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**Abstract.** *Wolf (*Canis lupus*) conservation is multidimensional. Its aspects include the consensus between different interest groups. The present research aimed to assess the attitude and knowledge of the students (N = 483 students from three schools age 14-19) enrolled in the environmentalist, veterinary and agricultural technician study programmes through a questionnaire, as their profession represents a part of this multidimensional consensus. The research results indicate that students have neutral to positive attitudes toward wolves, generally. Their knowledge of wolves, however, is limited. Agricultural technicians showed the most negative attitudes toward wolves and the lowest knowledge. Overall, correlations between all attitudinal dimensions and correlations between attitudinal dimensions and knowledge were found, with the highest correlations between conservation dimension and all other dimensions including knowledge. The research findings support the widespread assumption that education within the above-mentioned study programmes should focus also on the current socio-scientific issues of animal conservation. Special attention should be given to the education of agricultural technicians as their utilitarian view could interfere with the effective conservation of large carnivores.*

**Keywords:** *attitudes toward wolves, knowledge about wolves, vocational upper secondary school students.*

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## THE VOCATIONAL UPPER SECONDARY SCHOOLS STUDENTS' KNOWLEDGE AND THEIR ATTITUDES TOWARD WOLVES

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### Introduction

A wolf (*Canis lupus*) is a charismatic species which was heavily hunted and exterminated in the large part of Europe. Therefore, for most of the Europeans, attitudes towards wolves are not constructed on their primary experiences, but on sources such as Grimm's fairy tales (e.g. Little Red Riding Hood) where wolves are portrayed in a negative way (Kellert, 1985b). Negative attitudes towards wolves are an important factor of their abundance decrease (Majić Skrbinšek, 2012). Chapron et al. (2014) concluded that conservation of large carnivore species is only effective if positive public attitudes, besides implementation of actions which support human-carnivore coexistence and protective legislation, are considered. The big question is what can be done in schools to lower fears and change negative attitudes toward positive ones in order to help in wolf conservation efforts.

A wolf is the second most common species among large carnivores in Slovenia and Europe. Beside wolves, Slovenia is inhabited by brown bears (*Ursus arctos*), which are the most common and, Eurasian lynx (*Lynx lynx*) (Chapron et al., 2014) and, since 2005, the golden jackal (*Canis aureus*) (Krofel, 2009; Krofel & Potočnik, 2008).

The core area of wolf inhabitation is the south-western part of Slovenia. The population belongs to a wider Dinaric-Balkan population (Majić Skrbinšek, 2012) and consists of approximately 60 individuals (Bartol et al., 2017). Wolves prefer wide areas, where large prey abundance is high and disturbance is low (Jonozovič, 2003), but can also greatly adapt to live in human-dominated habitats (Chapron et al., 2014). Although, wolf populations and their habitats need to be preserved, one should be aware of the significance of human-wolf coexistence (Jonozovič, 2003). In Slovenia, from 1991 onwards, law protects wolves and other large carnivore species. Besides their inclusion in the Regulation on protected and wild animal species (Ur. l. RS, n. 46/04) and the Nature Conservation Act (ZON-UPB2) (Ur. l. RS, n. 96/04), several of documents defining obligations for aforementioned species protection were adopted.

Until now, many research studies assessing attitudes or perceptions towards different animal species were performed. They were focusing either on the animals that are disliked such as invertebrates (Kellert, 1993; Killermann, 1996), spiders, bats, snakes (Prokop, Özel, & Uşak, 2009; Prokop & Tunnicliffe, 2008, 2010; Tomažič, 2011a), endangered, i.e. amphibians



(Tomazič, 2011b; Prokop & Fančovičová, 2012), and charismatic or flagship species, such as primates (Lukas & Ross, 2005), sharks (Thompson & Mintzes, 2002) and dolphins (Barney, Mintzes, & Yen, 2005). Attitudes toward some animal species or animal groups are also researched in relation to human-animal conflicts (Špur, Pokorný, & Šorgo, 2016), or in relation to various dimensions of human-animal relationships (Binngießer, Wilhelm, & Randler, 2013) and environmental conservation (Binngießer & Randler, 2015).

Large carnivores, such as wolves, are also representatives of charismatic species. Because of their importance, these species have been the subject of many research studies. Besides various factors which influence attitudes development, such as age, gender, income, place of residence, and membership of interest group association (conservationists, hunters or livestock breeders), education is believed to be of great importance (e.g. Bjerke, Reitan, & Kellert, 1998; Ericsson & Heberlein, 2003; Karlsson & Sjöström, 2007; Kellert, 1996; Williams, Ericsson, & Heberlein, 2002). As early as in 1977, some authors (Dahlgren, Wywiałowski, Bubolz, & Wright) reported that men generally possess more knowledge of wildlife than women. This trend is present already at a young age (Kellert, 1985a). Women are also believed to express more antipredatory feelings (e.g. Shaw, 1977), supposedly because their physical abilities to escape the predators are lower than in men (Røskaft, Bjerke, Kalternborn, Linnell, & Andersen, 2003). This was explicitly investigated by Prokop and Fančovičová (2010). The same applies for attitudes toward wolves. In a research conducted by Prokop and Tunnicliffe (2010), girls showed more negative attitudes towards wolves than boys. On the other hand, the meta-analysis carried out by Williams et al. (2002) established that men's attitudes toward wolves are more negative than women's.

Johnson (1974) researched how children's age correlates with their attitudes toward wolves. Young children, less than ten years old, express the most negative attitudes. Surprisingly, when comparing these attitudes to those of adult people over thirty years old, the author found great similarity to the mentioned group of children (Johnson, 1974). Williams et al. (2002) in their meta-analysis of attitudes toward wolves reported that attitudes towards wolves become more negative with increasing age. The authors argued that correlation between age and negative attitudes may be due to cohort effect. Therefore, population aging does not necessarily correlate with more negative attitudes. A similar relation between age and attitudes was found in the survey conducted by Bjerke et al. (1998); the authors reported a decrease in pro-conservation attitudes towards wolves in a wolf region. In addition, Majić and Bath (2009) found, that older generations were far less influenced by wolf protection campaign than younger population and argued that the reason might be a higher "livestock concerns" of older generations.

