

INDIVIDUAL CHARACTERISTICS AND HUNTING PRACTICES ASSOCIATED WITH HUNTING PARTICIPATION IN SPAIN

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Abstract: The decline in the number of hunters may affect wildlife management, while overabundant game populations pose challenges for human activities and ecosystems. In this context, understanding hunter recruitment and retention is increasingly relevant. We used a survey to examine how individual characteristics and hunting-related practices associate with hunting participation in Spain. Hunting interest in game species varied by sex, age and hunting type, being higher in women, declining with age, and generally higher for big game. Sex differences were bigger for big game, and age-related declines were more pronounced for big than for small game. The probability that the father was the first hunting companion decreased with age and was higher in women, while dog use declined with age and showed no sex differences. These findings provide insights for context-specific and socially informed approaches to hunter recruitment and retention strategies.

Keywords: age, dog, game species, first hunting companion, hunter recruitment, hunter retention, sex, survey

Highlights

- Interest in game species was higher in women, declined with age, and was greater for big game.
 - Fathers were more often the first hunting companion, especially among women.
 - Dog use declined with age and did not differ between sexes.
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1. Introduction

The number of hunters has declined in many European and North American countries in recent decades (Gaspar et al., 2025; Massey et al., 2015; Winkler & Warnke, 2013). This trend has important economic implications, including reduced spending, fewer jobs, and lower income in rural areas that depend on hunting-related activities (Arnett & Southwick, 2015; Di Minin et al., 2021; Santos et al., 2016). The decline in hunting participation may also have sociocultural consequences, given that hunting remains an important social and cultural practice in many countries (Larson et al., 2014; McCorquodale, 1997; Sánchez-García et al., 2021). These consequences may be less pronounced in Central European countries, where hunting has historically been linked to aristocratic management systems (Knoll, 2004). Regarding its ecological implications, hunting may contribute to conservation outcomes in some managed systems (Di Minin et al., 2021; Heffelfinger et al., 2013); however, studies report inconsistent results, limited causal evidence, and potential risks to species and ecosystems (Ripple et al., 2016). Therefore, the ecological consequences of declining hunter numbers are context-

dependent and may be negative under certain ecological and management conditions (Di Minin et al., 2021).

Beyond these aspects, the declining number of hunters poses a major challenge for wildlife management, particularly regarding overabundant populations. Overabundance of wildlife negatively affects human welfare and economic activities, can impact the conservation of communities and ecosystems, and may compromise the health and survival of the overabundant species itself (Caughley, 1981). Small game species, such as the European rabbit (*Oryctolagus cuniculus*), can reach high local densities, posing significant threats to biodiversity and agriculture (Barrio et al., 2010; Cooke, 2012; Ríos-Saldaña et al., 2013). Similarly, ungulates such as wild boar (*Sus scrofa*) and deer (Cervidae) often reach high densities (Carpio et al., 2021; Valente et al., 2020; Warren, 2011) that cause issues related to the spread of infectious diseases (Martin et al., 2011; Rochlin et al., 2025), vehicle collisions (Colino-Rabanal et al., 2018; Zuberogoitia et al., 2014), crop damage (Bleier et al., 2017; Haney & Conover, 2013), and biodiversity loss (Bressette et al., 2012; Risch et al., 2021). Then the decline in the number of hunters poses a major threat to wildlife management, as recreational hunting is considered an effective tool for controlling population overabundance (Gortázar & Fernandez-de-Simon, 2022; Quirós-Fernández et al., 2017). Consequently, maintaining adequate levels of hunting activity may be an important component of management strategies in systems where hunting contributes to population control. In this context, although hunter recruitment may vary across countries (Hansen et al., 2012; Ryan & Shaw, 2011), examining the attitudes and factors associated with hunting participation might help identify key elements of strategies aimed at enhancing hunter recruitment (Vayer et al., 2021).

