

Presence of Elk in Czech Republic Wilderness from Adolescent Pupils Perspective

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Abstract

In the presented study, we examined the way pupils from different types of schools perceive the presence of European elk (*Alces alces*) and looked for variables that may influence their perception. For this purpose, we chose the form of a questionnaire survey with subsequent evaluation in the Jamovi program. The questionnaire survey included an attitudinal and a knowledge part. The attitudinal part was further divided into three components. The components were labelled the perception of Elk, which is also considered to be a dependent variable, the component of fear as a physical threat resulting from the presence of Elk, and the component of interest that students show in Elk. We used linear regression to determine the relationship between these components, socio-demographic items, and knowledge test scores. Based on this regression, we are going to demonstrate that pupils' attitudes change depending on their interest in European elk and also their fear of the species.

Keywords

European elk, Pupils' attitudes, Fear, Environmental Education, Conservation, Acceptance, Re-introduction

Abstrakt

V předložené studii jsme zjišťovali, jak žáci z různých typů škol vnímají přítomnost losa evropského (*Alces alces*), a hledali jsme proměnné, které toto vnímání mohou ovlivňovat. K tomuto účelu jsme zvolili formu dotazníkového šetření s následným vyhodnocením v programu Jamovi. Dotazníkové šetření obsahovalo část postojovou a znalostní. Postojová část byla dále rozdělena do tří složek. Složky byly označeny jako vnímání losa, což je zároveň považováno za závisle proměnnou, dále složka strachu, jakožto fyzického ohrožení vyplývající z přítomnosti losa a složka zájmu, který žáci o losa projevují. Pomocí lineární regrese jsme hledali závislost mezi těmito složkami, sociodemografickými položkami a výsledkem znalostního testu. Na základě této regrese zde ukazujeme, že postoje žáků se mění v závislosti na jejich zájmu o losa evropského a také strachu z tohoto druhu.

Klíčová slova

Los evropský, postoje žáků, strach, environmentální výchova, ochrana přírody, akceptace, re-introdukce

Introduction

The organization and sustainability of reintroduction efforts (reintroductions and other conservation translocations) and the management of spontaneous vertebrate returns have gradually become a very demanding political-scientific challenge. This is both in terms of international cooperation and funding, as well as the less mentioned but nonetheless important phase of supporting the dissemination of scientifically sound information and surveying public opinion and attitudes (Lee & Miller, 2003; Røskaft et al., 2003; Prokop & Fančovičová, 2010; Sernert, 2011; IUCN/SSC, 2013; Ewen et al., 2014; Morris et al., 2021; Soorae, 2021). In the first instance, these concern the species that are directly affected by reintroductions and spontaneous returns which take place for example near the respondents' residences or on their land, as well as foresters and hunters to whom these species encroach on their forest units and hunting grounds and may cause damage (e.g., Bavin et al., 2020).

To a significant extent, the availability of information also concerns pupils whose attitudes towards this issue are still being formed (Urban, 2015). It appears that the knowledge of and the awareness of each species can alleviate fear and apprehension. This can ultimately contribute to the prevention of human-wildlife conflicts in nature. Indeed, the public opinion ultimately plays a large role (Liska, 1999; Røskaft et al., 2003; Prokop & Fančovičová, 2010) and can contribute greatly to the failure of long-standing reintroduction efforts.

The implementation of these topics in the classroom subsequently helps students to understand biodiversity (Menzel & Bögeholz, 2009). Indeed, biodiversity conservation issues have both local and global dimensions (Madden & McQuinn, 2014) and can therefore contribute to the development of a positive perception of biodiversity (Grace, 2009).

In our research, we focused on the European elk (*Alces alces*), which is rarely found in the Czech Republic and is less frequently mentioned in the media than, for example, large carnivorous or piscivorous bird species. Although, it does not stand at the top of the food chain, it is a large animal whose presence can be a cause for concern (Prokop & Kubiátko, 2008). It is therefore important to understand human fears, concerns, and opinions about the whereabouts of this species, whether within the state, the region in which the person confronted with its presence lives, or in the immediate vicinity of human dwellings.