The attitudes toward wolves are influenced not only by age, but also by the place of residence. Contrary to the established beliefs, attitudes differ between urban and rural areas. The research conducted in Sweden (Heberlein & Ericsson, 2005) shows attitudinal differences also among urban citizens. Multigenerational populations who live in urban areas can have more negative attitudes toward wolves, and also towards hunting than those who are tied to rural areas (e.g. their parents' rural origins) or have experiences with animals or hunting. Also, those who were born in cities of parents who lived in cities feel that wildlife is less important, in comparison to those with rural experience.

Heberlein and Ericsson (2005) argue that this phenomenon may be due to urbanisation and therefore conclude that "actions that increase urban residents' contacts with rural areas could, however, help promote or maintain more positive attitudes toward wildlife-related attitude objects such as hunting and wolves".

Attitudes towards wolves can also differ between residents in wolf areas and those living outside such areas. People who live in wolf areas tend to have less positive attitudes towards wolves (Bjerke et al., 1998; Chavez, Gese, & Krannich, 2005; Ericsson & Heberlein, 2003; Williams et al., 2002). Also, results of the research among Norwegians (Roskaft et al. 2007) showed more negative attitudes among people living in wolf area. The same effect was detected among people who only believe wolves are present in near surroundings of their homes. In contrast, authors (Roskaft et al., 2003) pointed out less self-reported fear among rural people living in wolf area than among people living in rural area, but with no wolf presence. Authors argued that the reasons for such result might be in more contact of people and wolves in wolf areas. The distance from wolf territories can therefore be an important factor of influence. Karlsson and Sjöström (2007) found that favourable attitudes towards wolf conservation are positively associated with the distance to the nearest wolf territory. The effect of the distance variable was shown to have a similar power as the variables of being a member of a nature conservation organization or being a hunter, owning livestock, or owning a hunting dog. Furthermore, the distance effect was present even on the micro-level, where people living in wolf territories had a more negative attitude towards conservation of wolves than people living just outside these territories.



Attitudes towards animals are also linked with direct experiences with animals. Heberlein (2012) reported more negative attitudes of rural people, when wolves recolonized Sweden. More negative attitudes were the result of people's negative experiences with wolves, such as livestock, hunting dogs or pet predation. Williams et al. (2002) on the other hand concluded that people with fewer experiences with wolves have more positive attitudes towards them. Bjerke et al. (1998) argue that it is not just the experience that drives negative attitudes toward wolves, but also fear of being attacked.

Negative attitudes of livestock breeders toward wolves, and also other large carnivore species, have usually economic background even if breeders get damage payback. Besides livestock predation, wolves represent hunting competitors. Accordingly, these species are perceived as a threat (Skogen, 2001; Treves, Naughton-Treves, Shelley, 2013). Therefore, such interest groups usually support wolf hunting (Treves et al., 2013). But in general, members of hunting associations display more positive attitudes towards wolves than the general public (Williams et al., 2002).

Besides all reasoned factors that influence attitude formation, also having pets can lead to more positive attitudes and better knowledge of wolves (Prokop & Tunnicliffe, 2010). Some authors argued that fear and negative perceptions of wolves were often rooted in fairy tales of wolf predation (e.g. Røskaft et al., 2003; Røskaft, Händel, Bjerke, & Kaltenborn, 2007, see also Prokop, Usak, & Erdogan, 2011).

In the theory of planned behaviour (Ajzen, 1991), "behavioural intention", which generally leads to actual behaviour, is composed of three parts: "attitude toward the behaviour", "subjective norm", and "perceived behavioural control". Attitude is an evaluation of a certain object and can be either positive or negative. It consists of two parts; cognitive and affective. In their research, Glikman, Vaske, Bath, Ciucci and Boitani (2012) developed a model to research how respondents' attitudes towards wolves and bears influenced their normative beliefs (what agencies should do about their conservation). They used knowledge as moderator of both, cognitive and affective component. Greater amount of knowledge is believed to have positive influence on attitude development. For example, the results of Bath and Buchanan (1989) showed that education level (therefore knowledge in general) correlates with more positive attitudes toward wolves. However, they also pointed out, that respondents from Stock Grower Association hold negative attitudes regardless of their higher education. Ericsson and Heberlein (2003) reported that more acquired knowledge could lead to attitudes that are more positive.

Kellert (1985a) urged that children, who learn about animals in schools and zoos, gain insufficient knowledge and express negative attitudes. On the other hand, children engaged in programmes that are experience based, gain a more knowledge and expressed more positive attitudes toward animals than the former. In addition, the results of public perception of predators (Kellert, 1985b) also showed strong correlation of higher education (more knowledge) and positive attitudes toward wolves. According to Berninger, Kneeshaw and Messier (2009), newly acquired knowledge can affect attitude change among less knowledgeable people. On the contrary, high amount of knowledge can lead to more resistant attitudes and affect their reinforcement. Also, positive feelings (affective component) positively correlate with greater amount of knowledge. Glikman et al., (2012) therefore argued that people who express more positive feelings towards wolves might also be more willing to learn about them. People with more knowledge about these species will hold more positive feelings about wolves.

#### *Problem of Research*

The literature review revealed that surveys that assessed participants' knowledge of and attitudes toward wolves usually cover sample groups 18 years of age and over (i.e. Bjerke et al., 1998; Karlsson & Sjöström, 2007; Vittersø, Kaltenborn, & Bjerke, 1998). Only a few research studies have been conducted among primary or secondary school students (Prokop & Kubiak, 2008; Prokop & Tunnicliffe, 2010) and young people (age 16-20) (Skogen, 2001). Consorte-McCrea, Nigbur and Bath (2016) argued that attitudes of teenagers, as future wildlife decision makers, should be of worldwide concern. Since there is lack of information about vocational schools students' attitude and knowledge regarding large carnivores in general and the vocational high school students from the present sample will become wildlife decision makers, the authors set out to assess their attitudes and knowledge regarding wolves.

