DOES HUNTERS' WILLINGNESS TO PAY MATCH THE BEST HUNTING OPTIONS FOR BIODIVERSITY CONSERVATION? A CHOICE EXPERIMENT APPLICATION FOR SMALL-GAME HUNTING IN SPAIN

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Running head: A choice experiment for partridge hunting

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Abstract

In southern Europe, traditional hunting has been frequently replaced by models based on more intensive management. These systems include management strategies like the release of farm-reared animals that can cause harmful effects on biodiversity. However, little is known about the hunters´ views of this activity, and about their preferences for the ecological attributes of the hunting estates. We present the results of a choice experiment exercise evaluating the willingness to pay of Spanish hunters regarding different aspects of walked-up red-legged partridge (*Alectoris rufa*) shooting, including partridge quality (farm-reared vs. wild) and other attributes related to the ecological characteristics of the estate. We find that, when given the choice, hunting an additional wild partridge in a walked-up shooting day was valued more than 20 times higher than hunting an additional farm-reared bird. The diversity of small game available and the presence of natural vegetation in the landscape in which the walked-up hunting takes place were also significantly valued. Hunters also attributed economic value (albeit lower than other attributes) to the presence of protected non-game fauna in the estate. Overall, our results show that hunters are willing to pay more for hunting on estates that have better ecological characteristics, which may be indicative of good conservation status. This suggests that identifying and promoting such estates could lead to systems that are both ecologically and economically sustainable.

Keywords: *Alectoris rufa;* Game quality label; Hunters´ preferences; Questionnaire; Sustainable hunting; Willingness to pay

1. INTRODUCTION

Traditional hunting systems have been increasingly altered over recent decades, and in certain regions economic factors have become major drivers of hunting systems and game management (e.g. Delibes-Mateos et al. 2013a; Funston et al. 2013; Knoche and Lupi 2013). Traditional hunting based on game as a renewable natural resource has been in certain instances replaced by models based on more intensive management, where the aim is to raise game abundance and consequently hunting bags. In particular, the release of farm-reared animals to increase bags and revenues has strongly increased in recent decades in some areas within Europe, North America or Africa (Sokos et al. 2008; Champagnon et al. 2012). This practice has been criticized from an ecological point of view because of its negative effects on wild game (e.g. Cunningham 1996; Laikre et al. 2010; Champagnon et al. 2012) or even biodiversity conservation as a whole (Mustin et al. 2011; Van Poorten et al. 2011). However, it is practiced by some game managers targeting hunters that demand larger or more predictable bags, possibly because it may be perceived as securing game supply, simplifying management and/or increasing revenues. Nevertheless, little is known about the hunters´ views and values of this management activity. In this context, understanding the preferences of hunters for wild or released animals, and the economic value attached to those systems, is valuable to design appropriate strategies intending to promote sustainable and profitable hunting systems compatible with biodiversity conservation (e.g. Fried et al. 1995).

An example of this can be found in red-legged partridge (*Alectoris rufa*) hunting in Spain, where this activity represents a widespread land use in many rural areas, generating substantial profits

(Bernabeu 2002). Red-legged partridges are one of the most important small game species in Spain (MAGRAMA 2013), and one of the best-valued species by hunters (Reginfo 2008). Partridge populations have sharply declined since the second half of the 20th century, mainly as a consequence of changes in agricultural practices and hunting pressure (Blanco-Aguiar et al. 2004). The regular use of farm-reared birds to supplement wild populations has sharply increased ever since (González-Redondo 2004; Blanco-Aguiar et al. 2008). Releases of farm-reared partridges are increasingly documented to negatively affect wild red-legged partridge populations due to disease spread, changes in the population genetic pool, reduction in fitness, or an increase in hunting pressure over the wild stock (Blanco-Aguiar et al. 2008; Sokos et al. 2008; Villanúa et al. 2008; Barbanera et al. 2010; Casas et al. 2012; Díaz-Sánchez et al. 2012; Díaz-Fernández et al. 2013a). On the other hand, many game managers consider releases as necessary to guarantee hunting supply and maintain commercial hunting (Delibes-Mateos et al. 2013a).

