

Article

Wildlife Knowledge and Attitudes toward Hunting: A Comparative Hunter–Non-Hunter Analysis

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Abstract: Assessing the public's attitudes toward hunting and knowledge about wildlife is critical for successfully managing and conserving resources. This need is further emphasized by the increase in urbanization, resulting in decreasing participation in outdoor activities, such as hunting. This study aimed at investigating the attitudes toward hunting and the wildlife knowledge of Greek residents and at understanding the variation among hunters and non-hunters. Respondents to on-site, face-to-face surveys ($n = 461$; hunters, 146; non-hunters, 315) were asked to rate their acceptance of the motives for hunting and of hunting as a management tool and their knowledge about the ecology, biology, and behavior of wildlife. The hunters were highly motivated for hunting and supported it as a management tool. The non-hunters' attitudes were, however, neutral to negative. The hunters had greater knowledge about wildlife species, both game and non-game, than the non-hunters. The more experienced hunters with greater knowledge about wildlife were generally more positive toward hunting. Older, male, non-hunters who have a greater knowledge about wildlife and who consume game meat and have hunters in the family or among their friends were generally more positive toward hunting. The findings suggested that hunting is a controversial social issue. Policies aimed at informing public groups about good hunting practices and at increasing the public's engagement in outdoor activities would reduce such controversies, improve human health and well-being, and reinforce nature and wildlife stewardship and support for biodiversity conservation.

Keywords: hunting motives; wildlife management; experiential knowledge; sociodemographics; northeast Mediterranean



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1. Introduction

In modern times, and especially in western societies, hunting is exercised as a recreational activity [1,2]. Recreational hunting, hereafter just hunting, is defined as a pastime without a commercial or subsistence component, carried out voluntarily and involving the active pursuit and killing of wild vertebrate animals other than fish [3,4]. Hunting is also an important socioeconomic activity [5] and management tool, having been used as a means of controlling overabundant wildlife populations; in addition, the proceeds from hunting license fees provide funding for the conservation of wildlife species [6,7]. However, participation in hunting has declined, especially in developed countries, e.g., [8–11]. This decline has been attributed to the increase in the endorsement of more protectionist, mutualism values (seeing wildlife as part of one's social community and deserving of rights like humans) and the weakening of utilitarian, domination values (treating wildlife as a resource to be used for human benefit) due to increased urbanization, educational level, and income [12–14]. Hunting is controversial among the public, with varying degrees of acceptance among the public, both as an activity [15–17] and as a management tool [18,19]. Moreover, hunting is an outdoor activity and those participating in such activities have high experiential knowledge about wildlife and are supportive of wildlife conservation and management issues [20]. In addition, the ever-increasing urbanization has promoted the

gradual alienation from nature and wildlife, termed as the “extinction of experience” [21], leading to the deterioration of human health and well-being, collectively described as the ‘nature-deficit disorder’ [22]. Studying people’s attitudes toward hunting and their level of knowledge about wildlife would provide critical information for the assessment of the acceptability of the practice of hunting and its use as a management tool and of people’s degree of contact with nature. This would allow for the better management of resources for the conservation of biodiversity and the reversal of the extinction of experience [23,24].

Attitudes may vary from positive to negative and represent “an association, in memory, of an evaluation with an object or activity” (p. 341 in Fazio et al. [25]). Attitudes toward hunting may address the way that people perceive the reasons why someone would hunt, namely the motives for hunting, and also the evaluation of the usefulness of hunting as a management tool. Hunters regard hunting as an activity offering opportunities for excitement, exercise, enjoyment of nature, and learning about wildlife, and one which allows for the reinforcing of relationships with friends and family and the reduction in everyday stress [15–17]. In these studies, the non-hunters had more negative attitudes toward hunting than the hunters. The hunters are supporters of wildlife management, especially when it positively affects their favorite game [18,19]. They also have a long tradition of helping to conserve animal species, especially game, and their habitats in many countries [26,27]. The hunters accepted hunting more than the non-hunters as a useful wildlife management technique in different situations [15].

Knowledge refers to the collection of facts, information, and experience that people acquire, retain, and use through complex cognitive processes, such as belief, perception, communication, association, and reasoning [28]. Hunters have a greater knowledge about biology, ecology, populations, and the conservation status of wildlife species than the general public; their knowledge is similar to that of birdwatchers and members of nature protection organizations [20]. Such knowledge has been found to positively affect people’s attitudes toward wildlife conservation and management [29–31].

Among the demographic characteristics, age, gender, level of education, pet ownership, meat consumption, and having hunters in the family or among friends have been proposed as important factors influencing attitudes toward hunting. In general, men, older people, less educated people, and pet owners are more favorable toward hunting when compared with women, younger people, more educated people, and non-pet owners [15,32,33]. The consumption of game meat is positively associated with hunting [34]. Friends and family members who hunt also positively affect attitudes toward hunting [35,36].

The hunting population in Greece follows the international trend, having decreased from 344,000 in 1985 to 230,000 in 2010 [37] and to around 170,000 in 2019 (1.6% of the total population; [38]). Greece is an already highly urbanized country, with its level of urbanization expected to rise from 79% in 2018 to 88% by 2050 [39], a trend that could further negatively affect hunting participation. Along with urbanization, the steep decline in hunting participation after 2010 has also been attributed to the onset of the Greek debt crisis and the consequent decrease in the national gross domestic product (GDP) per capita [40]. The assessment of public attitudes toward hunting and knowledge about wildlife is important if we are to understand whether hunting is controversial and also understand the public’s degree of involvement with wildlife and contact with nature in general. In this study, we aimed at: (1) identifying differences in the attitudes toward the motives for hunting and of hunting as a management tool among Greek hunters and non-hunters; (2) assessing the level of factual knowledge about wildlife among Greek hunters and non-hunters; (3) examining how sociodemographic characteristics affect the attitudes of the Greek public toward hunting and the factual knowledge about wildlife; and (4) discussing the implications of our findings for hunting, wildlife management and the extinction of experience, in the light of the decreasing hunting participation and the increasing urbanization.