#### *Research Focus*

The present research included vocational upper secondary school students of veterinary, environmentalist and agricultural technicians. It is expected that during their working career this population will be directly involved



in animal conservation, including conservation of large carnivores or be a part of an interest group that could influence wolf conservation (livestock breeders, farmers, hunters etc.) Consequently, they will make decisions with an impact on the management of these animals. The present research aimed to identify the factors which are significantly related to the participants' attitudes and knowledge of wolves (their place of residence (living in or outside wolf area; rural or urban residence), gender, study programme, year of study (grade), a hunter in their family and being livestock breeders' family member).

The data collected might be indicative for the development of guidelines in preparation of large carnivore conservation biology teacher manuals and the inclusion of such socio-scientific topics in the vocational secondary schools' curricula.

## Methodology of Research

### *General Background*

The research design was quantitative. For the purpose of the research, a non-random sample selection method was applied. Attitudes and knowledge about wolves of Slovenian vocational high school students were assessed by administering a questionnaire, consisting of attitudinal items (Kellert, 1996) and knowledge questions about wolves biology, ecology and conservation. The research was conducted in the selected vocational high schools in the study year 2015/2016.

### *Sample*

Three Slovenian vocational upper secondary schools were selected for present research: the Biotechnical Educational Centre Ljubljana (the programme of Veterinary technicians, the School of Agriculture and Biotechnical upper secondary school Grm in Novo mesto, and Biotechnical Centre in Naklo (the programme of Environmentalist technician and the programme of Agricultural technician. The duration of all the programmes is four years. The reason for such sample collection is that the first and the last school are located outside the wolf area and the second school is bordering the wolf area. The school that educates Veterinary technician students is one of the two veterinary schools in Slovenia and the only school that enrolls students from and outside wolf area.

All of the students ( $N = 493$ ) from the first three study years (14-19 years of age; first year students  $M_{age} = 15.1$ ,  $SD = 0.45$ ; second year students  $M_{age} = 16.2$ ,  $SD = 0.59$ ; third year students  $M_{age} = 17.0$ ,  $SD = 0.62$ ) were included in the research. The participants of the research represent the entire generation of the aforementioned programmes; 186 (37.7 %) were enrolled in the Veterinary technician's study programme, 138 (28.0 %) in the Environmentalist technician study programme, and 169 (34.3 %) in the Agricultural technician study programme.

The cohort from the Veterinary technician study programme consisted of predominantly females (74.1 %) while a large majority of the participants from the Agricultural technician programme were males (70.2 %). Among the participants from the Environmentalist technician programme both genders were equally represented (51.5 % female students). Six students did not report their gender. A little less than one fifth of the students (19.3 %;  $N = 95$ ) reported their place of residence to be in a wolf area and 65.7 % ( $N = 324$ ) in a rural area. Only 16.6% ( $N = 82$ ) of students reported having a hunter in their family and only 49 (9.9 %) of students are from families of livestock breeders. Due to a small percentage and not equal distribution among different study programmes, the latter independent variable was excluded from the analysis.

All the necessary approvals were gathered before research began. First, consents were obtained from the school headmasters and teachers. Next, at the time of the questionnaire delivery, the students were informed that the questionnaires are anonymous and that the results would not affect their grades.

### *Instrument and Procedures*

The questionnaire administered to the respondents consisted of three parts. It was developed at the Biotechnical Faculty in Ljubljana (Nagode, 2014) and was also used in the project SloWolf (2016).

The first part consisted of questions inquiring about the respondent's socio-demographics. The second part of the questionnaire was composed of 20 attitudinal items concerning wolves. A 5-point Likert type scale (from 1 – strongly disagree to 5 – strongly agree) was used to measure the respondents' attitudes toward (a) conservation



of wolves, (b) fear of wolves, (c) their interest to learn about wolves and (d) their opposition to hunting or keeping wolves in captivity. Similar items, originating from the Kellert's (1996) typology of basic attitudes, were already used in the assessment of the respondents' attitude toward other animal groups or animal species (Kellert, 1996; Prokop et al. 2009; Prokop, Prokop, & Tunnicliffe, 2008; Prokop, Tolarovičová, Camerik, & Peterková, 2010; Prokop & Tunnicliffe, 2010). Two independent researchers checked the content validity of included items.

For the purpose of dependent variable number reduction, the principal component analysis (PCA) with Oblimin rotation was applied, through which four meaningful principal components (hereafter PC) were extracted (Table 1). Eigenvalue > 1.0 was used for the final solution. The Kaiser-Meyer-Olkin (KMO) measure of the sampling adequacy test (.899) and Bartlett's test for sphericity ( $\chi^2 = 3534.80$ ;  $df = 190$ ;  $p < .001$ ) suggested that the analysis was appropriate for this data set. Namely, the value of KMO exceeded the critical value of 0.7 (Leech, Barrett, & Morgan, 2005). The first principal component explained 32.15% of total variance and all three components together explained 55.61 % of total variability. The minimum loading of at least .38 was used (Tabachnick & Fidell, 2007). PC I was termed "Conservation", PC II "Fear of harm", PC III "Interest to learn" and PC IV "Hunt". Cronbach  $\alpha$  for total scale was .88. Also, Cronbach  $\alpha$ 's were satisfactory for first three PC's (PC I = .80, PC II = .78; PC III = .85). Cronbach  $\alpha$  for PC IV was low (.59) and its eigenvalue was according to parallel analysis lower than corresponding random eigenvalue (<https://analytics.gonzaga.edu/parallelengine/>), therefore this PC should be interpreted with caution. Lower scores on "Fear of harm" – negativistic dimension mean more negative attitude.

Because the data on PC I and PC IV were not normally distributed, a two-step approach was applied for transforming non-normally distributed dependent variables to normal in SPSS (version 20.0) according to Templeton (2011). This approach was used on all PC's in order to unify the scales. After transformations, all PC's could be used in multiple regression procedures.