This research complements our initial study (Andreska et al., 2019), in which we outlined, among other things, the attitudes of grammar school and secondary forestry school students toward selected vertebrate species. This time, we designed the research in a completely different manner. Firstly, it was much more extensive in the attitudinal part, and secondly, we narrowed it down to only one of the vertebrate species returning to the Czech Republic, namely the European elk. In the previous study, we concluded that the difference in perceptions of the presence of Elk among students was clear and that negative perceptions prevailed among foresters for reasons not easily explained (Andreska et al., 2019). Therefore, we decided to clarify those reasons. In addition, we now add the attitudes of primary school students to also get a more comprehensive picture of the perception of Elk among younger students.

Thus, the aim of this study was to try to uncover latent variables that may influence pupils' attitudes towards Elk, and to test whether there is a statistically and substantively significant difference between primary school, grammar school, and secondary forestry school pupils in their attitudes towards the European elk.

European elk - theoretical background

The European elk inhabits moist swamp forests in lowlands and uplands, avoiding steep slopes; it is rarely found in the Czech Republic. Existential conditions for its occurrence are both sufficient food resources and minimal disturbance (Romportl et al., 2017).

As a regularly breeding animal, it disappeared from the Czech lands very probably already during the reign of the Luxembourgers (Andreska & Andresková, 1993). As with other large mammal species, the return of the Elk has been facilitated by the regional protection of a relict population. After World War II, Poland took a consistent approach to save the highly endangered Elk population. In 1949, a preserve was created for Elk in Puzcsze Kampinoska, west of Warsaw. In there, the Elk multiplied rapidly and in 1956, the release of elk into the wild began. Outside the preserve, the number of Elk in Poland has also been increasing, with the number reported as of 2015 being approximately 6,000 individuals (Andreska & Andreska, 2015). The Polish population became a source of migrants that very soon penetrated our territory. The first occurrence near Litoměřice is dated to 1957 (Andreska & Andreska, 2015).

In 1974, reproduction was first documented (Andreska, 1988) and the number of elks gradually increased (Homolka, 1998). The turning point came after 1989 when the military-technical border protection measures, which prevented especially young elk from crossing the border, were dismantled and an outflow of elk to Austria and Bavaria occurred. In Austria, they were immediately hunted by forest owners, as they allegedly caused damage (Ševčík, 1994; Mrlík, 1998; Janík et al., 2021). The results of a study in which the authors collected 771 records of Elk sightings and deaths in the borderlands of the three countries (Austria, Germany and the Czech Republic) from 1958 to 2019 showed a progressive increase in Elk sightings after 1958, with peaks in the 1990s and around 2010, followed by a relatively sharp decline after 2013 (Janík et al., 2021).

From the perspective of modern foresters, the presence of Elk can be perceived as damaging to the forest beyond any doubt (therefore, based on Act No. 115/2000 Coll., on the provision of compensation for damage caused by selected specially protected animals, as amended, the state also covers damage caused by European elk). However, the Elk are not dangerous to humans, e.g., Sernert (2011) in his study states that there are no documented relevant cases of Elk attacks on humans.

In addition, due to the shyness of Elk, their presence is not very noticeable in the landscape they permanently inhabit. Encounters with humans have only occurred in the form of collisions with road and, in some places, rail traffic (Janík et al., 2021). These collisions are very likely the cause of the decline in numbers or even extinction of Elk populations in some regions where breeding populations have formed, such as in the Tabor or Poděbrady regions (Andreska, 2017). See Chart 1 for examples of collisions with Elk.