In Spain, hunting is a widely practiced activity with significant socioeconomic impact (Pérez-González et al., 2023; Sánchez-García et al., 2021). While several small-game species have declined, big-game populations have increased, reaching high densities in some areas. Hunting and game management have been proposed as tools for biodiversity conservation and for controlling overabundant species in Spain (Gortázar & Fernandez-de-Simon, 2022; Hidalgo de Trucios & Rengifo, 2020; Linares et al., 2024). However, as in other European countries, the number of hunting licenses has decreased in the past decades (Gallego et al., 2024; Gaspar et al., 2025; Massey et al., 2015; Pérez-González et al., 2023). Developing strategies to recruit and retain hunters may therefore support wildlife management and help address challenges associated with overabundant populations (Gortázar & Fernandez-de-Simon, 2022; Ríos-Saldaña et al., 2013).

In this study, we conducted a survey to investigate attitudes and factors associated with hunting participation among hunters in Spain, considering individual characteristics and hunting-related practices. Examining these factors may help inform strategies to improve hunter recruitment and retention and may be relevant to other European countries.

2. Theoretical background

Hunter recruitment and retention have become key topics amid declining hunting participation (Price Tack et al., 2018; Ringelman et al., 2020; Schummer et al., 2020). A growing body of research has examined hunters' attitudes, interests, and socioeconomic characteristics to identify factors that may inform strategies to sustain hunting activity (Hansson-Forman et al., 2020; Kupren & Hakuć-Błażowska, 2021; Legarth et al., 2025; Ryan & Shaw, 2011). These studies highlight that hunting participation is shaped by socially structured factors operating at multiple levels, including individual motivations, family traditions, community contexts, and broader societal influences (Larson et al., 2014).

With this framework, early socialization and mentorship play a central role in shaping hunting engagement. Traditional recruitment pathways, in which experienced hunters introduce relatives or close social contacts to hunting, have been identified as a primary mechanism for recruiting and retaining new hunters (Ryan & Shaw, 2011). Family members – especially fathers – are often key figures in the transmission of hunting knowledge, skills, and values across generations (Langenau & Mellon, 1980).

Sex and age are key dimensions shaping hunting participation. The proportion of women involved in hunting has increased in recent decades (Gallego et al., 2024; Heberlein et al., 2008), highlighting the need to consider gender-specific dynamics. Importantly, differences between women and men are not only demographic but are also influenced by the social and cultural context of hunting. Hunting has traditionally been a male-dominated activity, and women's participation may be shaped by gender norms, access to social networks, and structural barriers within hunting cultures (Pérez-González et al., 2023; Tickle et al., 2024). In addition, age and generational differences are important drivers of hunting participation, as younger hunters may exhibit distinct motivations, preferences, and engagement patterns compared to older hunters, reflecting broader social and cultural changes (Vayer et al., 2021). Understanding differences associated with sex and age can be important for identifying potential barriers and opportunities for recruitment and retention strategies.

In addition to these traditional factors, recent societal trends may also influence hunting participation. For example, the increasing prevalence of dog ownership and the strengthening of human-animal bonds (Payne et al., 2015) may contribute to engagement in hunting practices where the use of dogs is central. Considering both traditional and emerging factors may therefore provide a more comprehensive understanding of hunting participation and inform more effective and context-sensitive recruitment strategies.

Previous research shows that species-specific interests are associated with motivation in hunting satisfaction, perceived success, and participation patterns, suggesting that recruitment and retention processes may depend on the relationship between hunters' expectation and the opportunities available (McGowan et al., 2023). In this context, interest in particular species can serve as an indicator of distinct engagement pathways, reflecting differences in motivations such as social experience, skill development, or harvest orientation (Kaminski et al., 2024).

Consequently, considering species-specific interests may help identify more targeted and effective approaches to understanding and supporting participation in hunting.

Hunter recruitment, wildlife management needs, and broader social legitimacy are related but conceptually distinct. While recruitment and retention strategies aim to maintain or increase the number of active hunters, wildlife management focuses on ecological outcomes such as population control and biodiversity conservation. However, these objectives are not necessarily aligned. For example, controlling overabundant species does not automatically imply that increasing the number of hunters is the only and most socially accepted solution. Public attitudes towards wildlife management and hunting can differ across social groups and contexts (Carpio et al., 2026; Alba-Patiño et al., 2025), meaning that support for population control may coexist with limited acceptance of hunting. Therefore, participation in hunting should be understood within a broader social framework, in which legitimacy and public acceptance are key considerations.