Choice experiments (CE), a survey-based valuation technique used to simultaneously value different characteristics of a good (Hensher et al. 2005), are increasingly used to estimate people's willingness to pay (WTP) for environmental attributes (Carson 2011; Di Minin et al. 2013). This method involves asking individuals to state their choice over sets of hypothetical alternatives. Each alternative is described by several characteristics, known as attributes, including cost. The responses are used to determine whether preferences are significantly influenced by the attributes and also their relative importance (Hensher et al. 2005). This paper reports results of a CE valuation study dealing with different aspects of red-legged partridge shooting, like partridge quality (farm-reared vs. wild) and the value that hunters assign to other variables related to the potential ecological worth of the hunting estate; i.e. the presence of other game, natural vegetation and species of conservation concern. Through this exercise, we provide an estimation of the hunters' WTP values for these attributes. We also evaluate whether WTP varies according to hunters´ characteristics, like their experience as hunters and their investment in hunting, evaluated through the number of hunting days in a season. Using this approach, we aimed to evaluate whether hunters' WTP matches the hunting management options that have the highest benefits for biodiversity conservation. Finally, we discuss the implications of our results for the development of schemes that would support the implementation of management systems concerned with ecological and economic aspects, thus contributing to maintaining both livelihoods and the environment.

2. METHODS

2.1 Study species and system

In Spain there are more than one million hunters and more than 30,000 hunting estates, covering approximately 80% of the country (MAGRAMA 2013). Red-legged partridges are hunted in most of these estates, and the official number of partridges harvested exceeds 3 million per year (MAGRAMA 2013). Official figures for farm-reared partridges released annually are ca. 1.7 million in 2011 (MAGRAMA 2013), but other estimates have raised that number to more than 3-4 million per year (González-Redondo 2004; Gortázar 2012). Although mortality of farm-reared birds during the first days after release is usually high (e.g. Alonso et al. 2005), their contribution to the total partridge bag could be high (see Arroyo et al. 2012 and Díaz-Fernández et al. 2012 for regional data). Spain holds most of the world population of wild red-legged partridges (BirdLife International 2004). The species highest abundances are found within central-southern Spain, especially in hunting estates occupied by extensive farmland areas with a mixture of natural vegetation (Blanco-Aguiar et al. 2004). Furthermore, areas with these characteristics may host emblematic protected species, including predators (Delibes-Mateos et al. 2009) and steppe-birds (Estrada et al. 2012).

The valuation exercise reported here refers to a walked-up shooting day, the most widespread hunting method in most Spanish estates (Arroyo et al. 2012), where hunters shoot the partridges, and frequently also other small game species like rabbits (*Oryctolagus cuniculus*), hares (*Lepus* sp.) or doves (*Columba* sp.), as they encounter them.

2.2. Questionnaire design

A questionnaire to implement a CE valuation exercise of commercial red-legged partridge walked-up hunting in central Spain was designed after preliminary research on hunting day prices and characteristics, and consultations with key people in hunting organizations. We followed the standard procedures for the implementation of preference valuation studies, including questionnaire validation (see Mitchell and Carson 1989; Arrow et al. 1993; Bateman et al. 2002; Hensher et al. 2005; Riera et al. 2012, among others). First, focus group sessions, individual meetings with hunters and initial trials helped to shape the contents and wording of the questionnaire. Second, a pilot survey was conducted on 58 hunters toward the end of 2011 to fine-tune the questionnaire and check its viability, before widely distributing the final questionnaire for the main survey.

The questionnaire started with a presentation of the exercise and some questions on the habits of the hunters and their characteristics, including their years of experience as a walked-up partridge hunter (hereafter 'YEARS'; Table 1) and the number of walked-up partridge hunting days in the previous season (hereafter 'DAYS'; Table 1).