2. Materials and Methods

2.1. Sampling Protocol

The study was carried out in north Greece, in the districts of Central Macedonia and Eastern Macedonia and Thrace (Figure 1), an area with a population of roughly 2,490,000 people [41]. Data were collected by on-site, face-to-face surveys of residents of north Greece between June and September 2018. A pretest of the survey ($n = 30$ random people) was conducted to test question clarity and completion time. Cities, towns, and villages were visited in all the districts during open market hours (9.00–15.00 and 17.00–21.00, from Monday to Saturday). Every fifth person passing in front of the researcher was asked to participate by completing a questionnaire [42]. In the cases in which more than five persons had passed while a questionnaire was being completed, the first person encountered upon completion was selected. Hunting clubs within the study area were also visited to ensure the representation of hunters in the sample. It took respondents 40 min on average to orally complete the questionnaire with the assistance of the interviewer.

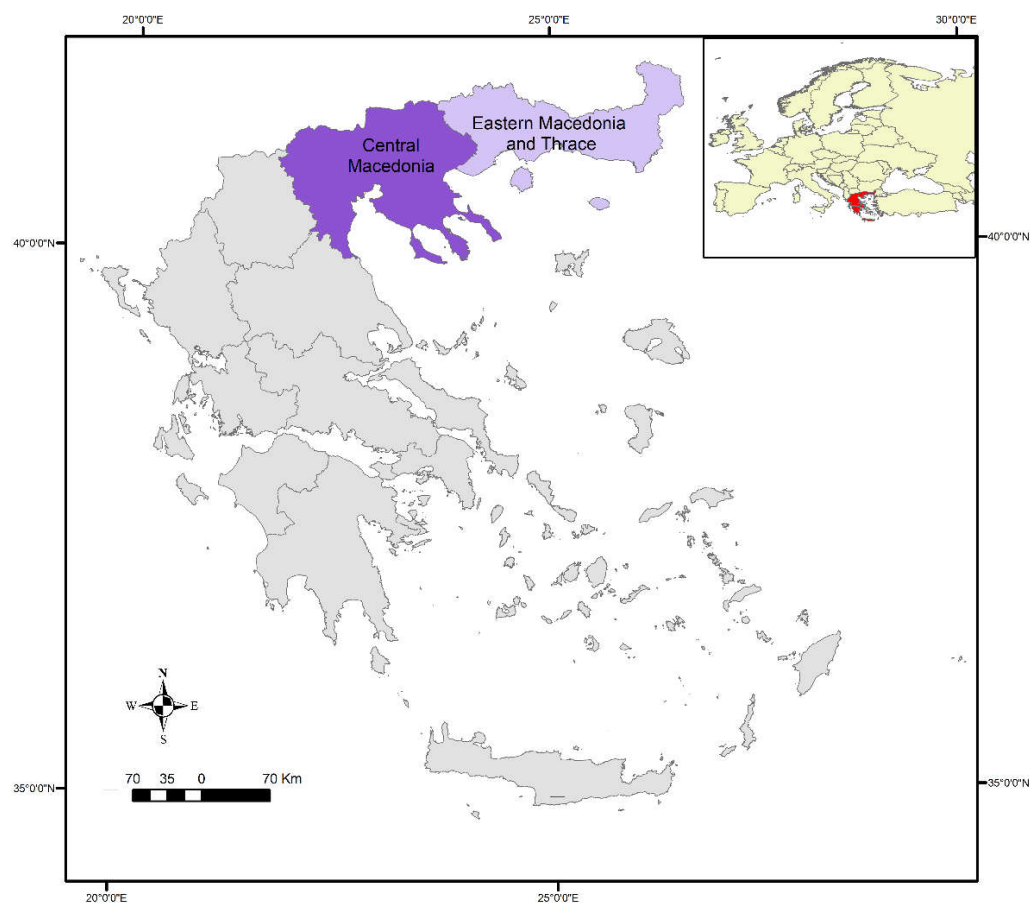


Figure 1. Map showing the region of Greece in which the study was carried out.

2.2. Research Design

The survey participants, classified as hunters, male non-hunters, and female non-hunters, were asked a series of questions about their sociodemographic characteristics, their knowledge about wildlife, and their attitudes toward hunting. The sociodemographic characteristics included gender (female or male), age, educational level (recorded as higher and lower [including elementary and secondary education]), pet ownership (yes or no), consumption of game meat (yes or no), having hunters in the family or among friends (yes or no), and hunting experience (in years; for hunters).

The participants' acceptance of the motives for hunting were assessed with 9 statements, while their attitudes toward hunting as a management tool were assessed with

another 9 statements. We ranked the mean responses of each participant for the motive and attitude scales as: (a) negative (mean 1–2.49), (b) neutral (mean 2.50–3.49), and (c) positive (mean 3.50–5). The factual knowledge about wildlife was assessed with 20 statements relating to the ecology, biology, and behavior of wildlife species, 10 of which concerned game species, while 10 concerned non-game species. The survey participants were asked to rate each motive, attitude, and knowledge statement on a 5-point scale (5 = strongly agree, 4 = agree, 3 = neither disagree nor agree, 2 = disagree, 1 = strongly disagree).