The third part of the questionnaire assessed the students' knowledge of wolves using 12 true/false statements and 9 multiple choice questions related to biology and wolf conservation. For each question, a "Don't know" option was included in order to minimize guessing. The summed score of correct answers was used in statistical analysis (Table 3).

### Data Analysis

Raw data, obtained from the questionnaires were input into the computer programme Microsoft Office Excel, later transferred to the programme SPSS. First, basic descriptive statistics was calculated for individual knowledge and attitude items. The principal component analysis (PCA) was then applied in order to reduce the number of attitudinal dependent variables and to extract meaningful principal components (PCs).

Extracted PC's from attitude part of the questionnaire and summed knowledge scores were used as dependent variables which were analysed according to selected independent variables; place of residence (lives in wolf area or not; rural/urban residence), gender, study programme, year of study (grade), hunter in his/her family and if they are livestock breeders. Those variables served as independent predictors in multiple regression models. In multiple regression statistics, transformed attitudinal PC's was used, because the data on two PC's were not normally distributed (see Research instrument section above).

All statistical procedures were conducted using SPSS 20.0 software.

## Results of Research

### Students' Ratings of Individual Attitude Items

Table 2 shows the frequencies of attitudinal item ratings. Items represent four different attitudinal dimensions (Table 1); Ratings in "Conservation" domain show the participants' strong agreements with most statements. Item ratings on "Negativistic" domain present neutral opinions of the respondents. Only the ratings on two items show slightly higher agreement. The respondents' attitudes were neutral on all "Scientistic" items, which indicates a lack of interest to learn about wolves. Results on "Hunting" domain show negative opinions on two items, referring to hunting directly and to wolf abundance. The respondents strongly agreed only with the statement which refers to killing of wolves.



**Table 1. Principal component analysis with an Oblimin rotation of items to the individual attitudinal dimension.**

Item	Principal component			
	I	II	III	IV
<b>Conservation</b>				
There is no need to preserve wolves in Slovenia, because they live elsewhere in Europe.*	.808			
All wolves should be exterminated.*	.741			
In Slovenia, wolves should be preserved for future generations.	.478			
Wolves are evil by nature because they attack livestock (sheep).*	.463			
If all wolves were killed in Slovenia, it would bother me.	.447			
Wolves should have rights too.	.402			
<b>Harm - Negativistic</b>				
I would be afraid walking through the forest, if I knew that wolves lived there.*		.855		
I would camp only where there are no wolves.*		.754		
I am afraid of wolves.*		.675		
Wolves should not be near human settlements.*		.592		
I would accept the wolf presence in forests near my neighbourhood.		.522		
Wolves are not dangerous to humans.		.408		
<b>Interest to learn - Scientific</b>				
I would like to know how wolves developed.			-.892	
I like to watch popular science broadcasts about wolves.			-.829	
I would like to learn about different habitats of wolves.			-.811	
I like to read about wolves.			-.809	
<b>Hunting</b>				
It is cruel to keep wolves in captivity.				.813
I would ban any kind of wild game hunting.				.593
Killing wolves for fun is cruel.				.412
In Slovenia, wolves' abundance should increase.				.404
<b>Cronbach's <math>\alpha</math> (for all 20 items .88)</b>	.80	.78	.85	.59
Eigenvalues	6.43	2.10	1.56	1.03
Explained variance	32.15	10.48	7.81	5.17
Mean	4.22	3.18	3.29	3.63
Standard deviation	0.72	0.77	0.94	0.83

Note: \* - reversed items; Principal component loadings over .38 are presented.



**Table 2. Students' ratings of individual attitude items.**

N	Item	M	SE	SD	f(%)				
					1	2	3	4	5
1	All wolves should be exterminated.*	4.6	0.04	0.94	4	1	6	11	79
2	There is no need to preserve wolves in Slovenia, because they live elsewhere in Europe.*	4.5	0.04	0.93	3	1	9	16	71
3	If all wolves were killed in Slovenia, it would bother me.	4.3	0.05	1.08	5	3	10	19	63
4	In Slovenia, wolves should be preserved for future generations.	4.2	0.04	0.93	2	3	16	30	50
5	Wolves should have rights too.	4.1	0.05	1.03	3	2	22	25	47
6	Wolves are evil by nature because they attack livestock (sheep).*	3.6	0.05	1.20	7	12	28	25	29
7	I would accept the wolf presence in forests near my neighbourhood.	3.6	0.05	1.13	4	13	28	29	26
8	I am afraid of wolves.*	3.5	0.05	1.19	6	14	26	28	25
9	I would be afraid to walk through the forest, if I knew that wolves lived there. *	3.2	0.05	1.19	7	22	29	24	18
10	I would camp only in places where there are no wolves.*	3.0	0.05	1.10	11	21	43	16	10
11	Wolves should not be near human settlements.*	2.9	0.05	1.07	11	23	43	15	9
12	Wolves are not dangerous to humans.	2.9	0.05	1.03	8	25	39	21	7
13	I would like to learn about different habitats of wolves.	3.6	0.05	1.10	6	9	34	30	23
14	I would like to know how wolves developed.	3.5	0.05	1.13	7	10	33	29	23
15	I like to watch popular science broadcasts about wolves.	3.2	0.05	1.16	10	13	37	24	16
16	I like to read about wolves.	2.9	0.05	1.14	16	17	43	15	9
17	Killing wolves for fun is cruel.	4.4	0.06	1.23	8	4	5	9	75
18	It is cruel to keep wolves in captivity.	3.6	0.06	1.21	6	13	25	24	32
19	In Slovenia, wolves' abundance should increase.	3.4	0.05	1.14	7	9	40	22	22
20	I would ban any kind of wild game hunting.	3.1	0.06	1.37	16	20	27	15	22

Note: \*reversed items.