Secondly, the questionnaire asked the hunter to place a score between 0 (no importance) and 10 (most importance) to various attributes separately, according to the subjective relevance in deciding whether to pay for a walked-up shooting day in a typical commercial hunting estate, with predominantly agricultural landscape and a size of 700 ha (average size in central-southern Spain; Arroyo et al. 2012). These attributes are shown in Table 1, and included the expected number of partridges to be harvested (hereafter 'QUANTITY'), and the quality of the partridge (hereafter 'QUALITY'). The questionnaire discriminated between lower quality partridges ('farm-reared partridges with lower flying ability and escape capacity') and higher quality partridges ('wild partridges or those that are difficult to distinguish from wild ones'). These descriptions were formulated according to hunters' advice during the initial trials, as according to them simply specifying 'wild' or 'farm-reared' would lead to disbelief from respondents. This is because the stated origin of birds is not always reliable, and thus cannot be determined *a priori* without doubt when buying a hunt (see also Díaz-Fernández et al. 2012, 2013b). However, the QUALITY of the partridges can be evaluated *a posteriori* as farm-reared partridges have lower flying ability than wild ones (Pérez et al. 2010; Duarte et al. 2011), something that was acknowledged by hunters during the design of the questionnaire. A third attribute reflected the possibility of shooting other small game species like European rabbits or hares during the hunting day (hereafter 'ADDITIONAL_GAME'). Two further non-monetary attributes related to the quality of the environment in the hunting estate were considered: the presence in the estate of species of conservation concern (hereafter 'FAUNA'), such as raptors, mammalian carnivores or steppe birds, and the existence of natural vegetation (i.e. Mediterranean scrubland; hereafter 'FLORA'). The last attribute was the payment cost for the hunting day (hereafter 'COST').

The central part of the questionnaire was devoted to the CE exercise, where respondents had to choose among hunting options according to these attributes. Table 1 shows the definition of the attributes used in the CE exercise, and their levels and coding type. Briefly, QUALITY, ADDITIONAL_GAME, FAUNA and FLORA were characterized by two levels. QUANTITY was defined by three levels, which depended on the quality of the partridges to be hunted, reflecting typical discrepancies between hunting farm-reared and wild partridges; i.e. it is generally much more difficult shooting wild partridges than farm-reared ones due to their lower abundance and better escape ability. Lastly, the payment for the hunting day ranged from 100 to 400 Euro.

Since each choice situation was composed of the status quo (SQ) option (taken here as simply indicating the 'choose none' answer, which would vary for a given individual, and would represent the average number of hunting trips they make each year) plus two hunting alternatives (Appendix A1) there were 192[2] possible combinations (2^4x3x4 = 192). Each respondent faced six choice situations out of all possible combinations, so 24 choice situations were selected and blocked into four subsets of six choice situations – the number that was presented to each respondent. A Bayesian d-efficient design (see for example Bliemer et al. 2008) optimized for the Mixed Logit model (see below) was prepared in NGene software (ChoiceMetrics 2012). The priors were taken from the pilot survey conducted on 58 respondents, with six choice situations each.

The questionnaire ended with a debriefing question asking to rate the confidence in which the choice task was answered, from 0 (totally unconfident) to 10 (totally confident), and leaving space for further comments.

2.3 Survey implementation

The main survey was conducted in the first half of 2012. The target population was Spanish partridge hunters at large. Questionnaires were self-administered and distributed mainly through hunting associations, as well as through individual hunters. A total of 632 questionnaires were collected, of which 131 were incomplete, mostly on the socioeconomic information. The remaining 501 were used in the statistical estimations, with 3005 completed choices (since one respondent completed five of the six choice sets).

2.4 Economic and Statistical Models

The economic model of the CE exercise is based on the Random Utility Maximization framework (McFadden 1974), where it is assumed that respondents know perfectly well their preferences, but the researcher cannot observe them completely or without errors. This results in the formulation of a utility function in two parts, a deterministic one (the portion measured by the researcher) and a stochastic one (the part not accurately observed by the researcher). Thus, the utility function can be modeled in probabilistic terms.

