.,* 2021; Gómez Herrera *et al.,* 2023b). Mammals are the most consumed group due to their larger body mass and higher protein content (Osorno *et al.,* 2014; Hernández-Coronado, 2018). In turn, preferences for reptile meat, particularly species from the families Emydidae (aquatic turtles) and Alligatoridae (caimans), reflect their importance in the local food culture. They are considered essential sources of protein for both rural and urban populations of the Caribbean region. In addition to their nutritional value, factors such as abundance, resource availability, and ease of capture are key for year-round sustainable use (De la Ossa and De la Ossa-Lacayo, 2011; De la Ossa-Locayo and De la Ossa, 2012).

Wild animals also represent an important source of income for many rural and Indigenous communities worldwide (Fa *et al.,* 2022). This is evident in the Ayapel region, where there is high commercial demand for reptile and mammal meat. Gómez-Herrera *et al.* (2023b) found that *T. callirostris* and *H. h. isthmius* are among the most commercialized species in urban markets of central Magdalena. Similarly, David-López *et al.* (2016) reported that *H. h. isthmius* is preferred in both rural and urban areas of Ayapel. Although bird species represent a smaller portion of the meat trade, many species from the families Anatidae (ducks), Phalacrocoracidae (cormorants), and Columbidae (pigeons) are also hunted and sold in the Caribbean and other parts of Colombia (Gómez-Herrera *et al.,* 2023b; Quiceno-M *et al.,* 2015).

During hunting activities for food and trade, some mammals and birds are captured alive and kept as pets. This practice, driven by sociocultural and economic factors, is widespread in Colombia. Despite being illegal, mammal pet ownership had already been reported in Ayapel (David-López *et al.,* 2017). Keeping wildlife as pets' places additional pressure on natural populations (Osbahr and Morales, 2017). However, in this study only *H. h. isthmius* was reported for this purpose, contrasting with other research where primates were the most commonly kept wild pets (Salcedo-Rivera *et al.,* 2018).

Globally, reptiles are among the most popular exotic pets, fueling their demand in international markets (Bush *et al.,* 2014; Alves *et al.,* 2019). In Ayapel and surrounding areas, reptiles such as *T. callirostris* and *C. c. fuscus* are also important companion animals. This differs from other Caribbean regions where the red-footed tortoise (Chelonoidis carbonarius) is the most commonly kept reptile (Gómez-Herrera *et al.,* 2023a). While T. callirostris is widely consumed and traded nationally, *C. c. fuscus* is valued for artisanal and ornamental uses. However, its presence in homes appears to be transitional and often ends in its consumption.

Shotguns were the most frequently cited tool used in hunting,

playing a central role in both subsistence hunting and control hunting. This pattern has been documented in other regions of Colombia (Díaz and Moreno, 2003; Garrido-Serrano *et al.,* 2010; Martínez-Salas *et al.,* 2015). It is important to note that these tools are not species-specific, as the same instrument may be used to hunt multiple species.

Overall, the results support the hypothesis that hunting and wildlife use hold significant cultural and economic importance for local communities, as ancestral practices that provide food and income at both local and regional levels (Jones and Johnson, 2016). However, this study also reveals the significant negative impacts of hunting on wildlife populations in the Ayapel wetland complex, raising concerns about overexploitation and biodiversity loss. These findings are consistent with previous research showing species declines due to hunting pressure (Brown and White, 2017), which, in combination with deforestation and pollution, exacerbate threats to natural populations (Senhadji *et al.,* 2017).

The demographic analysis, particularly the age ranges of hunters, suggests a strong link to sociocultural factors. Socioeconomic profiles influence hunting patterns and wildlife use (Heberlein *et al.,* 2002). Ethnozoological studies argue that the hunter's profile can affect both hunting success and the number of individuals captured (Nunes *et al.,* 2020). Although no significant differences in the number of species hunted across age groups were found in this study, previous literature indicates that age can be a significant factor when correlated with hunting diversity (Souza *et al.,* 2022). Likewise, differences in the number of individuals hunted were not statistically significant; however, young hunters were the most active, which may relate to greater physical capacity and time availability, especially in areas with limited employment and educational opportunities (García, 2017; Smith, 2018; Jones and Brown, 2020). Moreover, the intergenerational transmission of traditional hunting knowledge contributes to the involvement of younger individuals, who may view hunting as both a necessity and a cultural practice (Kit *et al.,* 2023).

Conclusions

The use of wildlife in the Ayapel Wetland Complex is an ancestral practice of deep cultural, social, and economic relevance for both rural and urban communities in the region. The findings show that while hunting fulfills basic food needs and supports local economies through the commercialization of wildlife products, this activity, combined with deforestation and environmental pollution, exerts substantial pressure on wild populations.

Hunting allows human communities direct access to faunal resources; however, socioeconomic factors such as age significantly influence harvesting patterns. The higher participation of younger hunters appears to be related to regional circumstances, including limited job opportunities, low educational coverage, and the intergenerational transmission of traditional practices.

Mammals, birds, and reptiles are exploited for multiple purposes (food, trade, pets, and recreation) underscoring the multifunctional role of wildlife in the territory. In this context, it is essential to design and implement integrative management and conservation strategies that reconcile biodiversity preservation with the sustainability of traditional livelihoods in Colombians Caribbean region. These strategies should incorporate local ecological knowledge, promote responsible use practices, and strengthen existing regulatory and institutional frameworks.

Finally, future research is needed to deepen the understanding of the ecological and socioeconomic impacts of hunting, in order to inform evidence-based conservation actions and ensure the long-term preservation of biodiversity in this strategic ecosystem.

Conflict of interest

The authors declare that they have no conflict of interest.

Author contributions

Jesús Ballesteros-Correa, Ramiro A. Gómez-Herrera, Adriana M Luna Hoyos, Shirley A. Arroyo Salgado y Javier Racero-Casarrubia: performed the experiments, analyzed the data and wrote this manuscript.

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