Chart 1: Examples of collisions with European elk

1974	two Elk observed in Břežany u Prahy	one was hit by a train in 1975
1985	a collision with an Elk in the J. Hradec – Jarošov section	the hit Elk survived
1993	in the vicinity of Veselí nad Lužnicí in the direction of Č. Budejovice	a collision with an Elk that didn't survive
2003	near Přední Výtoň	a collision with an Elk that didn't survive
2009	near Hodkovice nad Mohelkou	a collision with an Elk that didn't survive
2009	near České Velenice	a collision with an Elk that didn't survive
2017	Šumava	three car accidents with elks

The last area in the Czech Republic where the European Elk is expected to be permanently present is on the right side of the Lipno water reservoir, which is usually delimited by the border with Austria in the south, the right bank of the reservoir in the north, the former village of Kapličky in the east and the settlement of Svatý Tomáš in the west. This area covers approximately 100km square, Elks find shelters there throughout the year, and their current numbers are estimated at 10-20

individuals (Romportl et al., 2017; Janík et al., 2021). Despite all the protection the Elks receive, their numbers and distribution in this area are stagnant or declining (Schönfeld, 2009; Romportl et al., 2017).

Methodology

The data were obtained from a questionnaire survey of a total of 1,172 pupils from all regions of the Czech Republic, including 656 pupils (353 girls and 303 boys) from the ninth grade of primary schools, 324 pupils (212 girls and 112 boys) from the final year of grammar schools and 192 pupils (70 girls and 122 boys) from secondary forestry, fishing, or agricultural schools.

Data collection

Online questionnaires were circulated via the Google Forms application at the end of the calendar year 2021. A total of 60 teachers across the country, who had previously collaborated with the authors and were willing to participate in their survey, were contacted. The teachers then asked 9th-grade pupils, grammar school, and secondary forestry school students to complete the questionnaires during their classes or as voluntary homework. There was no time limit to complete the questionnaires. It was explained to all pupils at the beginning that the test was informative only and that it would not be graded in any way and the result would not affect their school grades.

Research tool

The questionnaire consisted of three functional blocks, namely the socio-demographic, attitudinal, and knowledge parts.

The socio-demographic part of the questionnaire included general questions about gender, age, the region where the pupil lived, whether the pupil lived in a town or a village, whether the pupil owned a pet, and whether the pupil owned a farm animal. The first part of the questionnaire also included a question about the pupil's relationship to science or biology.

The development of the attitudinal section of the questionnaire was inspired by the research of Bath et al. (2008); Tomažič (2011); Tomažič & Šorgo, (2017) and Randler et al. (2020), see Chart 2.

The items in the attitudinal part of the survey were divided into three components, which we pre-set. These items aimed to measure the affective component of attitude involving emotions. Furthermore, the students' interest in the species was also examined using a 5-point Likert scale, on which No. 1 meant I agree with the statement, No. 2 I partially agree, No. 3 I don't know or I am not sure, No. 4 I partially disagree with the statement and No. 5 I completely disagree with the statement. The individual items, divided into three components, are shown in Chart 2.

Chart 2: Items from the second part of the attitudinal questionnaire

Attitudinal components of the questionnaire survey	Items	Adapted and adjusted using:
Perception of European elk (dependent variable)	<i>1. It would be best if this species were (again) exterminated.</i>	Bath et al. (2008); Tomažič (2011); Tomažič & Šorgo, (2017); Randler et al. (2020)
	<i>2. There is no need to protect this species in the Czech Republic.</i>	
	<i>3. This species should not be found near human habitation.</i>	
	<i>4. This species should not be protected because it causes damage in nature and needs to be regulated.</i>	
	<i>5. This species is a vector of disease and its population should be extensively regulated</i>	
	<i>6. I'm afraid I'm going to get some kind of human-transmitted disease from this species.</i>	
	<i>7. In the Czech Republic, this species should be preserved for future generations.</i>	Randler et al. (2020)
	<i>8. The presence of this species is very important for nature</i>	Randler et al. (2020)
	<i>9. It would upset me if all of a given species were wiped out in the Czech Republic.</i>	Randler et al. (2020)
	<i>10. I don't like this species because it can kill or endanger animals that people keep.</i>	Bath et al. (2008)
Fear (physical threat resulting from an encounter with the species)	<i>11. I would be afraid to go through the woods or to the water if I knew this species lived there.</i>	Bath et al. (2008); Tomažič (2011); Tomažič & Šorgo, (2017); Randler et al. (2020)
	<i>12. I'd rather see a movie about this species than meet it in the wild.</i>	
	<i>13. I would only camp in a place where this species does not live.</i>	
	<i>14. I'm afraid of this species.</i>	
	<i>15. I would accept the presence of this species near my area.</i>	Randler et al. (2020)
Interest in nature (specifically European elk)	<i>16. I get bored when we learn about this species at school.</i>	Tomažič & Šorgo, (2017); Randler et al. (2020)
	<i>17. I like to watch educational programs about this species.</i>	