Different assumptions on how the random part is distributed give rise to several statistical models and treatments. Two of the most common econometric models applied to CE exercises are the standard Multinomial Logit (MNL) and the Mixed Logit (MIXL) model (Hensher et al. 2005). A development of both the economic and the statistical models can be found as Electronic Supplementary Material (Appendix A2). A maximum likelihood estimation of the model parameters was conducted in NLOGIT 5.0. (Greene 2007).

3. RESULTS

The average number of YEARS of hunting experience in respondents was 19.34 ± 12.52 SD (n=501), and the average number of DAYS in a hunting season was 10.68 ± 8.95 SD (n=501). When asked for their confidence in answering to the choice task, respondents gave an average score of 8.6 ± 1.3 (n=424) in the 0 to 10 scale. This can be taken as a sign of relatively low cognitive burden of the choice exercise, which may be partly due to the familiarity of the hunting population with the good presented for valuation, as reflected in the frequencies of the

DAYS and YEARS variables. The relatively high confidence score places some extra assurance on the results shown below.

The most important attributes for a walked-up hunting day, according to respondents' scores, were partridge QUALITY and FLORA, followed by ADDITIONAL_GAME and COST; the QUANTITY, and particularly FAUNA, obtained relatively lower scores (Table 2).

Results of the CE showed that the signs of the coefficients were consistent in both the MNL and MIXL models (Table 3). The estimate for the SQ constant was negative, indicating that most respondents opted for one of the alternative hunting trips in the choice exercise. The positive and statistically significant estimates for the fixed MNL and MIXL coefficients imply that hunting trips with a higher level of QUANTITY, ADDITIONAL_GAME, FAUNA and FLORA were more likely to be chosen. Moving from the fixed MNL model to the MIXL model with the five random parameters improved the Log-Likelihood (LL) value by 442 units, which is highly significant. Therefore, MIXL is taken here as the preferred model. The standard deviations of the random parameters, apart from QUANTITY_HIGH, were significant at the 95% level, suggesting a substantial random heterogeneity in tastes.

While considering the interactions among the attributes and the socioeconomic characteristics, those not significant at 95% level were dropped from the final model. At the end, three (QUANTITY_LOW*YEARS, QUANTITY_LOW*DAYS and ADDITIONAL_GAME*DAYS) turned out to be statistically significant in the MNL model, but only two were significant in the MIXL model

(QUANTITY_LOW*DAYS and ADDITIONAL_GAME*DAYS). Despite that, QUANTITY_LOW*YEARS was kept in the MIXL model so the two models remained nested and a standard Log-likelihood Ratio test could be performed. The negative sign of the interaction of QUANTITY_LOW with DAYS and YEARS indicates that the more days respondents spent on hunting partridges in a given year, and the more years of partridge hunting experience they had, the less they valued harvesting an additional farm-reared partridge. On the other hand, the positive sign of ADDITIONAL_GAME*DAYS denotes that adding the opportunity to shoot at other game in the same hunting day was relatively more valued by more active partridge hunters.

The WTP estimates for both models are shown in Table 4. As expected, a unit of QUANTITY_HIGH was valued more than one of QUANTITY_LOW. The WTP for ADDITIONAL_GAME, FAUNA and FLORA was positive, with hunters willing to pay more for FLORA than for FAUNA. The WTP for a unit of QUANTITY_LOW increased when YEARS and DAYS decreased (Fig. 1), and the WTP for ADDITIONAL_GAME increased when DAYS increased (Fig. 2). The ordering of WTP was consistent across both models (Table 4). The most substantial difference between the two models was that the mean for QUANTITY_LOW was positive in the MNL model and became negative with MIXL. This is not surprising given that the estimate of QUANTITY_LOW was higher in MNL than the estimated mean in the MIXL model; furthermore, the interaction terms between QUANTITY_LOW and DAYS and YEARS were larger in the MIXL model. Both effects combined result in the negative mean for the QUANTITY_LOW WTP in the MIXL model and positive in the MNL model. However, there was large WTP heterogeneity for this attribute (with a standard deviation of circa 68, as shown in Table 4), reflecting that almost half of the studied sample had a positive WTP estimate for QUANTITY_LOW.