#### *Students' Responses to Individual Knowledge Items*

The highest percentage of correct answers was recorded for statements about hunting/management, wolves' role in ecosystem, state of threat, predation and systematics. The smallest percentage of correct answers was achieved in the section about wolves' ecology (with the exception of lifestyle) and anatomy (with the exception of recognition of carnivore skull). The average students' knowledge score was only 42.9% (9 out of 21 answers) (see Table 3 for more details).



**Table 3. Students' ratings of individual knowledge items.**

N	Item	Wrong/correct statement	Correct	Wrong
1	Wolves do not need to be hunted in order to protect people.	C	74.8	25.2
2	Wolves are solitary animals.	W	70.4	29.6
3	People can replace the ecological role of wolves in nature.	W	66.5	33.5
4	A wolf is an endangered species in Slovenia.	C	65.3	34.7
5	Hunting wolves is not an effective method for prevention of livestock predation.	C	60.2	39.8
6	Because of their high abundance in Slovenia, wolves attack farm animals.	W	59.8	40.2
7	Wolves are dangerous to people.	W	49.9	50.1
8	The wolf is not native to Slovenia.	W	38.9	61.1
9	The wolf predated the healthiest herbivores in nature.	W	35.5	64.5
10	Many wolf cubs die in their first year.	C	25.8	74.2
11	In wolves, the mode of urination does not depend on gender (as in dogs) but on social rank/status.	C	23.9	76.1
12	Wolves walk or run approximately 7 km per day.	W	8.7	91.3
13	Encircle skull which is typical for carnivores.	Picture	93.3	6.7
14	Wolves are classified into a family of: dogs.	Multiple choice	89.7	10.3
15	Wolves live most of their lives: in packs.	Multiple choice	78.5	21.5
16	Wolves hunt especially: weakened herbivores.	Multiple choice	40.6	59.4
17	In Slovenia, wolf's main prey represent: deer and roe deer.	Multiple choice	40.0	60.0
18	In your opinion, how many wolves live in Slovenia?: 41-60.	Multiple choice	32.7	67.3
19	In Slovenia, the average body weight of a (male) wolf is between: 30-40 kg.	Multiple choice	16.2	83.8
20	How many cubs do wolves have?: 5-8.	Multiple choice	15.0	85.0
21	Wolves mate: in winter.	Multiple choice	5.5	94.5

### *The Results of Multiple Regression Analyses*

The results of multiple regression analyses are presented in Table 4.

Female students supported conservation of wolves to a greater extent than male students. Also, the students enrolled in the Environmentalist and Veterinary technician study programmes had more positive attitudes toward wolves' conservation than the students enrolled in the Agricultural technician study programme.

On "Fear of harm" domain, the students of Veterinary technician programme showed significantly more positive attitudes toward wolves than Agricultural technician students. The same applied for Environmentalist technician students. In addition, the second-year students displayed less fear on harm of wolves than the first-year students, but there was no difference in ratings between the first and the third-year students. The respondent who reported having a hunter in their family, displayed less fear of harm than their counterparts.





On "Interest to learn" domain, students who were enrolled in Veterinary technician and Environmentalist study programme, showed significantly more positive attitudes toward wolves than the students of Agricultural technician study programme. The third-year and male students were less willing to learn about wolves than the first and the second-year students or female students.

On "Hunting", the students enrolled in Veterinary technician and Environmentalist technician study programmes showed significantly more positive attitudes toward wolves than the students of Agricultural technician study programme. Male students less strongly opposed hunting wolves or keeping them in captivity than female students. Also, the students living in rural areas less strongly opposed hunting wolves or keeping them in captivity than their counterparts.

The study programme was the only predictor that showed contribution to the mentioned dependent variable. The most knowledgeable were the students from Veterinary technician programme, followed by Environmentalist study programme students.

**Table 4. Multiple regression (forward stepwise method) on Conservation (PC I) domain.**

	B	SE of B	$\beta$	t	p	Predictors
<b>Conservation (PC I) domain:</b> $R^2 = 0.256$ , $F(3,479) = 54.95$ , $p < .001$						
(Constant)	3.98	0.061		64.76	< .001	
Gender (male)	-0.274	0.058	-0.200	-4.700	< .001	Wolf area, place of residence, hunter in the family and grade were excluded from the model.
Environmental	0.510	0.070	0.333	7.270	< .001	
Veterinary	0.611	0.069	0.434	8.922	< .001	
<b>Fear of harm (PC II) domain:</b> $R^2 = 0.121$ , $F(4,478) = 16.41$ , $p < .001$						
(Constant)	2.795	0.060		46.63	< .001	
Veterinary	0.487	0.077	0.311	6.301	< .001	Gender, wolf area and place of residence as predictors were excluded from the model.
Environmental	0.404	0.083	0.238	4.853	< .001	
Hunter in a family	0.258	0.088	0.127	2.939	.003	
Second year	0.172	0.069	0.108	2.470	.014	
<b>Interest to learn (PC III) domain:</b> $R^2 = 0.143$ , $F(4,478) = 19.94$ , $p < .001$						
(Constant)	3.171	0.093		34.04	< .001	
Environmental	0.639	0.100	0.314	6.379	< .001	Wolf area, place of residence and a hunter in the family as predictors were excluded from the model.
Veterinary	0.428	0.098	0.229	4.361	< .001	
Third year	-0.265	0.083	-0.136	-3.200	.001	
Gender (male)	-0.268	0.083	-0.147	-3.208	.001	
<b>Hunting (PC IV) domain:</b> $R^2 = 0.224$ , $F(4,478) = 34.42$ , $p < .001$						
(Constant)	3.755	0.101		37.193	< .001	
Environmental	0.548	0.088	0.302	6.239	< .001	Grade, wolf area and hunter in the family as predictors were excluded from the model.
Gender (male)	-0.523	0.071	-0.322	-7.382	< .001	
Veterinary	0.213	0.088	0.128	2.415	.016	
Place of residence	-0.164	0.073	-0.096	-2.231	.026	



	B	SE of B	$\beta$	t	p	Predictors
<b>Knowledge domain:</b> $R^2 = 0.208$ , $F(2,480) = 62.996$ , $p < .001$						
(Constant)	8.030	0.231		34.816	< .001	Having pets, gender and individual grade students as predictors were excluded from the model.
Veterinary	3.562	0.318	0.520	11.198	< .001	
Environmental	2.105	0.346	0.283	6.087	< .001	

### Correlations Between Attitudinal Dimensions and Knowledge

Correlations between every attitudinal dimension and between attitudinal dimensions and knowledge were significant. The highest correlations were found between the "Conservation" attitudinal dimension and all other attitudinal dimensions including the knowledge dimension (Table 5).