2.3. Data Analysis

The hunters were all male, and the genders usually differ in their perceptions and attitudes toward hunting [32]. Therefore, we made comparisons among the hunters, male non-hunters, and female non-hunters. One-way analysis of variance (ANOVA) with pairwise Tamhane post hoc tests to account for heteroscedasticity, applying Bonferroni correction to adjust for multiple testing, was used for comparing the mean responses of the hunters and non-hunters regarding the acceptability of the motives for hunting, the attitudes toward hunting as a management tool, and the factual knowledge about wildlife statements.

Next, we were interested in assessing the effects of sociodemographic characteristics on the acceptability of the motives for hunting, attitudes toward hunting as a management tool, and factual wildlife knowledge. First, we investigated whether motive, attitude, and knowledge statements could adequately describe constructs (factors) [42], using principal component exploratory factor analysis. The following criteria were used for the factor and variable selection: (a) factor eigenvalue ≥ 1 , (b) communality of a variable ≥ 0.5 , (c) factor loading of a variable ≥ 0.4 , and (d) exclusion of a variable when factor loadings exceeded 0.400 in two or more factors [43]. Cronbach's alpha was used to determine whether the statements included in a factor reliably measured the respondent's acceptance, attitude, or knowledge, with a value greater than 0.7 considered acceptable [44]. The relationships between the determined motive, attitude, and knowledge factors and the sociodemographic characteristics were then assessed with multiple linear regression models. Multicollinearity among the independent variables was tested with the variance inflation factor (VIF).

All analyses were performed in SPSS Statistics (version 21.0, IBM Corp., Armonk, NY, USA, 2012). The significance level was set at $\alpha = 0.05$.

3. Results

3.1. Sociodemographics

A total of 461 questionnaires were completed, with 55 refusals, yielding a response rate of 89% (the required size for a confidence level of 95% and a margin of error of 4.56%). Among the survey participants, 146 were hunters and 315 were non-hunters. The study area's population has a 51.3% female/48.7% male gender ratio; the age ratio, after excluding those under 18, is 39.7%/36.3%/34.0% in the age classes of 18–34, 35–54, and 55+ years old, respectively, and the lower/higher educational ratio is 77.5%/22.5% [41]. The non-hunters' gender, (50.5% female/49.5% male), age (36.3%/33.5%/30.2% in the age classes of 18–34, 35–54, and 55+ years old, respectively), and the educational level (72.6%/27.4%) structure was not different to that of the population (gender: $\chi^2 = 0.059$, $df = 1$, $p = 0.765$, age: $\chi^2 = 4.583$, $df = 2$, $p = 0.101$; educational level: $\chi^2 = 2.734$, $df = 2$, $p = 0.083$).

The hunters were all male; their age ratio was 19.2%/53.8%/26.9% in the age classes of 18–34, 35–54, and 55+ years old, respectively, and their lower/higher educational ratio was 80.2%/19.8%.

3.2. Acceptability of Motives for Hunting

The hunters did not accept hunting for trophies or for the game meat (Table 1). However, they were mostly involved in hunting for contacting with nature, for the excitement, for socializing, and as a stress-reducing recreational activity. Both the male and the female non-hunters perceived hunting as a source of pride, reducing stress, offering excitement,

and promoting contact with nature and as providing opportunities to socialize and identify with hunters, while they did not accept hunting for trophies, recreation, and game meat. The differences between the hunters and non-hunters were significant with regard to all the statements on the acceptability of the motives for hunting, except for hunting as identity between hunters and both male and female non-hunters, hunting for trophies between hunters and male non-hunters, and hunting for meat between hunters and female non-hunters. The acceptance of hunting for meat was significantly lower in females than males.

Table 1. Comparisons regarding the acceptability of motives for hunting among hunters and non-hunters.

Motive Statements ^a Hunting Is Acceptable Because...	Hunters (<i>n</i> = 146)	Non-Hunters (<i>n</i> = 315)		<i>F</i> _{2,458}	Factor Loadings ^b	
		Male (<i>n</i> = 156)	Female (<i>n</i> = 159)		Hunters	Non-Hunters
It promotes contact with nature.	4.88 ± 0.38 ^A	3.77 ± 1.13 ^B	3.45 ± 1.25 ^B	84.803 ***	0.91	0.72
It is exciting.	4.69 ± 0.67 ^A	3.75 ± 0.96 ^B	3.65 ± 0.93 ^B	68.953 ***	0.93	0.62
It provides identity.	3.13 ± 1.41 ^A	3.31 ± 1.03 ^A	3.29 ± 1.10 ^A	2.314	0.69	0.65
It is an important means of socializing.	4.21 ± 1.09 ^A	3.45 ± 1.13 ^B	3.09 ± 1.14 ^B	32.472 ***	0.88	0.64
It is a source of pride.	3.42 ± 1.38 ^A	4.35 ± 0.73 ^B	4.06 ± 0.99 ^B	49.556 ***	0.80	—
It offers peace and quiet and helps in reducing stress.	4.81 ± 0.63 ^A	3.92 ± 0.93 ^B	3.66 ± 0.74 ^B	89.677 ***	0.93	0.66
It is a recreational activity.	4.77 ± 0.65 ^A	2.38 ± 1.61 ^B	2.09 ± 1.45 ^B	182.185 ***	0.75	0.83
It is done for collecting trophies.	1.83 ± 1.12 ^A	1.52 ± 0.98 ^{AB}	1.34 ± 0.78 ^B	8.465 ***	0.66	0.72
It provides meat.	2.00 ± 1.05 ^A	2.78 ± 1.37 ^B	2.26 ± 1.27 ^A	19.140 ***	0.69	—

^a Mean ± SD; 5-point scale: 1 (strongly disagree)–5 (strongly agree). *** *p* < 0.001. ^b Factor loadings were determined by principal component factor analysis for the hunter and non-hunter (males and females combined) groups. Note: one-way ANOVAs were used for comparisons. Means not sharing a common letter (A or B) are significantly different (*p* < 0.05; Tamhane post hoc tests with Bonferroni correction).