3. Methodology

3.1 Data collection

The data used in this study were obtained from a survey conducted in Spain and agreed upon by the research team. With the aim of achieving a significant sample size and ensuring the participation of people from all 17 autonomous communities and 50 provinces in Spain, the survey was distributed via the Spanish Hunting Federation, an organization comprising the 17 regional federations, under the coordination of the Fundación Artemisan, a non-profit organization dedicated to promoting the conservation of wildlife and the rural environment through scientific research. The survey was conducted digitally and self-administered. It was distributed once to hunters via email and social networks, reaching 11,536 hunters and resulting in a 14.4% response rate. The data collection period ran from October 2021 to August 2022. This extended timeframe was necessary to obtain a sufficiently large sample size, ensuring adequate representation across all combinations of sex and age categories and broad geographic coverage across Spain. The survey included the following questions (see Table S1 in Supplementary Material):

Question 1 (sex). Only surveys in which hunters identified as either woman or man were included in the analyses.

Question 2 (age). Seven categories were established: under 21, 21–30, 31–40, 41–50, 51–60, 61–70, and over 70. For the analyses, these categories were treated as an ordinal variable and coded numerically from 1 (under 21 years) to 7 (over 70 years), with higher values indicating older age.

Questions 3 to 7 (interest in big game hunting by species). The survey assessed hunters' interest in game species using a scale from 0 (very low interest) to 5 (very high interest). Participants were asked about their interest in game species that are most popular in Spain (Pérez-González et al.,

2023). In big game, we included wild boar, red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), fallow deer (*Dama dama*), and mouflon (*Ovis aries musimon*).

Questions 8 to 11 (interest in small game hunting by species). As for big game species, the analyses included the red-legged partridge, the European rabbit, the Iberian hare (*Lepus granatensis*), and pigeons (Columbidae).

Question 12 (first hunting companion). Hunters were asked about the person or people with whom they first hunted (first hunting companion, FHC). In this case, hunters were allowed to choose one or more FHC, as they could be accompanied by a group of people rather than just one person on their first day of hunting. As the father was the most frequently mentioned person serving as a hunting mentor in our sample (see below), we constructed a dichotomous variable with 0 indicating the father was not the FHC and 1 indicating the father was the FHC.

Question 13 (the use of dogs in hunting). We recorded whether the surveyed hunters typically hunted with dogs (0: No, 1: Yes).

3.2 Statistical analysis

Interests in hunting big and small game species were correlated (Table S2 in Supplementary Material). Therefore, we conducted two Principal Component Analyses (PCAs) to summarise patterns of hunting interest: one using the 5 variables for interest in big-game species and the other using the 4 variables for interest in small-game species. Principal components (PCs) with eigenvalues greater than 1 were selected based on the Kaiser-Guttman criterion (Figure S1 in Supplementary Material). According to this criterion, we selected the first PC for both PCAs (Pérez-González et al., 2023). The scores for these PCs were used to represent hunters' interest in hunting both big and small game species. Factors associated with hunting interest were analysed using a linear model, with interest in hunting game species as the dependent variable, and sex (women vs. men), age (1–7), and type of hunting (big vs. small hunting) as explanatory variables. Initially, all double interactions and the triple interaction were included, but the model was simplified using a backward stepwise procedure to minimize the Akaike information criterion.

Factors associated with the likelihood that the father was the FHC were analysed with a generalized linear model (GLM) with a binomial distribution. In this model, the response variable was a binary indicator of whether the father acted as the FHC, and sex (women vs. men), age (1–7), and their interaction were included as explanatory variables. Similarly, we analysed factors associated with the likelihood of hunting with dogs using a GLM with a binomial distribution. This GLM was the same as the previous one, except that the dichotomous variable indicating whether hunters use dogs was used as the dependent variable. Although the interaction term was initially included in the model, it was removed because it did not have a significant effect.

The analyses were conducted using R software (R Core Team, 2024). GLMs were performed with the 'nlme' package (Pinheiro et al., 2017) in R.

4. Results

The survey collected responses from 1,662 hunters (328 women and 1,334 men). The 21–30 age class was the most frequent category (Figure S2 in Supplementary Material). The most common FHC was the father (66.61% of hunters), followed by the uncle/cousin (29.29%), the grandfather (25.72%), and the friend (22.95%). All other categories accounted for less than 8% of respondents. In our survey, 81.05% of hunters typically hunted with dogs.