	<i>18. I like to read about this species.</i>	
	<i>19. I would like to know where this species lives.</i>	
	<i>20. I would like to know more interesting facts about this species.</i>	

The knowledge part of the questionnaire survey included general knowledge about the biology and ecology of the European elk and was measured by a knowledge test consisting of 5 questions, which are listed in Chart 3. Correct answers are highlighted in bold.

Chart 3: Knowledge part of the questionnaire. Correct answers are marked in bold.

Which characteristic belongs to the Elk?
The male has massive shovel-shaped or perch-like antlers, is more robust and lives alone.
Both males and females have flattened antlers, which they shed, and live in herds.
The female does not have flattened antlers.
Both males and females have flattened antlers, which they shed, and live alone.
I don't know.
The Elk lives mostly...
in herds.
alone.
in pairs.
in herds in winter and in pairs in summer.
I don't know.
Elk in the Czech Republic...
occurs sporadically.
is not present as it was exterminated.
does not and never has occurred.
occurs commonly in forests.
I don't know.
The Elk is...
the largest of the deer family.
as big as a deer.
as big as a deer.
the smallest of the deer family.
I don't know.
Elk mostly feed on...
plant food.
tree bark only.
as they are grazing in meadows.
leaves and leaves only.
I don't know.

Statistical methods

The results of the questionnaire survey were processed in Jamovi. Reliability was verified using the Cronbach's alpha coefficient. Cronbach's alpha was calculated for all three components of the attitudinal part, and for the knowledge part.

For the components of the attitudinal part, listed in Chart 2, indexes were calculated, which are treated as individual variables below. These indexes were calculated as averages of the values of the attitudinal components as expressed by each student's responses.

The calculated indexes for all three types of schools were then compared using ANOVA. The relationship of the results to the socio-demographic items was also assessed. The next step was to determine the correlations primarily between the attitudinal components and the knowledge test scores. Linear regression was used to model the relationship between the variables to determine the effect of these variables on each other.

The results obtained were assessed from two perspectives, namely whether they were statistically significant, i.e., whether the results of the statistical test were significant at the confidence level of $p < 0.001$, and substantively significant, where the main value assessed was the value of the correlation coefficient (R), where in this paper $R \geq 0.3$ was considered significant. Values in the interval $< 0.1; 0.3$) were also considered but not assessed as substantively significant. If the results were statistically and substantively significant, they were considered significant and are discussed further in the Discussion section.

Results

Calculated indexes

The calculated indexes from the individual components obtained from the attitudinal parts of the questionnaire survey for each type of school are provided in Chart 4, where it is obvious that they are very evenly balanced and differ by only one-tenth.

Chart 4: Calculated indexes from the attitudinal parts of the questionnaires.