Results of the CE thus correlated well with the *a priori* scores of importance assigned by hunters to the different attributes. Hunters assigned the highest scores to QUALITY, FLORA and ADDITIONAL_GAME (Table 2), which were among the most positively valued attributes in the CE (Tables 3 and 4). In addition, FAUNA showed the lowest score of importance (Table 2), and the WTP for this attribute was also low (Table 4).

4. DISCUSSION

Different studies have shown that natural resources are economically more appreciated by consumers when conserved (e.g. Morse-Jones et al. 2012; Schuhmann et al. 2013). Our study shows that hunters, beyond the quantity of animals shot, place economic value on ecological characteristics of the estate that may be indicative of good conservation status. These include the presence of wild game instead of released animals, the possibility of hunting other small game species, the presence of natural vegetation in the estate, or even the presence of protected (non-huntable) species.

Spanish partridge hunters are willing to pay at least 20 times more per additional wild partridge hunted than for an additional farm-reared bird. This is in agreement with the higher WTP of Alabama hunters for shooting game of good quality (Hussain et al. 2004). In addition, our results are consistent with the poor perception that farm-reared partridges have among the

Spanish hunters (Vázquez-Guadarrama 2013), expressed also in focus groups (farm-reared partridges were considered as ‘artificial birds’; Delibes-Mateos et al. 2013a). Differences in WTP values between both types of partridges were strikingly high. This suggests that the introduction of farmed-reared game partridges may not necessarily be driven by hunters´ preferences *per se*, but rather by current scarcity of wild partridges (Blanco-Aguiar et al. 2004). In this sense, the position of hunters regarding releases is apparently close to that of conservationists. This could be used as a point to link efforts for conservation between both stakeholder groups (Knezevic 2009).

The WTP estimate for additional farm-reared partridges was not linear. It was increasingly lower for more experienced (thus probably older) and active small-game hunters. This may reflect a difference in purchasing power among generations. Nevertheless, Vázquez-Guadarrama (2013) also showed that older hunters mentioned more frequently than younger ones their concerns about hunting being de-naturalized and modified through farm-reared animals. Therefore, our results may also reflect that older hunters are more sensitive to hunting as a way to interact with nature, and thus with an affection of nature, than younger hunters. Our results may thus suggest a change in attitudes among generations, with increasing dissociation between people and nature, which is in tune related to increasing distance from a rural existence; i.e. current older hunters have either lived in the country or have had parents or grandparents who lived in the country, whereas this rarely happens in the case of current young hunters. In addition, this result may just reflect larger experience in older hunters. In this sense, several studies have shown that people with more nature experience generally value biodiversity attributes more positively. For example, more experienced visitors of protected areas in South Africa had broader interests in biodiversity than inexperienced visitors, who were mostly interested in charismatic megafauna (Di Minin et al. 2013). In summary, our results may thus suggest that experienced or regular partridge hunters value strongly the difference between good and poor quality partridges, and are thus willing to pay much more extra money for them. This also means that it would be useful to involve hunters in reversing the current situation of wild partridge decline while these birds, and thus personal hunting experience of them, still exist.