Overall, 70.5% of the hunters were positive, and 29.5% were neutral toward the motives for hunting (mean 3.75 ± 0.46 SD), while 27.4%, 66.3%, and 6.3 % of the male non-hunters were positive, neutral, and negative, respectively (3.25 ± 0.60), and 16.9%, 66.7%, and 15.4% of the female non-hunters were positive, neutral, and negative, respectively (2.99 ± 0.59). The differences were significant among all the groups (ANOVA *F*_{2,458} = 60.678, *p* < 0.001; *p* < 0.05, pairwise Tamhane post hoc tests with Bonferroni correction; Figure 2).

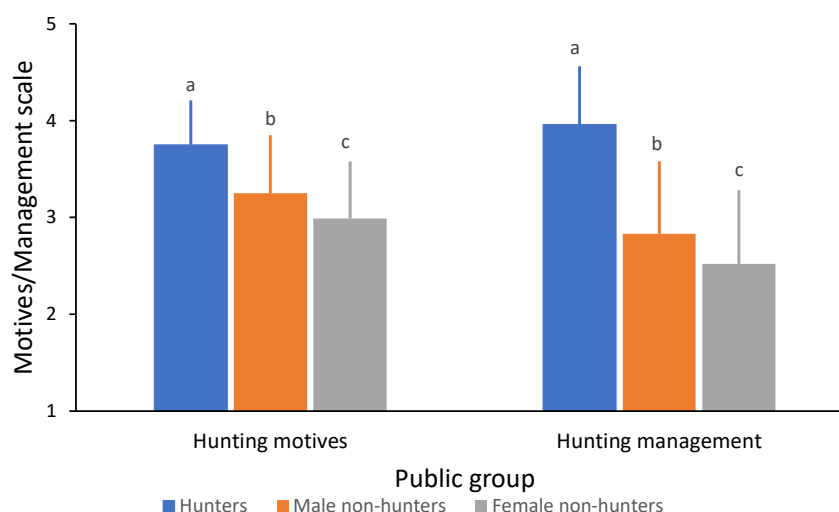


Figure 2. Comparisons of the acceptability of motives for hunting and attitudes toward hunting as a management tool (mean + SD) among hunters (*n* = 146), male (*n* = 156), and female (*n* = 159) non-hunters. In each public group, mean responses not sharing a lowercase letter (a, b, c) are significantly different (*p* < 0.05; pairwise Tamhane post hoc tests with Bonferroni correction).

The factor analysis determined one factor of the acceptability of the motives for hunting for: (a) hunters, including nine statements, with an eigenvalue of 5.9 and accounting for 65.6% of the common variance, and (b) non-hunters, including seven statements, with an eigenvalue of 3.4 and accounting for 48.1% of the common variance (Table 1). The Cronbach's α was 0.924 and 0.785 for the hunters and non-hunters, respectively. These factors were used in the subsequent analyses.

3.3. Attitudes toward Hunting as a Management Tool

Differences were significant in all the attitudes toward hunting as a management tool statements, except for the acceptance of hunting abundant game populations between hunters and male non-hunters (Table 2). Male and female hunters did not significantly differ in their attitudes toward hunting as a management tool, except for the acceptance of hunting abundant game populations and hunting as a wildlife habitat management tool. Overall, 81.5% of hunters were positive, and 18.5% were neutral toward hunting as a management tool (3.96 ± 0.60), while 24.2%, 33.7%, and 42.1 % of the male non-hunters were positive, neutral, and negative, respectively (2.83 ± 0.60), and 15.4%, 21.5%, and 63.1% of the female non-hunters were positive, neutral, and negative, respectively (2.52 ± 0.76). The differences were significant among all groups (ANOVA $F_{2,458} = 117.095$, $p < 0.001$; $p < 0.05$, pairwise Tamhane post hoc tests with Bonferroni correction; Figure 2).

Table 2. Comparisons of attitudes toward hunting as a management tool among hunters and non-hunters.

Attitude Statements ^a	Hunters (<i>n</i> = 146)	Non-Hunters (<i>n</i> = 315)		<i>F</i> _{2,458}	Factor Loadings ^c	
		Male (<i>n</i> = 156)	Female (<i>n</i> = 159)		Hunters	Non-Hunters
It is acceptable to hunt animals when their populations are abundant.	3.88 ± 1.11 ^A	3.55 ± 1.14 ^A	2.83 ± 1.23 ^B	35.767 ***	0.84	0.64
It is acceptable to hunt animals that were reared and released by people.	3.52 ± 1.50 ^A	2.84 ± 1.01 ^B	2.49 ± 1.09 ^B	30.497 ***	0.80	0.84
Hunting helps keep nature in balance.	4.21 ± 1.00 ^A	3.23 ± 1.21 ^B	2.86 ± 1.18 ^B	55.662 ***	0.92	0.65
Hunting helps reduce agricultural damage by reducing animal populations.	4.08 ± 1.17 ^A	3.00 ± 1.41 ^B	2.63 ± 1.27 ^B	60.763 ***	0.84	0.72
Hunting helps control predators such as foxes and martens.	4.13 ± 1.07 ^A	2.47 ± 1.49 ^B	2.51 ± 1.51 ^B	82.335 ***	0.82	0.79
Hunting commonly results in a species becoming threatened or endangered. ^b	3.77 ± 1.20 ^A	1.75 ± 0.91 ^B	1.80 ± 1.13 ^B	146.762 ***	0.62	0.65
Hunting helps control wildlife diseases by reducing animal populations.	4.02 ± 1.18 ^A	3.11 ± 0.79 ^B	2.89 ± 0.66 ^B	60.078 ***	0.78	—
Hunting provides funds used to manage other wildlife species that are not hunted.	3.94 ± 1.29 ^A	2.63 ± 1.44 ^B	2.26 ± 1.33 ^B	65.546 ***	0.85	0.83
The demand for hunting maintains wildlife habitats.	4.10 ± 0.93 ^A	2.92 ± 1.02 ^B	2.39 ± 1.00 ^C	116.385 ***	0.86	—