School	Primary school	Grammar school	Foresters and fishermen
Elk perception index	1.79	1.52	1.70
Cronbach's alpha	0.797	0.706	0.785
Fear index	3.12	3.24	3.34
Cronbach's alpha	0.828	0.829	0.839
Interest index	2.32	1.83	1.86
Cronbach's alpha	0.831	0.836	0.810

Knowledge test results

Figure 1 shows the average result of the knowledge test. It shows that students answered on an average 2.5 questions correctly. Foresters and fishermen had the worst and grammar school students the best results.

Figure 1: Average knowledge test results

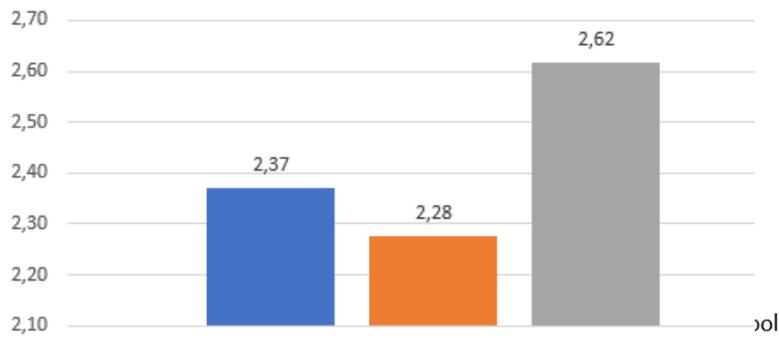


Figure 2, 3, and 4 show the influence of pupils' characteristics - region and gender - on their perceptions of the European Elk.

Figure 2: Influence of the region on the perception of Elk South Bohemia=1; South Moravia=2; Karlovy Vary=3; Hradec Kralove=4; Liberec=5; Plzeň=6; Olomouc=7; Pardubice=8; Moravian-Silesian=9; Prague=10; Central Bohemia=11; Ústí=12; Vysočina=13; Zlín=14.