Hunters' interest in game species (scores of the PCA summarizing interest in different game species) was significantly influenced by sex, age, and hunting type (Table 1). Overall, interest was lower in men than in women and decreased with age. Interest was also lower for small game species than for big game species. However, the interaction between sex and hunting type indicated that differences between men and women were more pronounced for big-game species than for small-game species (Table 1, Figure 1). In addition, the interaction between age and hunting type showed that interest in big game species was higher among younger hunters and declined more markedly with age, whereas interest in small game species showed a weaker age-related decline (Table 1, Figure 1). The distribution of observed values also suggests differences in variability, with higher maximum values for big-game species and lower minimum values for small-game species.

Table 1. Results of the linear model with hunters' interest as the dependent variable and sex (women vs. men), age (ordinal, 1–7), and hunting (big game vs. small game species) as explanatory variables. The table also shows the interactions that remained significant after the backward stepwise procedure. In the model, women were used as a reference for the sex factor, and big game species as a reference for hunting. Source: own elaboration

	Estimate	Standard error	t value	p value
Intercept	1.366	0.118	11.580	< 0.001
Sex (men)	-0.329	0.109	-3.029	0.002
Age	-0.317	0.003	-10.973	< 0.001
Hunting type (small)	-1.090	0.167	-6.533	< 0.001
Sex (men) * hunting type (small)	0.594	0.154	3.866	< 0.001
Age * hunting type (small)	0.177	0.041	4.318	< 0.001

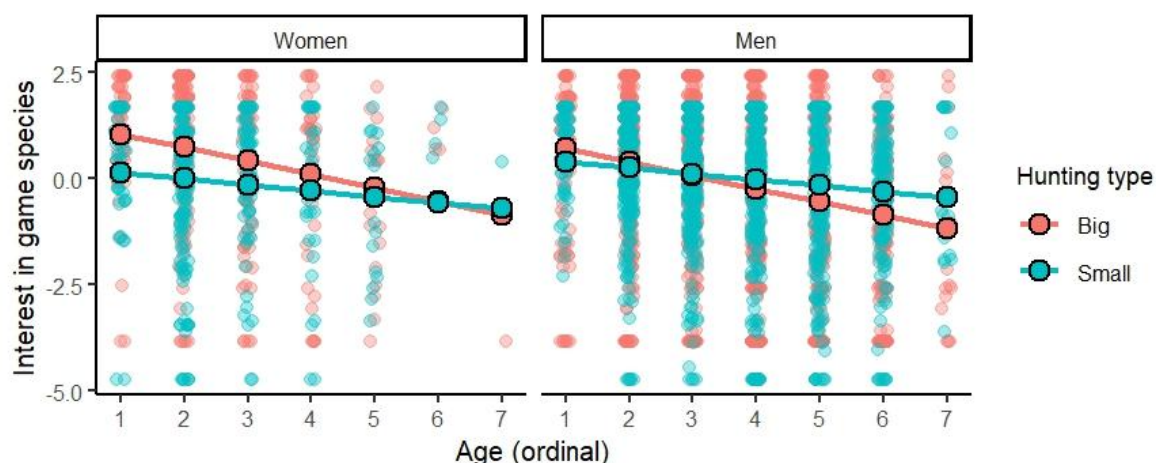


Figure 1. Hunters' interest in game species according to sex (women vs. men), age (ordinal, 1–7), and hunting type (big vs. small game species). Points represent observed values, and lines represent predicted values from the model described in Table 1. Source: own elaboration

The probability that the father was the FHC was significantly influenced by sex, age, and their interaction (Table 2, Figure 2). Overall, this probability decreased with age and was lower in men than in women. However, the interaction between sex and age indicated that the age-related decline was steeper in women than in men.