**Table 5. Correlations between questionnaire dimensions**

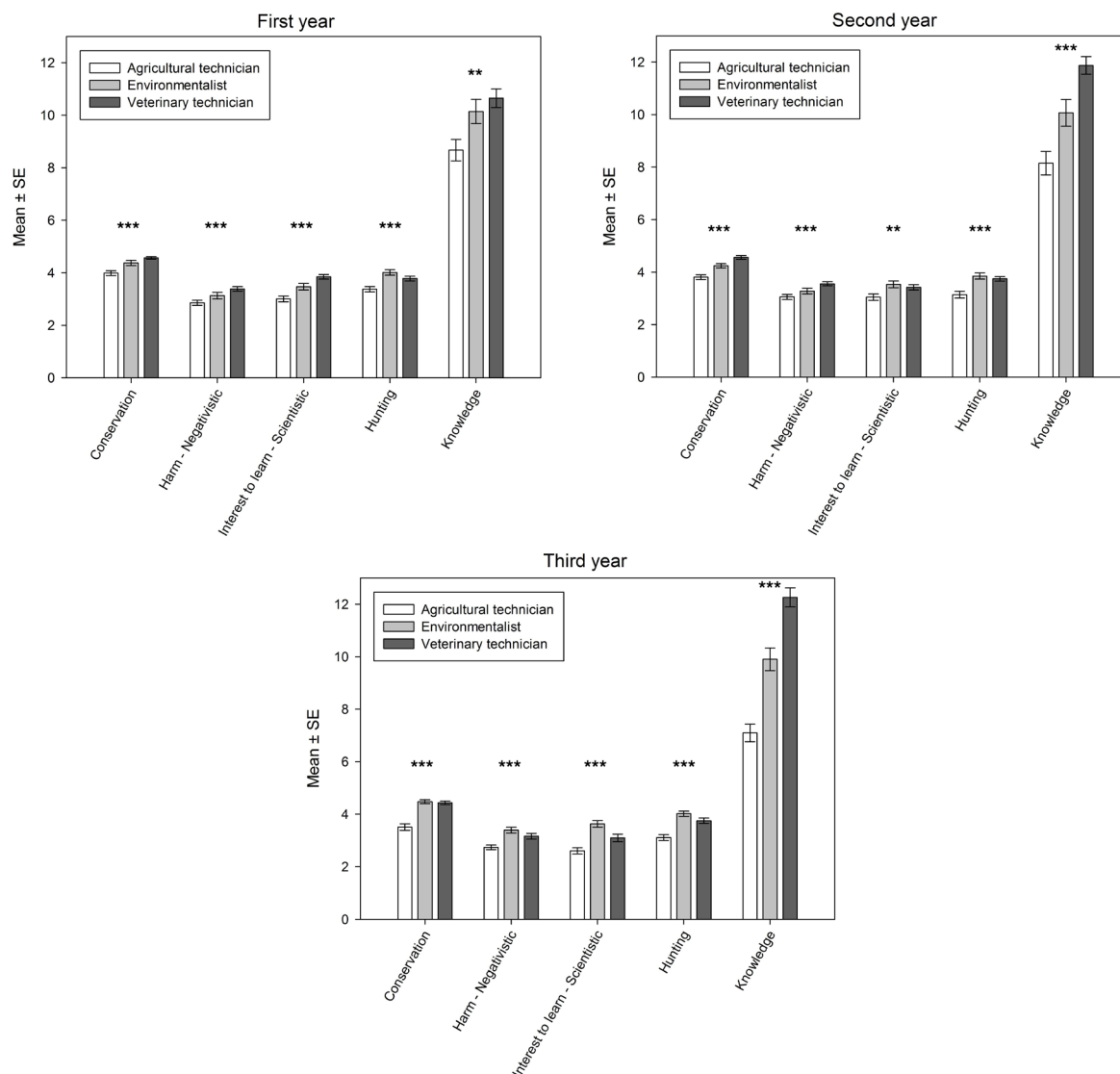
	Harm	Learn	Hunt	Knowledge
Conservation	.492**	.497**	.568**	.516**
Harm	-	.415**	.299**	.461**
Learn	-	-	.336**	.399**
Hunt	-	-	-	.293**

Note: Partial correlation coefficients; meaning of asterisks: \*\*  $p < .01$ .

### Differences in Students' Attitude Ratings and Knowledge Scores According to Study Programme and Study Year

According to multiple regression analyses, the educational programme showed to produce the highest differences in student attitude ratings and knowledge scores (Table 4). Those differences are presented in detail in Figure 1, where Kruskal-Wallis test was used to assess the significance of the differences. Differences in attitude ratings and knowledge scores between programmes emerged already at the beginning of the first study year. It can be seen that Agricultural technicians displayed more negative attitudes on all attitudinal dimensions regardless of the study year. The same applied for knowledge. The ratings and scores of Environmentalists technician and Veterinary technician students are more mixed. Namely, Environmentalists technicians oppose more to hunting wolves than Veterinary technicians do. Their interest to learn about wolves is also higher in second and third year of study than is the interest of Veterinary technicians. On the other hand, Veterinary technicians are the most knowledgeable of all, regardless of the study year.





**Figure 1.** Differences in students' attitude ratings and knowledge scores according to study programme and study year.