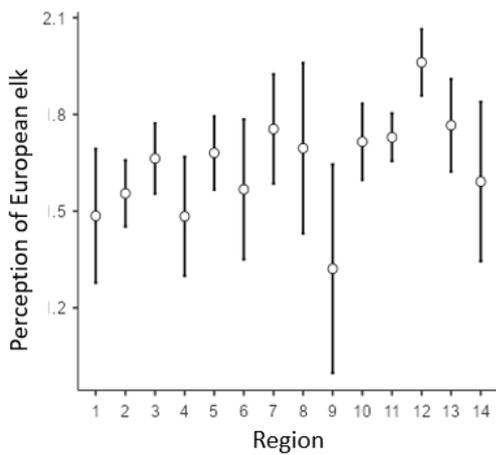


Figure 3: Effect of gender on fear of Elk, by school type

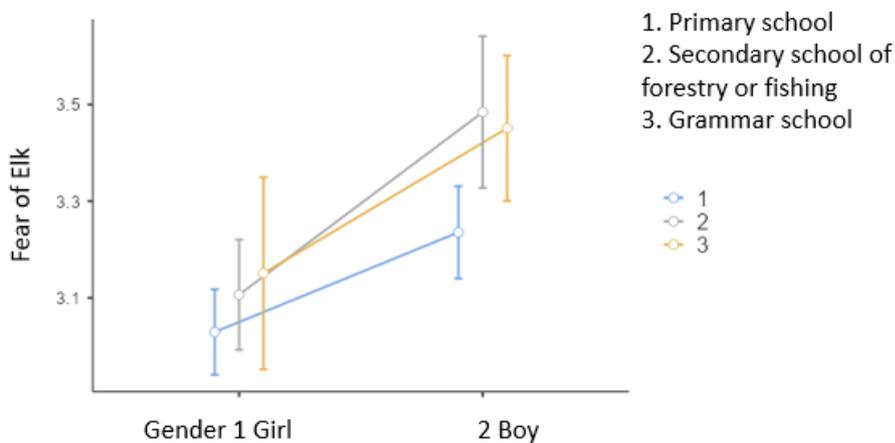


Figure 4: Effect of gender on perceptions of Elk, by school type

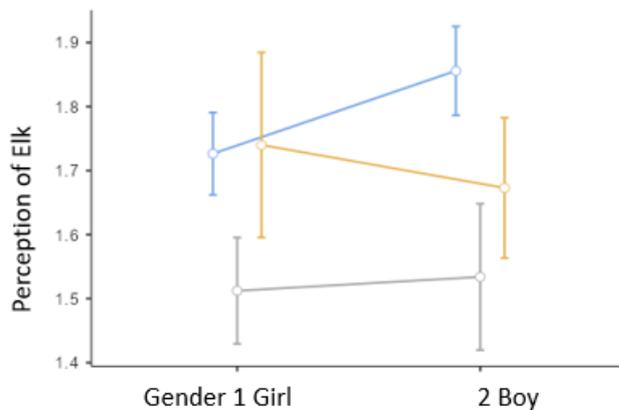


Chart 5 shows the calculated correlation matrix (statistically significant correlations are indicated by three asterisks and substantively significant correlations are indicated in bold), which shows that the correlation is evident for liking science and interest in Elk.

Chart 5: Correlation matrix between the individual items of the socio-demographic part of the questionnaires, attitudinal dimensions, and the fact whether the student enjoys science or biology

	PERCEPTION	FEAR	INTEREST	KNOWLEDGE
PERCEPTION	-			
	-			
FEAR	-0.366***	-		
	< 0.001	-		
INTEREST	0.421***	-0.180***	-	
	< 0.001	< 0.001	-	
KNOWLEDGE	-0.152***	0.099***	-0.087**	-
	< 0.001	< 0.001	0.003	-
The popularity of biology	0.269***	-0.146***	0.435***	-0.075**
	< 0.001	< 0.001	< 0.001	0.006

The linear regression presented in Chart 6, where Elk perception is treated as the dependent variable, shows that knowledge (defined by the knowledge test score), fear of Elk, interest in Elk, gender, and the region from which the student comes do affect Elk perception by 28.5%.

Chart 6: Linear regression where the dependent variable is the perception of European elk-. (SE= standard deviation, t= t-test value and p= calculated significance level).

Linear regression	r (correlation coefficient)		r2 (determination coefficient)	
Attitude	0.534		0.285	
Predictor	Estimate	SE	t	p
Intercept	1.8095	0.08843	20.46	< 0.001
Knowledge	-0.0394	0.01020	-3.86	< 0.001
Gender	0.1027	0.03195	3.21	0.001
Country	0.0124	0.00388	3.20	0.001
Fear	-0.2189	0.01883	-11.63	< 0.001
Interest	0.2069	0.01559	13.27	< 0.001

Discussion

This study objective was to attempt to identify variables that may influence pupils' perceptions of the European elk and to test whether there was a statistically and substantively significant difference between primary, secondary, and forestry school pupils in their perceptions of the European elk. The findings were to complement our previous research, in which we concluded that there was a difference in perceptions of the presence of elk between students and that negative perceptions prevailed among forestry students for reasons not easily explained (Andreska et al., 2019).

The most significant variable influencing the perception of European elk was a simple interest in Elk. In an addition, if a student indicated that they enjoyed the subject of science or biology, they were also more likely to indicate that they would like to learn about Elk, and at the same time, such students were also more inclined to protect the species. The fact that it is a large animal, not common in our country, which can fascinate people, also played a role. There was no significant correlation with gender perception of the European elk, which, however, had a statistically significant effect on fear of the European elk. The reason might have been that it is a little-known species to the pupils. The effect of gender on fear was most significant in the case of forestry and fishing school pupils and least significant in primary school pupils. This is logical as the majority of secondary forestry school respondents were boys, while in the case of secondary schools, the majority of respondents were girls, and in the case of primary schools, gender representation was the most balanced. Several studies have argued that fear determines adult feelings toward wildlife conservation (Bath et al., 2008; Lescureux et al., 2011). Our study also concluded that fear was a predictor of attitude, namely that the more fearful students were of a species, the more negative their subsequent attitude was towards it.