The presence of natural vegetation was also very positively valued by partridge hunters. This may be another point in common between hunters and conservationists (Knezevic 2009), as natural vegetation has been shown to increase the biodiversity value in farmland habitats (Olivero et al. 2011). This agrees with results from other studies, which show that wanting to be amongst nature and learning about nature are among the main motives for hunting in Europe and North America (Fischer et al. 2013; Kelly and Rule 2013). The opportunity to hunt additional small game species like rabbits or hares was also of considerable importance for Spanish hunters, particularly those that were more active in small game hunting (Fig. 2). A higher value attributed to areas conserving multiple instead of single emblematic species has been similarly found among National Park visitors (Cerda and Losada 2013). Our finding in this regard is not surprising since rabbits, for example, are an important small game species in Spain (MAGRAMA 2013). The fact that more active walked-up hunters value more the diversity of potential game in the hunt may also indicate that they may be more interested in the general hunting experience than occasional hunters, who may be more interested in a particular type of target (red-legged partridges). In sum, hunters have a distinctive preference for estates that are able to harbor a variety of small game species, which in turn suggests better ecological quality and a more diverse habitat.

The appreciation of non-game fauna of conservation concern was noticeably lower than that of other attributes. This could be explained by the fact that many of these species are mammalian carnivores and raptors, so predators that are frequently negatively viewed by hunters (e.g. Marker et al. 2003), particularly in Spain (Delibes-Mateos et al. 2013b). Additionally, it is likely that hunters appreciate the landscape or shooting additional small game because these attributes can directly influence their enjoyment during the hunt. In contrast, the presence of species of conservation concern may not be directly associated with such enjoyment, since most of those species are rarely seen. This means that hunters could perceive the presence of species of conservation concern as an indirect and *rational* attribute (rather than sensorial). In other words, hunters can like/dislike hunting in an estate where species of conservation concern are present, although it is highly probably that they are not going to have contact with such species. In any case, our results suggest that hunters place economic value to the ecological characteristics of the estate, beyond those directly associated with the hunting experience *per se,* as other stakeholders do (e.g. Cerda et al. 2013; Di Minin et al. 2013).

Labelling is increasingly used to identify the environmental quality of different products (e.g. Zanoli et al. 2013). In this line, there have been attempts of creating a 'Game Quality' label as a way to promote the profitability of ecologically-favourable game management in Spain (Carranza and Vargas 2007). This label would allow hunters to identify estates with better quality game and overall higher ecological values. Game managers could thus potentially ask for higher prices. One of the possible problems associated with this type of certificate is that the preferences of experts, who are typically in charge of deciding on the labels, and those of the public usually diverge (e.g. Rogers et al. 2013). However, our results indicate that it is likely that hunters would agree with a label based on the criteria suggested by scientists; e.g. estates that, among other things, do not release farm-reared birds, but protect wild stocks and preserve good quality habitats (Carranza and Vargas 2007). Nevertheless, further studies on the economic costs and benefits associated with the implementation of this label, as well as on the degree of hunters' acceptance of the label (e.g. Zanoli et al. 2013 for other labels) are still needed. In addition, the development of a mandatory tagging system for released partridges would allow a clear identification of the quality of the product, which is currently missing. It has been pointed out that fraudulent selling of hunts, with released partridges advertised as wild partridges, exists (Delibes 1992; Díaz-Fernández et al. 2013b), although the extent of this practice is not known (see also Díaz-Fernández et al. 2012).

In many areas throughout the world, biodiversity conservation must take place in multiple-use landscapes alongside other human activities. Hunting, for example, involves millions of people and it is undertaken on millions of hectares of land in Europe, North America and Africa. In this context, it is essential to find ways of sustainably using game resources that are acceptable by all involved stakeholders. In most of Europe, hunters and conservationists have traditionally viewed their interests as opposite or conflicting (e.g. Thirgood et al. 2000). However, our results show that the preferences of the former are quite likely to align with those of the later, as hunters are willing to pay more for hunting in estates that have better ecological conditions. Therefore, identifying and promoting such estates could lead to systems that are both ecologically and economically sustainable. A strategy linking views of apparently opposing stakeholder groups should be explored in other ecological/hunting systems as a potentially useful conservation tool within a framework of wise natural resource use.

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6. SUPPLEMENTARY MATERIAL

Appendix A1 and A2 are available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author

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Table 1. Definition, levels and coding type of attributes used in the CE exercise.