Table 2. Results of the generalized linear model as the proportion of hunters whose fathers acted as their first hunting companion (FHC) as the dependent variable, and sex (women vs. men), age (ordinal, 1–7), and the interaction of both as explanatory variables. In the model, women were used as a reference for sex. Source: own elaboration

	Estimate	Standard error	z value	p value
Intercept	2.399	0.335	7.161	< 0.001
Sex (men)	-1.352	0.371	-3.648	< 0.001
Age	-0.582	0.113	-5.132	< 0.001
Sex (men) * age	0.476	0.120	3.969	< 0.001

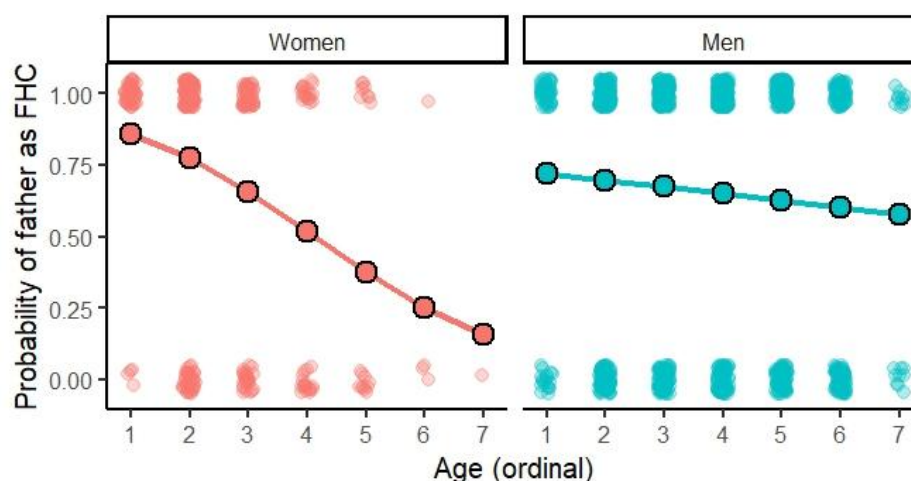


Figure 2. Probability that the father was the first hunting companion FHC, according to sex (women vs. men) and age (ordinal, 1–7). Points represent observed values (0: the father was not the FHC, 1: the father was the FHC), and lines represent predicted values from the model described in Table 2. Source: own elaboration

The probability of hunting with dogs was significantly affected by age but not by sex (Table 3). Overall, this probability decreased with age, whereas no significant differences were observed between women and men (Table 3, Figure 3).

Table 3. Results of the generalized linear model as the proportion of hunters that typically hunt with dogs as the dependent variable, and sex (women vs. men), and age (ordinal 1–7) as explanatory variables. In the model, women were used as reference for sex. Source: own elaboration

	Estimate	Standard error	z value	p value
Intercept	2.185	0.194	11.279	< 0.001
Sex (men)	-0.065	0.177	-0.366	0.714
Age	-0.189	0.044	-4.276	< 0.001

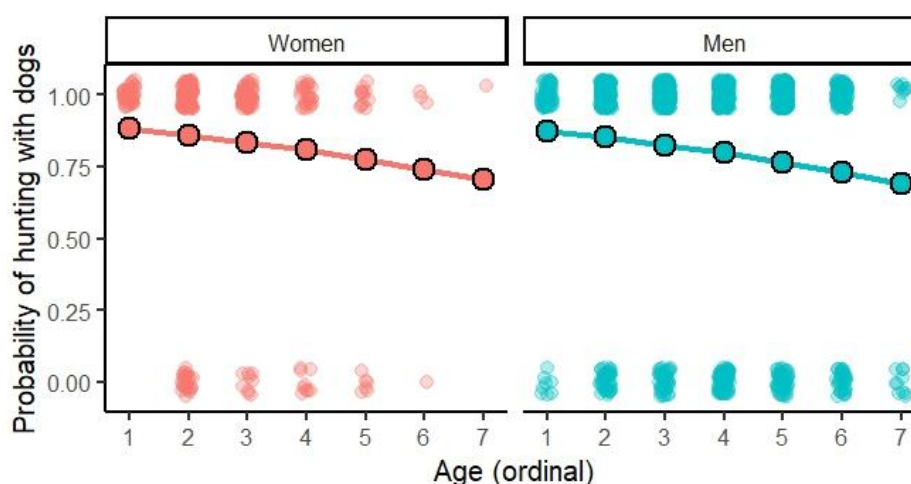


Figure 3. Probability that the hunters hunted with dogs according to sex (women vs. men) and age (ordinal, 1–7). Points represent observed values (0: hunting without dogs, 1: hunting with dogs), and lines represent predicted values from the model described in Table 3. Source: own elaboration

5. Conclusion and discussion

Our results show that interest in hunting game species varied according to sex, age, and hunting type, with higher values in women, a general decline with age, and higher values in big game species. Differences between women and men were particularly marked for big game, and age-related declines in interest were more pronounced for big game than for small game. The probability that the father was the FHC also declined with age and was higher in women, although this decline was steeper in women. Finally, the probability of hunting with dogs decreased with age but did not differ between sexes. These relationships between individual characteristics and hunting-related factors may have implications for hunting recruitment and retention.