^a Mean \pm SD; 5-point scale: 1 (strongly disagree)–5 (strongly agree). ^b Reverse-coded. *** $p < 0.001$. ^c Factor loadings were determined by principal component factor analysis for the hunter and non-hunters (males and females combined) group. Note: one-way ANOVAs were used for comparisons. Means not sharing a common letter (A, B or C) are significantly different ($p < 0.05$; Tamhane post hoc tests with Bonferroni correction).

The factor analysis determined one factor of the attitudes toward hunting as a management tool for: (a) hunters, including nine statements, with an eigenvalue of 6.0 and accounting for 66.9% of the common variance, and (b) non-hunters, including seven statements, with an eigenvalue of 3.8 and accounting for 54.1% of the common variance (Table 2).

Cronbach's α was 0.938, and 0.752 for hunters and non-hunters respectively. These factors were used in the subsequent analyses.

3.4. Knowledge about Wildlife

The knowledge of hunters about the ecology and biology of wildlife species, both non-game (the first 10 statements in Table 3) and game (the last 10 statements in Table 3), was generally high for both the males and the females. On the other hand, wildlife knowledge was generally medium among non-hunters. The knowledge about wildlife was significantly higher for hunters than for non-hunters in 16 of the 20 statements, for both the males and the females, while gender differences were not observed between non-hunters in any of the knowledge statements (Table 3).

Table 3. Comparisons of knowledge about wildlife among hunters and non-hunters.

Knowledge Statements ^a	Hunters (<i>n</i> = 146)	Non-Hunters (<i>n</i> = 315)		<i>F</i> _{2,458}	Factor Loadings ^c	
		Male (<i>n</i> = 156)	Female (<i>n</i> = 159)		Hunters	Non-Hunters
Brown bears mostly eat meat. ^b	3.63 ± 1.30 ^A	3.54 ± 1.37 ^A	3.92 ± 1.25 ^A	1.077	—	—
Black storks nest in trees.	3.71 ± 0.65 ^A	2.75 ± 0.85 ^B	2.95 ± 1.08 ^B	31.766 ***	0.84	—
Common European adders are male nose-horned vipers. ^b	3.52 ± 1.02 ^A	2.93 ± 0.93 ^B	2.85 ± 0.85 ^B	22.375 ***	0.58	0.54
Eurasian otters are rodents. ^b	2.50 ± 1.21 ^A	2.27 ± 1.25 ^A	2.43 ± 1.36 ^A	1.002	0.61	0.59
Eurasian otters mostly eat cultivated seeds and fruits. ^b	4.35 ± 0.99 ^A	3.03 ± 1.19 ^B	2.66 ± 1.09 ^B	103.861 ***	—	0.52
Northern, white-breasted hedgehogs mostly eat leaves and grasses. ^b	3.25 ± 1.48 ^A	2.16 ± 0.95 ^B	2.28 ± 1.00 ^B	39.597 ***	—	0.50
Red foxes might carry rabies	4.54 ± 0.94 ^A	4.36 ± 0.74 ^A	4.32 ± 0.81 ^A	1.381	0.73	—
Red and roe deer shed their antlers each year.	4.38 ± 0.97 ^A	3.23 ± 1.12 ^B	3.09 ± 1.43 ^B	49.912 ***	0.65	0.63
Roe deer are monogamous.	2.52 ± 1.16 ^A	2.73 ± 1.18 ^A	2.92 ± 1.15 ^A	1.945	—	0.53
Turtles are a common sight in winter. ^b	3.90 ± 1.40 ^A	2.24 ± 1.09 ^B	2.23 ± 0.96 ^B	89.655 ***	0.77	0.67
Brown hares nest in burrows. ^b	3.77 ± 1.64 ^A	2.33 ± 1.29 ^B	2.51 ± 1.45 ^B	43.714 ***	—	0.53
Female brown hares give birth to one young each year. ^b	4.56 ± 1.02 ^A	3.88 ± 1.26 ^B	3.80 ± 1.38 ^B	22.587 ***	—	0.56
Ducks feed during the day and sleep during the night. ^b	4.12 ± 1.23 ^A	2.34 ± 1.20 ^B	2.54 ± 1.25 ^B	98.231 ***	0.67	0.59
Female ducks have colorful plumage. ^b	4.48 ± 1.00 ^A	3.40 ± 1.27 ^B	3.65 ± 1.32 ^B	35.901 ***	0.57	—
Eurasian woodcocks prefer wet, densely vegetated habitats.	4.79 ± 0.54 ^A	3.72 ± 1.03 ^B	3.75 ± 0.97 ^B	76.066 ***	0.68	—
Rock partridges are galliforms.	4.40 ± 0.87 ^A	3.65 ± 0.88 ^B	3.58 ± 0.97 ^B	37.197 ***	0.81	—
Rock partridges form pairs at the end of winter.	4.10 ± 0.85 ^A	2.91 ± 0.64 ^B	2.89 ± 0.72 ^B	134.868 **	—	0.59
Turtle doves are migratory birds.	4.71 ± 0.89 ^A	3.43 ± 1.15 ^B	3.68 ± 1.11	73.934 ***	—	—
Wild boars can mate with domestic pigs.	4.56 ± 0.83 ^A	3.35 ± 1.12 ^B	3.26 ± 0.96 ^B	78.025 ***	0.77	0.65
Wild boars take mud baths to cool themselves. ^b	2.85 ± 1.67 ^A	1.90 ± 0.91 ^B	2.08 ± 1.04 ^B	22.342 ***	0.83	—

^a Mean ± SD; 5-point scale: 1 (strongly disagree)–5 (strongly agree). ^b Reverse-coded. ** $p < 0.01$. *** $p < 0.001$.