Attribute	Levels	Coding type	Description
COST	100, 200, 300, 400	Continuous variable	Cost of the hunting day, in Euros of 2012
QUANTITY_HIGH	2, 4, 6	Continuous variable	Quantity of high-quality partridges likely to be shot in the hunting day
QUANTITY_LOW	6, 12, 18	Continuous variable	Quantity of low-quality partridges likely to be shot in the hunting day
ADDITIONAL_GAME	Yes, No	Coded as dummy variable with NO possibility of hunting additional small game species being the reference level	Possibility of hunting additional small game species during the hunting day
FAUNA	Yes, No	Coded as dummy variable with NO existence of species of conservation being the reference level	Presence of species of conservation concern in the hunting estate
FLORA	Yes, No	Coded as dummy variable with NO existence of natural vegetation being the reference level	Presence of natural vegetation (Mediterranean scrubland) in the hunting estate
SQ	Dummy for SQ	SQ coded as 1, Alternative Specific Constant for Hunting codded as 0	Status quo
YEARS	Number of years	Continuous variable	Number of hunting years of experience of the respondent
DAYS	Number of days	Continuous variable	Number of hunting days of the respondent in a hunting season
Interactions between choice attributes and socio-demographic variables			
QUANTITY_LOW*YEARS		Continuous variable	Multiplication of the relevant levels
QUANTITY_LOW*DAYS		Continuous variable	Multiplication of the relevant levels

ADDITIONAL_GAME*DAYS	Continuous variable	Multiplication of the relevant levels

Table 2. Average (± SD) *a priori* importance of different attributes for choosing an estate where to buy a walked-up red-legged hunting day, in a scale of 0 (not important) to 10 (very important). In brackets, range and sample size (number of respondents). The names of the variables are the same as in Table 1.

	Score
COST	7.5 ± 2.3 (0-10, n = 601)
QUANTITY	6.7 ± 2.4 (0-10, n = 608)
QUALITY	8.9 ± 1.5 (1-10, n = 611)
ADDITIONAL_GAME	7.9 ± 2.1 (0-10, n = 611)
FLORA	8.4 ± 1.7 (1-10, n = 611)
FAUNA	5.4 ± 3.1 (0-10, n = 604)

Table 3. Choice modelling results for the Multinomial Logit (MNL) and Mixed Logit (MIXL) specifications. The names of the variables are the same than those in Table 1. The responses of 501 hunters (n=3005 choices; see text for details) were used in the statistical estimations. The standard deviations of random parameters were estimated in NLogit, using 500 Halton draws, and were calculated based on the values of the Choleski matrix.

	MNL		MIXL	
	Coefficients	Asy t-stat	Coefficients	Asy t-stat
	Mean of main effects			
COST	-0.00642	-18.95	-4.58882	-53.42
QUANTITY_HIGH	0.32174	13.94	0.50244	9.47
QUANTITY_LOW	0.05450	5.26	0.05189	1.60
ADDITIONAL_GAME	0.85947	9.43	1.77703	8.25
FAUNA	0.16169	2.48	0.38220	2.83
FLORA	0.60574	9.13	1.24246	7.60
SQ	-0.14437	-1.21	-0.99377	-3.39
	Interactions with socio-demographics			
QUANTITY_LOW*YEARS	-0.00138	-4.11	-0.00163	-0.98
QUANTITY_LOW*DAYS	-0.00109	-2.21	-0.00405	-3.57
ADDITIONAL_GAME*DAYS	0.01610	2.72	0.02564	2.10
	Standard deviations of random parameters			

COST		0.94901	9.11
QUANTITY_HIGH		0.11900	1.72
QUANTITY_LOW		0.22219	4.30
ADDITIONAL_GAME		0.95209	4.17
FAUNA		0.66723	1.96
FLORA		0.90831	2.68
SQ		2.52379	2.92
	Model summary		
LL(β)	-2594.73	-2293.1	
Parameters	10	38	
Adjusted pseudo $\rho^2(0)$	0.199	0.3481	

Table 4. Willingness-To-Pay estimates for the Multinomial Logit (MNL) and Mixed Logit models (MIXL), in Euro of 2012. The name of the variables are the same than those in Table 1. N.B. Values were estimated from each individual, taking into account the socioeconomic interactions, and thus reflecting heterogeneity also in the MNL model. Matlab software (2014) was used in the MIXL to simulate 1000 draws for each respondent from the estimated mixing distribution. The standard errors (S.E.) were calculated using the Delta method.