Hunting participation is shaped not only by individual preferences but also by broader socio-ecological contexts, including changing societal expectations, cultural values, and the social legitimacy of hunting (DiCamillo & Schaefer, 2000; Hinrichs et al., 2021; Larson et al., 2014; Vajas et al., 2023). In this sense, hunters should not be considered a homogeneous group, but rather a socially diverse set of individuals whose motivations and practices are influenced by both personal and contextual factors (von Essen et al., 2019). These patterns should also be interpreted in the context of the diversity of hunting systems across Europe, which range from more formalised and institutionally regulated models in Central and Eastern Europe to more flexible and socially embedded practices in Mediterranean countries. Such variation may influence both access to hunting and the social meaning attached to participation. Accordingly, the drivers of hunting participation and the effectiveness of recruitment strategies are likely to vary across European countries. Nevertheless, understanding variation in hunting interest and practices can provide useful insights for designing context-specific and socially informed strategies for hunter recruitment and retention (Hansson-Forman et al., 2020; McGowan et al., 2023; Quartuch et al., 2017; Vayer et al., 2021). This may be particularly relevant in situations where overabundant populations pose significant threats and increasing participation in hunting can play an important role (Keuling et al., 2016; Quirós-Fernández et al., 2017).

Women's participation in hunting is increasing in Europe and North America, and their role in family decision-making is well established (Heberlein et al., 2008; Gallego et al., 2024; McFarlane et al., 2003; Larson et al., 2014; Pérez-González et al., 2023). In this context, our results showing higher interest in big game species among women suggest that preferences for different hunting modalities may vary by sex (see also Gallego et al., 2024; Pérez-González et al., 2023). Understanding these patterns may help inform context-specific strategies for hunter recruitment and retention where these are considered necessary. In particular, approaches that account for the factors shaping women's engagement in big-game hunting may be especially relevant.

Furthermore, social networks are among the most important factors influencing the intention to hunt (Hansson-Forman et al., 2020), with family support identified as a key predictor of hunting participation (Larson et al., 2014). Traditionally, hunters have been introduced to hunting by their fathers (Langenau & Mellon, 1980), although other family members, such as husbands, may also

play an important role as initiators for female hunters (Adams & Steen, 1997; Jackson et al., 1989). We found that the probability of the father acting as the FHC was higher among women and declined more steeply with age among women than among men. These patterns suggest that family-based initiation pathways may be especially relevant for younger female hunters. Overall, our findings reinforce the ongoing relevance of fathers in hunting recruitment, particularly among women. Recognising the role of these social pathways may help inform strategies aimed at supporting hunting participation where appropriate.

The patterns obtained regarding sex differences may not depend solely on demographic factors. Women's participation in hunting is increasingly understood as being shaped by hunting cultures, social expectations, and structural barriers that influence both access to hunting opportunities and the development of preferences (Tickle et al., 2024). In a traditionally male-dominated context, such factors may affect how women enter and engage with hunters, as well as the types of hunting activities they pursue. Therefore, the differences observed between women and men in our study may reflect not only individual interests but also broader gendered dynamics within hunting systems (Anderson et al., 2023). Incorporating these social dimensions is essential for developing more nuanced and inclusive approaches to understanding and supporting participation in hunting.