^c Factor loadings were determined by principal component factor analysis for the hunter and non-hunter (males and females combined) groups. Note: one-way ANOVAs were used for comparisons. Means not sharing a common letter (A or B) are significantly different ($p < 0.05$; Tamhane post hoc tests with Bonferroni correction).

The overall knowledge about wildlife was high for hunters with regard to game species (4.23 ± 0.55), non-game species (3.63 ± 0.50), and for all species (3.93 ± 0.46) (Figure 3). Conversely, wildlife knowledge was generally medium for non-hunters (male: 3.09 ± 0.36 , 2.92 ± 0.33 , 3.01 ± 0.28 ; female: 3.17 ± 0.42 , 2.97 ± 0.38 , 3.07 ± 0.32 for game, non-game, and all species, respectively). The differences in knowledge about wildlife were significant between hunters and both male and female non-hunters for game, non-game, and all species (all $F_{2,458} > 127.071$, $p < 0.001$; $p < 0.05$, pairwise Tamhane post hoc tests with Bonferroni correction). In contrast, the differences in knowledge about wildlife between

male and female non-hunters were not significant for game, non-game, and all species ($p > 0.05$, pairwise Tamhane post hoc tests with Bonferroni correction).

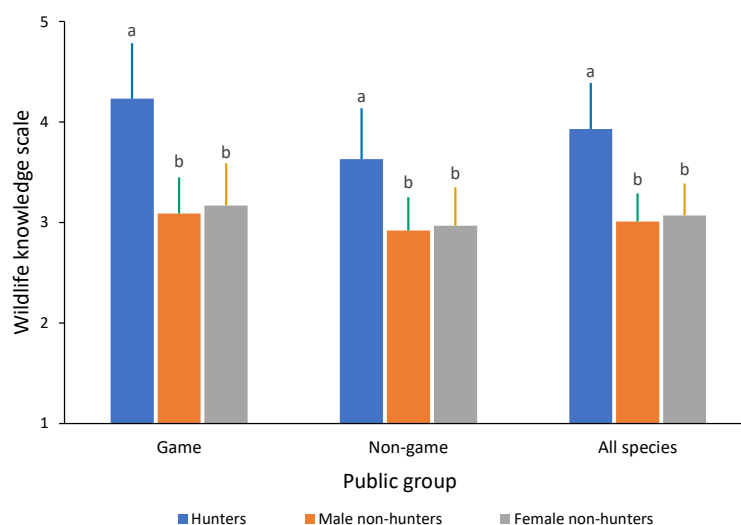


Figure 3. Comparisons of knowledge about wildlife (mean + SD) among hunters ($n = 146$) and male ($n = 156$) and female ($n = 159$) non-hunters, by game species (10 statements), non-game species (10 statements), and all species (20 statements). In each species group, mean responses not sharing a lowercase letter (a, b, c) are significantly different ($p < 0.05$; pairwise Tamhane post hoc tests with Bonferroni correction).

Within the groups, knowledge was significantly higher for game than for non-game species among the hunters (paired $t_{145} = -14.285$, $p < 0.001$) and male (paired $t_{155} = -5.543$, $p < 0.001$) and female (paired $t_{158} = -5.139$, $p < 0.001$) non-hunters.

The factor analysis determined one factor of knowledge about wildlife for: (a) hunters, including 12 statements, with an eigenvalue of 6.1 and accounting for 50.6% of the common variance, and (b) non-hunters, including 12 statements, with an eigenvalue of 4.0 and accounting for 33.3% of the common variance (Table 3). The Cronbach's α was 0.854 and 0.712 for hunters and non-hunters, respectively. These factors were used in the subsequent analyses.

3.5. Effects of Sociodemographic Factors

Multicollinearity among the independent variables was not detected in all the multiple regression models, with VIF values of 2.579 or lower. The hunters that were more highly motivated, more knowledgeable about wildlife, and had more years of hunting experience also held more positive attitudes toward hunting as a management tool than those with a lower motivation for hunting, less wildlife knowledge, and less hunting experience (Table 4). Hunters with more hunting experience had higher knowledge about wildlife than those with less hunting experience.

The non-hunters that were older, had higher acceptance of hunting motives, had more knowledge about wildlife, ate game, and had hunters in their family or as friends were more positive toward hunting as a management tool than younger females, who did not eat game meat and did not have hunters in their family or as friends. Older, male non-hunters, with more wildlife knowledge, and with hunters in their family or as friends had more acceptance of the motives for hunting than those that were younger, female, had less knowledge about wildlife, and did not have hunters in their family or as friends. Older, more educated non-hunters with hunters in their family or as friends had more wildlife knowledge than those who were older, less educated, and did not have hunters in their family or as friends.

Table 4. Relationships between the attitudes toward hunting as a management tool, the acceptability of motives for hunting, wildlife knowledge, and sociodemographic factors, as assessed by hunter and non-hunter groups.