	MNL			MIXL		
	Mean	S.E.	Std. dev.	Mean	S.E.	Std. dev.
QUANTITY_HIGH	50.11	3.59	-	62.39	5.65	48.99
QUANTITY_LOW[a]	2.53	1.16	2.51	-4.29	2.23	67.68
ADDITIONAL_GAME[b]	160.30	11.15	22.21	201.41	20.06	304.23
FAUNA	25.18	9.96	-	37.60	13.40	171.52
FLORA	94.34	9.31	-	122.23	16.26	284.47

[a] Evaluated at the mean values of YEARS=19.34 and DAYS=10.68.
[b] Evaluated at the mean value of DAYS=10.54.

FIGURE LEGENDS

Figure 1. Willingness to Pay (WTP) for an additional unit of low-quality partridges in relation to hunting experience (YEARS) and hunting activity (number of hunting days in a hunting season, DAYS).

Figure 2. Willingness to Pay (WTP) for the possibility of hunting additional small game, in relation to hunting activity (number of hunting days in a hunting season, DAYS).

FIGURE 1

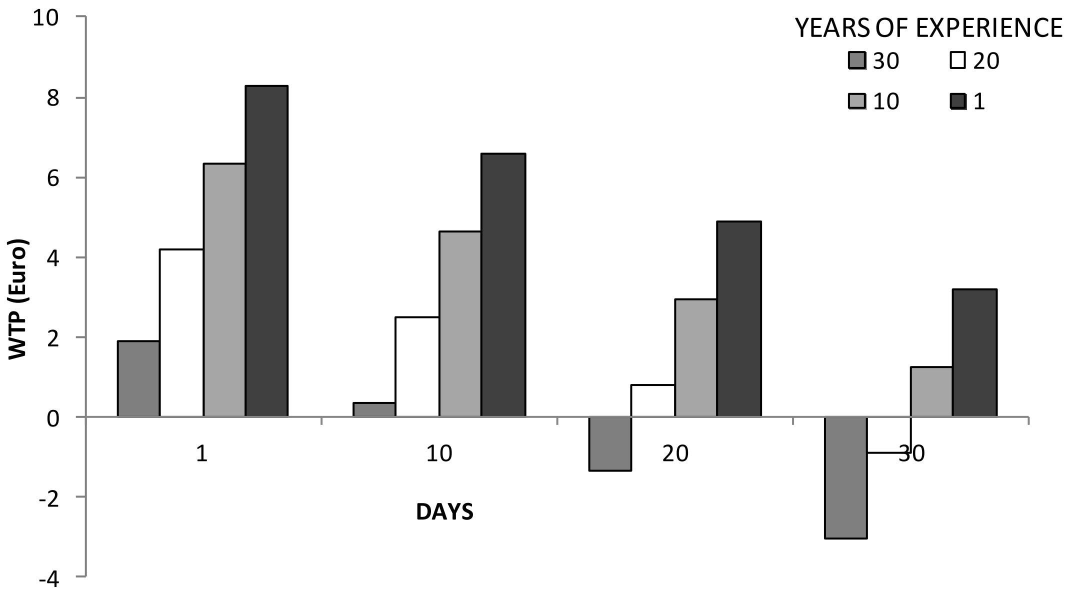
YEARS OF EXPERIENCE
30
20
10
1
WTP (Euro)
10
8
6
4
2
0
-2
-4
1
10
20
30
DAYS

FIGURE 2