The higher interest shown by young hunters in hunting might be attributable to a stronger passion for engaging activities, similar to that reported for high-risk sports (Frühauf et al., 2020). Alternatively, this difference might highlight an issue for hunter recruitment. Interest or motivation does not guarantee actual participation in hunting (Hansson-Forman et al., 2020). The interest of potential hunters must surpass certain social and economic thresholds to translate into actual participation. The increasing social pressures and economic constraints in recent years may have made these thresholds more restrictive, hindering hunter recruitment (Di Minin et al., 2021; Schorr et al., 2014). However, the decline in hunting interest with age observed in this study should be interpreted with caution, as age may reflect not only differences in motivation but also accumulated experience and changing expectations. Older hunters may not necessarily be less engaged, but may evaluate hunting experiences differently. In this sense, hunter seniority has been negatively associated with satisfaction, suggesting that more experienced hunters may be harder to satisfy (Linares et al., 2025). This indicates that age-related differences in interest may reflect more complex relationships between experience, expectations, and satisfaction, rather than directly translating into participation patterns.

The use of dogs in hunting has been proposed as a factor influencing hunting experience (Hinrichs et al., 2021). In our study, the probability of hunting with dogs decreased with age, with no significant differences between sexes. This pattern suggests that the role of dogs in hunting practices may vary across age groups, potentially reflecting differences in preferences, traditions, or access to resources. This result was not found in surveys conducted more than 25 years ago in the same study area (Hidalgo de Trucios & Rocha, 2000). However, this comparison should be interpreted with caution, as our cross-sectional design does not allow us to distinguish between age, cohort, or temporal effect. Overall, hunting with dogs appears to represent one aspect of

hunting practices that may be associated with participation within a broader social and structural context.

Beyond the cross-sectional design, which does not allow us to distinguish among age, cohort, or temporal effects, this study has several limitations. The survey was distributed through hunting associations and events, which may have resulted in a sample biased towards active and engaged hunters, limiting the generalisability of the findings to the broader population, including non-hunters or less active hunters. Furthermore, the variables analysed in this study, such as hunting interest, FHC, and the use of dogs, capture only part of the processes underlying hunting participation and do not fully account for broader social, cultural, and structural factors. Finally, the results are based on self-reported data and reflect associations rather than causal relationships. Future research may adopt longitudinal designs, more representative sampling, and a broader set of social and contextual variables to better understand hunting participation.

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SUPPLEMENTARY MATERIAL

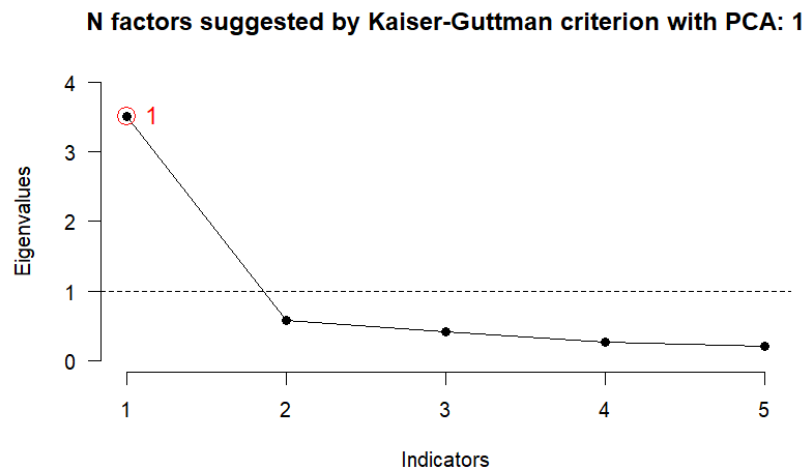
Table S1. Survey questionnaire used in the study (English translation from the original Spanish version).

Question	Response options
1) Please indicate your sex.	Woman, Man
2) Please indicate your age.	< 21 years, 21–30, 31–40, 41–50, 51–60, 61–70, > 70 years
3) What is your interest in hunting wild boar?	0 (very low), 1, 2, 3, 4, 5 (very high)
4) What is your interest in hunting red deer?	0 (very low), 1, 2, 3, 4, 5 (very high)
5) What is your interest in hunting roe deer?	0 (very low), 1, 2, 3, 4, 5 (very high)
6) What is your interest in hunting fallow deer?	0 (very low), 1, 2, 3, 4, 5 (very high)
7) What is your interest in hunting mouflon?	0 (very low), 1, 2, 3, 4, 5 (very high)
8) What is your interest in hunting red-legged partridge?	0 (very low), 1, 2, 3, 4, 5 (very high)
9) What is your interest in hunting rabbit?	0 (very low), 1, 2, 3, 4, 5 (very high)
10) What is your interest in hunting hare?	0 (very low), 1, 2, 3, 4, 5 (very high)
11) What is your interest in hunting pigeon?	0 (very low), 1, 2, 3, 4, 5 (very high)
12) Who accompanied you on your first hunting day?	Open-ended response
13) Do you usually hunt with dogs?	Yes, No

Table S2. Correlation matrices of interest in hunting big (A) and small game species (B). The table shows the correlation coefficients (above the diagonal) and p-values (below the diagonal).