	Hunters (<i>n</i> = 146)			Non-Hunters (<i>n</i> = 315)		
	Hunting and Management	Hunting Motives	Wildlife Knowledge	Hunting and Management	Hunting Motives	Wildlife Knowledge
Hunting motives	0.388 ***	-	-	0.489 ***	-	-
Wildlife knowledge	0.208 ***	0.056	-	0.208 ***	0.134 *	-
Age	-0.078	-0.028	-0.016	0.244 ***	0.558 ***	0.521 ***
Gender (female)	-	-	-	-0.123 *	-0.147 *	0.076
Education (higher)	0.061	0.007	0.057	-0.05	0.033	0.234 ***
Pet ownership	0.373 ***	0.023	0.074	0.001	-0.009	0.031
Eat game	-	-	-	0.118 *	0.074	-0.027
Hunters' kin/friends	0.078	0.205 ***	0.075	0.109 *	0.151 *	0.172 **
Hunting experience	0.279 ***	0.054	0.329 ***	-	-	-
Constant	1.569	3.933 ***	4.184 ***	0.873 **	1.351 ***	1.991 ***
adj. <i>R</i> ²	0.337	0.194	0.219	0.715	0.527	0.290

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Note: multiple linear regression models were used. Dummy variables: gender (female = 1), education (higher = 1), pet ownership (yes = 1), eat game (yes = 1), hunters' family/friends (yes = 1). Standardized regression coefficients and adjusted R^2 are given.

4. Discussion

4.1. Attitudes toward Hunting

Greek hunters were generally highly motivated toward hunting, considering their pastime as a valuable wildlife management tool. In contrast, most non-hunters, both male and female, were neutral in the acceptance of the motives for hunting and displayed negative attitudes toward hunting as a management tool. Their opinions were significantly more negative than those of the hunters for both hunting motives and management. The results from other similar studies indicated that the attitudes toward hunting are related to its purpose. Ljung et al. [34], in a study in Sweden, reported that 80% of non-hunters had a favorable attitude toward hunting. This rate of approval was strongly associated with game meat consumption. We also asked about hunting in general, and meat consumption was also positively associated with attitudes toward hunting in our study. Furthermore, Ljung et al. [34] did not study male and female non-hunters separately; however, their sample's gender composition was similar to ours (49% male); hence, our datasets could be compared. In our sample, 21% of non-hunters, including males and females, had positive attitudes toward hunting, with most being negative (51%), and 23% accepted the motives for hunting, with most being neutral (67%). In a Danish study, the majority of non-hunters had a positive attitude toward recreational hunting (43%), while 25% displayed negative attitudes [35]. In Denmark again, only 25% of non-hunters expressed a positive attitude toward recreational hunting [17]. Grandy et al. [45] reported that in the U.S. the approval for hunting for meat was higher than 80%; the approval for hunting for recreation and meat was a little higher than 60%, while approval for hunting only for recreation was below 40%. Ljung et al. [34] also reported that 63% of non-hunters considered hunting for "sport and recreation" cruel. In responses to specific statements, 66%, 90%, and 61% of non-hunters rejected recreation, sport, and game meat procurement as motives for hunting. In contrast, the vast majority of Greek hunters declared that they hunted for recreation (98%) and not for sport (12%) or the game meat (10%). As hunting is a recreational activity in Greece and at the same time the main way for procuring game meat, we consider the results from similar European countries to be comparable to ours. These results suggested that the attitudes toward hunting are more negative in Greece compared to other, mainly European, countries. Hunting is a complex social phenomenon and several factors, such as differences in hunting tradition, culture and management, and game meat use (non-commercial in Greece, commercial in other countries) might explain the observed differences, but not before further research.

Both the hunters and the non-hunters ranked similar hunting motives (i.e., contact with nature, excitement, and socializing) and management functions (i.e., keeps nature in balance and helps control wildlife diseases) as the most important. Other studies that compared hunting attitudes between hunters and non-hunters also reported differences in the perception of hunting motives and management functions and similarities in the rankings of the hunting motives and management functions that were similar to our findings [15,16]. Hunters of other European countries and of North America also see themselves as stewards of nature [46,47]. Hunters participated in other outdoor activities, both consumptive (e.g., berry picking and fishing) and non-consumptive (e.g., birdwatching and hiking), more often than non-hunters [48]. Cooper et al. [49] found that public groups with an interest in wildlife, such as hunters, were 4–5 times more likely than those with no such interest to participate in pro-environmental behaviors.

Hunting has helped in mitigating agricultural damage by regulating overabundant wildlife populations [5,7,50,51]. In other cases, hunting was responsible for the considerable decline of wildlife populations and for biodiversity loss [52]. Hunters often engage in wildlife conservation and management, especially when game species are involved [26,27]. Furthermore, they are more positive toward wildlife management when the game species are not negatively affected. Kontsiotis et al. [18], in a study of the public opinion in the region of eastern Macedonia and Thrace, north Greece, found that hunters were less willing to accept management strategies involving the reduction in the game wild boar (*Sus scrofa*) than of the non-game European badger (*Meles meles*) populations, when both damage crops. Similarly, hunters in central Italy accepted non-lethal and rejected lethal strategies to prevent wild boar damage to crops [53].

4.2. Knowledge about Wildlife

Hunters had greater knowledge about the ecology, biology, and behavior of wildlife species, both game and non-game, than non-hunters. Kellert [20] measured the public's knowledge about predatory animal species. In the survey, he included, among others, questions about the taxonomy, biology, superstitions, and folk knowledge concerning wildlife. His results revealed that hunters had great knowledge of predators, similar to that of birdwatchers and environmental protection organization members. In contrast, anti-hunters and zoo enthusiasts, although they expressed strong affection and support for protecting predators, had relatively low knowledge about them. As hunters participate in outdoor activities, both consumptive and non-consumptive, more than non-hunters, they have the opportunity for a hands-on experience of nature and wildlife and gain direct knowledge about several aspects of the life history of wildlife species, both game and non-game [48]. Zoo enthusiasts might focus their interest on the exotic species that zoos most often host.