## Discussion

The research produced results which show no difference between males and females in negativistic attitudes toward wolves. On the other hand, differences in interest to learn and attitudes toward hunting were identified. Having a hunter in one's family resulted in fear reduction among students. The study programme proved to be a factor of great influence; what does not mean that study programme by itself has an influence. There were differences between students of different study programmes in attitudes and knowledge even at the beginning of their study (first year students). Veterinary technician students displayed the most positive attitudes toward wolves and the students of Agricultural technician programme the least positive ones. In the research, no attitudinal differences were noted between students residing in wolf area and those living outside these areas, with the exception of opposition toward hunting. Positive correlations were found between all attitudinal dimensions and between attitudinal dimensions and knowledge.



### *Gender*

Some authors (i.e. Kellert & Berry, 1987; Musila, Prokop, & Gichuki, 2018) suggest that gender is significant influential factor in the development of humans' attitude toward wildlife species. Different from the research studies that reported more negative attitudes toward wolves among females than males (e.g. Prokop & Tunnicliffe, 2010), which was also explained by women's evolutionary background of antipredatory behaviour and lesser physical abilities (Røskaft et al. 2003), the current research identified no gender-related differences in regards to the fear of wolves. On the other hand, females held more positive attitudes toward wolf conservation than males. Such tendency was also noted in meta-analysis conducted by Williams et al. (2002). Gender-related differences also correlated with the interest to learn about wolves. Male students were less willing to learn about wolves than female students although some research studies report that male students prefer wild species (Lindemann-Matthies, 2005). The results of the present research regarding the interest to learn about wolves are consistent with the findings of Glikman et al. (2012). It can be concluded that individuals (especially females) who hold more positive attitudes toward wolves (e.g. conservation of wolves) will be more willing to learn about these species and probably more readily engage in pro-environmental behaviour (Zelezny, Chua, & Aldrich, 2000).

The results of the present research also show that male students opposed less to hunting wolves than females; this trend may be due to high male's abundance in agricultural part of sample. Similar results were reported in previous research (Treves et al., 2013), exploring the attitudes toward hunting among livestock breeders. Kellert and Berry (1987) reported that women voiced greater opposition to hunting than men. These attitudes may be explained by the fact that females hold more humanistic and moralistic attitudes, and harbour more pronounced anthropomorphic feelings toward large and aesthetic animal species. On the report of these authors, males may oppose less to hunting because of their higher utilitarian and dominionistic attitudes; a will to have control over animals. However, males expressed more favourable attitudes toward conservation of species and the concern for balanced ecosystems. Nevertheless, hunting is important and requires careful orchestration of ecological, social and economic factors in order to establish balance and sustainability in human dominated ecosystems.

### *A Hunter In the Family*

Having a hunter in the family proved to be a factor that reduces the students' fear of harm. Some authors (Williams et al., 2002) argued that members of hunting associations express more positive attitudes toward wolves in comparison to the general public. According to the current research findings, hunters may contribute to fear reduction of wolves among their family members. It seems that having a hunter in the family significantly reduces fear but does not have any effect on any other attitudinal domain, interest to learn or conservation dimension or even on the students' knowledge.

### *Study Programme*

As the differences on all attitudinal domains and in knowledge scores were detected among early first graders between study programmes, it can be concluded, that pupils with less knowledge, less willingness to learn and less opposition towards hunting and more negative attitudes toward wolf conservation decide to become agricultural technicians. Those are presumably the students of different goals with more pronounced utilitarian views. On the other hand, Veterinary technicians are the most knowledgeable as their study programme focuses also on gaining knowledge about domestic carnivores that they were able to apply to questions about wolves. Environmentalists technicians might oppose more to hunting due to their conservationist beliefs. Results of present research, that shows differences in attitudes and knowledge among study programmes, are consistent with the findings of previous research on the attitude toward other large carnivore species (Schlegel and Rupf, 2010). At this point, it is important to acknowledge former attitude formation and amount of knowledge gained that is evidently not limited to formal educational settings. It was confirmed that the utilitarian way of thinking among agricultural technicians contributes to more negative attitudes (Schlegel and Rupf, 2010). Also, the lack of species and ecological knowledge may lead to lower acceptance of large carnivore species. In our case, poor knowledge of Agricultural technician students may very likely be one of the indicators. As in this research, similar negative attitudes toward wolves was found among adult rural residents/farmers (Chavez et al., 2005; Ericsson & Heberlein, 2003) and in the meta-analysis of Williams et al. (2002). The attitudes toward wolves among ranchers/farmers and environmental/



wildlife associations in America and Europe show a similar pattern distribution as the current research. Although the present research sample represents upper secondary school students only, the results show that they share similar attitude patterns with the above-mentioned groups. Besides more positive attitudes, Veterinary and Environmentalist technicians express significantly higher interest to learn about wolves than Agricultural technicians.

#### *Study Year (Age)*

The results show that the second-year students displayed less fear of harm than the first and the third-year students. The study year also influenced the students' readiness to learn about animals. The third year students expressed the least interest to learn. Prokop and Tunnicliffe (2010) reported that children aged between 10 and 15 years are more familiar with animal species which are not popular. In their research, a wolf was represented as a predator, therefore was treated as unpopular. Large carnivore species are not always treated as a factor of fear but are also admired because of their aesthetics or intelligence (Kellert, 1985a, 1985b). Therefore, they can be also classified as popular. Nevertheless, Prokop and Tunnicliffe (2010) argued that even if the students are more familiar with species that are not so popular, their attitudes toward those species can be negative. This may in part explain more negative attitudes of the first-year students. Some authors (Berninger et al., 2009; Kellert, Black, Rush, & Bath, 1996) argued that more knowledge can enhance the strengthening and reinforcement of already formed attitudes. If they acquired new knowledge of animals during their upper secondary education, the third-year students in our sample should therefore express even more favourable attitudes relative to their counterparts. Surprisingly, the results proved just the opposite. Several authors (e.g. Johnson, 1974; Williams et al., 2002, Prokop & Kubiak 2008; Binngießer & Randler 2015) found that age increase correlates with more negative attitudes. Similarly, Consorte-McCrea et al. (2016) documented age-dependent decrease of attitude toward maned wolf (*Chrysocyon brachyurus*) among teenagers. The third-year students' lack of interest to learn about wolves may be due to a variety of factors. The reasons for the student's academic amotivation can be self-determined, such as poor academic achievements (Deci & Ryan, 1985). Low interest to learn may be due to ineffective students' learning habits or their negative attitudes toward the subject (Çimer, 2012). Nevertheless, reasons for lacking motivation result from a broader social and not only educational context. "Key social agents", such as friends, parents or even teachers, influence the student's attitudes and even behaviours regarding education (Deci & Ryan, 1985). Therefore, teaching style is of great importance. Nevertheless, interest to learn may be also due to the topic itself (Trumper, 2006; Çimer, 2012).