A)	Wild boar	Red deer	Fallow deer	Roe deer	Mouflon
Wild boar		0.73	0.54	0.60	0.51
Red deer	< 0.001		0.71	0.61	0.62
Fallow deer	< 0.001	< 0.001		0.61	0.75
Roe deer	< 0.001	< 0.001	< 0.001		0.57
Mouflon	< 0.001	< 0.001	< 0.001	< 0.001	
B)	European rabbit	Iberian hare	Red-legged partridge	Pigeons	
European rabbit		0.55	0.57	0.44	
Iberian hare	< 0.001		0.43	0.32	
Red-legged partridge	< 0.001	< 0.001		0.52	
Pigeons	< 0.001	< 0.001	< 0.001		

A)



B)

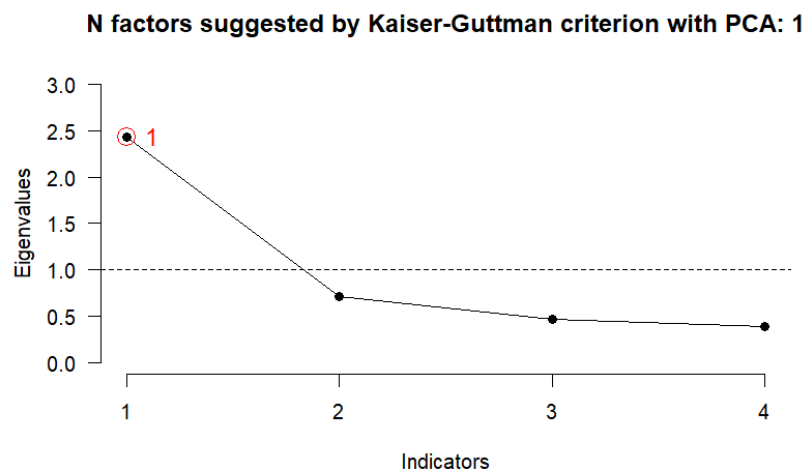


Figure S1. Number of factors suggested by Kaiser-Gutmann criterion for big games (A) and small game species (B). In both analyses, the number of PCs suggested was 1.

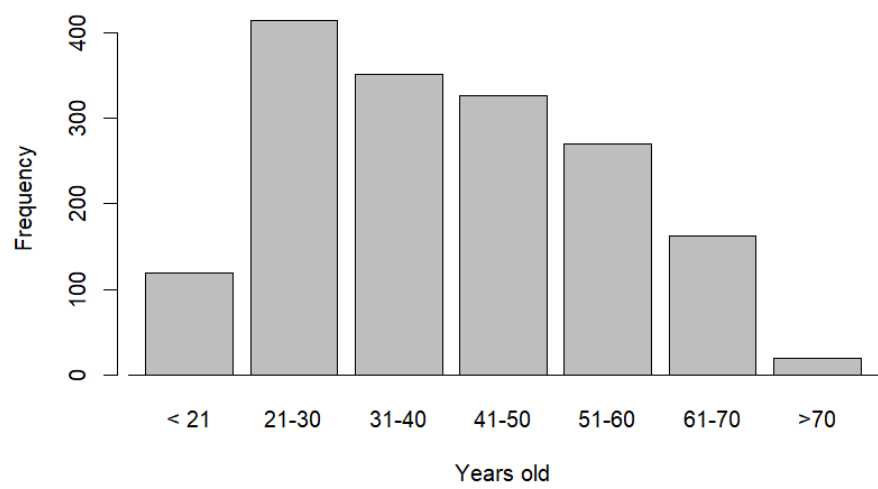


Figure S2. Frequency of hunters for each age category.