4.3. The Effect of Sociodemographics

The acceptability of the hunting motives and knowledge about wildlife were positively associated toward hunting for managing wildlife, for both hunters and non-hunters. Hunters are consumptive users of wildlife that gain knowledge through experience. Moreover, the more experienced among hunters are more strongly attached to their favorite pastime [54]. Non-hunters hold variable utilitarian and animal rights convictions [55]. It seems that increasing knowledge about wildlife and the associated management issues shifts the balance toward human benefits instead of animal welfare, resulting in higher support for hunting. Having friends or family members who hunt positively affected the acceptability of the hunting motives for both hunters and non-hunters, as well as attitudes toward hunting as a management tool for non-hunters. Previous research also found similar trends, suggesting that social interactions with hunters positively affect attitudes toward hunting [34–36]. These studies also concluded that, because socializing is an important motive for hunting, those with hunters in their social network are more likely to become

hunters and to be more attached to their activity as they have the opportunity to hunt in close-knit groups.

Hunting experience positively affected the hunters' attitudes toward hunting as a management tool. In [56], it was found that more experienced hunters were more efficient in bagging willow grouse (*Lagopus lagopus*) than less experienced hunters. Harvest success was directly related to satisfaction with white-tailed deer (*Odocoileus virginianus*) management in Pennsylvania [57]. The more experienced hunters also had more knowledge about wildlife species. The more time someone spends in the outdoors, the more experiential knowledge about the ecology, biology, and behavior of wildlife species they gain [15,32,33].

Older non-hunters had more positive attitudes toward hunting motives and hunting as a management tool than younger people. Females were more negative toward hunting as a management tool and hunting motives than males. Previous research also found that older age is positively associated and female gender is negatively associated with hunting [15,32,33]. Non-hunters who eat game meat were more positive toward hunting as a management tool than those who do not. Game meat consumption was an important reason for the positive attitudes toward hunting expressed by non-hunters in Sweden, where it is legally sold [34]. However, the sale of game meat is illegal in Greece and can only be accessed through friends and family. Older, more educated non-hunters who had friends or family members who hunt were more knowledgeable about wildlife. Experience comes with age, while education has been related to an increased interest in wildlife and support for wildlife conservation and management [58,59]. Socializing with hunters allows non-hunters to learn about wildlife species, both game and non-game, through the narration of outdoor ventures [34–36].

4.4. Management Implications

Attitudes toward hunting were controversial, being more positive for Greek hunters than for non-hunters. For example, the hunters stated that they hunt mostly for recreation, while non-hunters largely rejected hunting as a recreational activity but justified it for meat procurement. Moreover, participation in hunting has declined in Greece [37,38] and is predicted to continue to decline because of the continually increasing rates of urbanization and the consequently greater proportion of the public subscribing to mutualism value orientations toward wildlife [13,14,39]. Wildlife managers must adapt to this change. The necessary funds for wildlife conservation and management should be collected through the promotion of other, non-consumptive outdoor activities, such as wildlife watching and photography. Outreach programs should aim at informing public groups about good hunting practices and the utility of hunting for addressing specific wildlife issues. Our findings suggested that priority groups for outreach programs should be anti-hunters and young females without connections with hunters and with little knowledge about wildlife and wildlife-related issues. Such information should reduce the controversy among the stakeholders and allow for the successful management of the conflicts concerning the good practice of hunting and its use as a management tool.

Our findings also revealed that hunters had a greater knowledge than non-hunters about wildlife, both game and non-game. As the participation in hunting is currently declining and expected to further decline [13,14] and also because people are disconnected from nature due to urbanization, an ever-decreasing proportion of the population will acquire experiential knowledge about wildlife and understand nature and wildlife-related problems [48]. This may result in weaker attitudes toward environmental issues and therefore in fewer people acting as advocates of nature and wildlife. The alienation from nature and wildlife is also responsible for the deterioration of human health and well-being [21,22]. Therefore, there is an urgent need for wildlife managers to act to stop and reverse these trends and thus secure support for wildlife conservation and management and improve human health and well-being. Educational programs should aim at increasing the public's knowledge about the ecology, biology, and behavior of wildlife species [60]. Research has shown that outdoor educational programs involving experiential activities

increased wildlife knowledge and improved attitudes toward wildlife species [61–64]. Therefore, environmental educators should aim at introducing urban people to outdoor activities that would allow for the increase in wildlife knowledge, improving health and well-being and reinforcing nature and wildlife stewardship through direct experience thereof (e.g., wildlife watching, photography, and animal tracking through the seasons). In this context, hunters could be used as educators to teach people how to experience nature and wildlife. This contact of hunters with non-hunters could also reduce the antipathy toward hunters and hunting.

5. Conclusions

We used several statements to reveal the differences in the acceptance of the motives for hunting and of hunting as a management tool and in the knowledge about wildlife among hunters and non-hunters. Hunters had high motivations for hunting, which they also considered as a valuable management tool. On the other hand, both male and female non-hunters were significantly more negative than hunters in their acceptance of the motives for hunting and in their attitudes toward hunting as a management tool. In addition, hunters had greater knowledge about wildlife species than non-hunters. Our findings suggested that hunting is highly controversial between hunters and non-hunters in the Greek society and as such they would be valuable for wildlife managers and policy makers in their efforts to manage this conflict. Further research on the perceptions and knowledge of specific public groups, such as vegetarians and outdoor enthusiasts, would also help reaching better decisions.

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