#### *Place of Residence*

Earlier research associate the place of residence with the attitudes toward wolves (Bjerke et al., 1998; Consorte-McCrea et al., 2016; Ericsson & Heberlein, 2003; Karlsson & Sjöström, 2007; Williams et al., 2002), suggesting that the residents who live within wolf areas display more negative attitudes toward wolves than those who live outside such areas. In contrast to these findings, however, the present research produced different results; there were no attitudinal differences regarding living areas. The only exception was that the students residing in wolf areas oppose less to hunting than their counterparts. Kränge and Skogen (2007) and Skogen (2001) argued that more hunting support among men is due to their working-class status and rural hunting tradition. To turn rural residents' attitudes to more positive, education may be of great importance. In education, direct experiences with animals are used to promote positive attitudes. According to Tomažič (2008), direct experiences can positively influence the students' attitudes. Consorte-McCrea et al. (2016) reported that seeing maned wolf in zoo can promote conservation support and learning interest even if individual's direct experience from wolf areas was negative. The same may also be true for grey wolf. A survey by Bjerke et al. (1998) pointed to an education-dependent increase of support of wolf conservation among people in wolf territories. The conservation literacy guidelines published by the Society for Conservation Biology (Trombulak et al. 2004) emphasise that "education is most successful when it focuses on developing knowledge, skills, and attitudes in a way that gives people extended direct experience." (p. 1189). If, however, direct experiences with wolves are negative (i.e. damages caused by wolves), it cannot be expected that a person's attitudes toward animals would be positive.

These findings have an important implication for the environmental education of the vocational upper secondary school students, especially those who live in rural areas, or come from family of livestock breeders. The study programmes should encompass not only animal biology but also the strategies to mitigate damages caused by wolves.



### Knowledge

The current research revealed that the average students' knowledge about wolves was fairly limited (average score of only around 43 %). Students lack the knowledge of wolves' ecology the most. Their knowledge scores show that half of them perceive wolves as a threat to people's safety. While in some world regions, wolves' attacks on people have been reported (Linnell et al., 2002), in Slovenia, according to SloWolf (<http://www.volkovi.si/>), there were no attacks in more than 100 years. The students' belief that wolves are dangerous to people might be the result of watching nature TV channels or even movies where wolves are sometimes presented as dangerous or even bloodthirsty. More research on this topic needs to be undertaken. In previous research (e.g. Dahlgren et al. 1977; Kellert & Berry, 1987), more knowledge of wildlife species among men than women was presented. The present research did not confirm any significant gender-related differences in the respondents' attitude toward wolves. The results indicate that the only factor influencing the knowledge is the study programme. According to Røskaft et al. (2003) less knowledge of large carnivores, especially their behaviour and habits, can be linked with more negative attitudes and conflicts in rural areas. The students' knowledge could therefore be increased with the implementation of programmes, which include wolf-related topics, especially wolves' ecology. Some authors argue that even shorter environmental courses can promote positive attitudes and higher knowledge (Campbell Bradley et al., 1999; Prokop, Tuncer, & Kvasničák, 2007). Kikvidze and Tevzadze (2015) stressed the importance of traditional knowledge, such as appropriate husbandry practices among livestock breeders to reduce wolves' predation. Besides the perceived damage, fear also plays an important role in attitude formation. Johansson and Karlsson (2011) urge that fear reduction may be the most effective, if those interest groups gain knowledge of their own proper behaviour rather than the behaviour of wolves'. For that reason, the agricultural technician programme should include the identified relevant topic. Barney et al. (2005) argued that only positive attitudes do not directly lead to pro-environmental behaviour, if knowledge of species biology is lacking. Morrone, Mancl and Carr (2001) outlined that: "...knowledge and attitudes are important components of environmental literacy, especially if the goal of environmental education is to change behaviour."

### Conclusions

The review of the entire sample's attitudinal patterns shows that the upper secondary school students from vocational programmes hold positive attitudes toward wolves in general, but their knowledge is scarce. Neutral attitudes were displayed in fear-related topics, such as fear of being harmed and predation of farm or companion animals. The average of the students also expressed neutral interest to learn. On the question of knowledge, the research produced some interesting results. The most knowledgeable were Veterinary technician study programme students, and the least were the Agricultural technician programme students. The study programme has proved to be an important factor of influence regarding all attitudinal categories and knowledge. The type of the study programme was the only factor having impact on the respondents' knowledge. Although gender was not a factor of influence on "Knowledge" domain, it influenced most the attitudinal dimensions. Females held more positive attitudes toward wolves and showed more readiness to learn about them. The study year was also a predictor of interest to learn; where the third-year students showed less willingness to learn. Having a hunter in the family and a place of residence also influenced the respondents' attitudes. A hunter in the family leads to fear reduction and living in rural area diminishes opposition to hunting. The educational programmes should encompass also the wolf topics as the students might be directly involved in species management or conservation practices. Special attention should be focused especially on the Agricultural technician study programme, the students of which hold most negative attitudes and possess the least knowledge. This is of importance because they will probably have the most direct experiences with wolves during their career work, therefore, they should gain more knowledge on species ecology, behaviour and especially practices that promote human-wolf conflicts solutions. Along with the renewed study programmes, future research on the current topic are recommended to further explore and determine the impact of instructions on attitudes and knowledge about wolves.



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