Regarding the influence of the respondents' region of origin on their perception of Elk, it turned out that students from Moravian regions were generally more friendly towards the returning species.

The paper showed, among other things, a significant correlation between the place of residence of the pupil and their keeping of a farm animal. Although, this finding is logical by its nature, we assign great importance to it in terms of verifying the reliability of the questionnaires. Otherwise, this variable had essentially no effect on either attitude towards or fear of the species, as is the case in the research of e.g., Martens et al. (2019), and is therefore not shown in the results.

Pet ownership showed no statistically significant effect on the perception or fear and familiarity with the species, which is, however, contrary to other works e.g., (Prokop & Tunncliffe, 2010).

Nor can we confirm the hypothesis that the perception of the European elk is somehow significantly influenced by the fact that someone in the student's family belongs to the hunting community. However, perceptions of Elk do vary across school types, which confirms our initial research (Andreska et al., 2019).

The difference in perceptions of Elk was evident among students of primary schools, grammar schools, and secondary schools of forestry and fishing. Foresters and fishermen generally take more extreme attitudes in dealing with issues than grammar school students, but the effect of popularity of science on the interest factor is not as great with them as with grammar school students.

Knowledge scores also played only a small role, as in the research by Orajem & Tomažič (2018). However, this does not imply that knowledge of the studied species is unimportant.

Comparing the results of this research with other studies, such as Lee & Miller (2003), which also targeted attitudes towards Elk, albeit, from a different perspective, we can see some differences in the perceptions of Elk between students and adults. In this study, the authors found that Arizona residents were afraid of encountering Elk near a motorway or a road; they also would not want Elk near children. Conversely, these respondents would not mind Elk being near their homes and consuming scrub brush, which in the case of our study, nearly half of the respondents would rate as a risky situation. Arizona respondents, on the other hand, would not worry even in the event of an

impending direct encounter with an Elk. This may reflect a broader knowledge of this species behaviour, as well as greater experience with random collisions. Americans may be more accustomed to the presence of wildlife near their homes in terms of lot sizes or remoteness of residences (large lots in some states with greater distances between them than in our country attract wildlife), whereas in the Czech Republic, homes are situated closer together. Any wildlife presence near a garden would mean that the species is very close to the residents, and in a densely populated area.

Further, the respondents of the compared studies indicated that the primary reason for hunting Elk would be to maintain a balance between the Elk and the environment in which they are found, not, for example, to obtain food or as part of a recreational hunt. The research also compared the differences between people who identified themselves as hunters and people who do not hunt (Lee & Miller, 2003). In this paper, a comparison can be made between a group of near-adult or adult grammar school students and secondary forestry school students, i.e., potential hunters. It has been evidenced that fear plays a significant role in decision-making and that this correlation increases in the case of foresters. In the case of the M. E. Lee & Miller's (2003) research, game hunters were more cautious and moderate regarding the issue of Elk hunting.

We worked with a relatively large sample of respondents, so we consider the analyses performed to be relatively indicative. However, this is still only the available sample of pupils, and we treat the results accordingly.

Conclusion

The results of the questionnaire survey showed that variables such as gender, place of residence, and ownership of a domestic or farm animal do not have overall influence on students' perceptions of the European elk.

However, the fact that the popularity of biology leads to a greater interest in Elk, which further leads to a positive view of the conservation of these animals, has been confirmed.

Thus, in seeking answers to the set objective, we conclude that students' perceptions of Elk in all types of schools included in this study are influenced by students' attitudes toward science as well as their interest in and fear of European Elk.

We also conclude that the students' perception of the European elk is partly influenced by their fear. This, however, basically confirms the theory that environmental education and scientifically documented information have their justification in education and should be embedded already in primary and secondary school curriculum, where students' environmental attitudes are formed and shaped.

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