

v1: 16 October 2024

Research Article

Negative and Extrapositive Attitudes towards Cold-Blooded Tetrapods among Students of the Secondary Education Course: Ethical and Normative Aspects

Peer-approved: 16 October 2024

© The Author(s) 2024. This is an Open Access article under the CC BY 4.0 license.

Qeios, Vol. 6 (2024)
ISSN: 2632-3834

Pavlina Marinova¹, Antoniya Paneva¹, Teodora Koynova¹, Klaida Doychinova¹, Kamen Teofilov², Nikolay Natchev²

1. Department of Biology, Faculty of Natural Sciences, Shumen University, Shumen, Bulgaria; 2. Department of Pedagogy of training in Fine arts and Technology Education, Shumen University, Shumen, Bulgaria

The present study represents empirical research, the purpose of which was to investigate the attitudes towards the species of the Suborder Snakes (Serpentes) and of the Order Turtles (Testudines) among adolescents. We aimed to determine the risks regarding the conservation of herpetofauna. Questionnaires were constructed, adequate to the learning objectives of the subject "Biology and Health Education" in the respective classes. Students from the seventh, ninth, and eleventh grades in two of the schools in the city of Shumen (NE Bulgaria) were surveyed. The total number of respondents was 426, of which 198 were for attitudes towards snakes and 228 were for attitudes towards turtles. The results of the present study showed the problems in the field of protecting the biological diversity of snakes and turtles in Bulgaria. The attitude toward snakes was clearly negative, and that toward tortoises was extremely positive. A very low level of environmental culture was detected. The vast majority of the recipients insisted on an in-depth revision of the education plans in Biology. Unfortunately, the analysis of the textbook content used for the education of the recipients indicated an insufficient and improper selection of information concerning reptiles. Since once established, attitudes are difficult to change, the main target group of education efforts must be concentrated on secondary course students.

Correspondence: papers@team.qeios.com — Qeios will forward to the authors

1. Introduction

Public attention and the concentration of the specialized scientific literature were aimed at addressing the main factors and processes threatening

biodiversity (pollution, introduction of invasive species, genetically modified organisms, hunting/fishing, global warming, fragmentation, etc.), which were recognized as some of the main causes of destruction and transformation of natural habitats and destruction of species diversity (Kellert, 1979, Rawat et al., 2015, Prakash et al., 2022, Kontsiotis et al., 2022). As a result of such studies, the necessary policies were developed –

both at the national and European levels. The necessary normative measures were taken to protect biological diversity (Prokop, 2009). A good regulatory framework is a necessary, but often not a sufficient, condition for the effectiveness of biodiversity conservation policies. The second condition for success in this area is the implementation and compliance with these norms (Kellert, 1984). In this regard, more and more research was directed towards socioecological studies, since only research and knowledge about public attitudes towards animals can provide an answer as to why conservation policies for some species were successful and others were not (Kellert, 1979, Stokes, 2007, Ceriaco, 2012).

Reptiles are among the most problematic animals in this regard. They were rather rarely accepted (see Deng et al., 2024) as the so-called "flagship species" - popular, widely accepted, and loved species, such as, e.g., dolphins, pandas, lions, etc., used as a "face" to raise funds in various conservation campaigns or to promote biodiversity protection policies (Stokes, 2007). Although they are not among the species causing significant economic losses and few species are dangerous, they cause fear and were rather often exterminated (Ceriaco, 2012, Maarten, 2012). Reptiles are important in maintaining balance in ecosystems (Larson et al., 2024). Killing, poaching, as well as attempts to domesticate wild animals outside their natural environment, were also threats to biodiversity (Alves, 2012).

The non-marine herpetofauna of Bulgaria is rich compared to most countries in Europe. On the territory of Bulgaria, 23 species of amphibians and 40 species of reptiles, including 18 species of snakes and 4 species of turtles, have been found (Stojanov et al., 2011). Two invasive species of water turtles were also detected - the red-eared and the yellow-eared sliders (Kuzmanova et al., 2018). In Bulgaria, all species of turtles, as well as 14 of the 18 species of snakes, are protected, not only according to the local legislation but also by various international acts (Stojanov et al., 2011, IUCN red list).

In the legislation of the European Union, species from the Suborder Snakes (Serpentes) and from the Order Turtles (Testudines) are highly protected and were included in Annex II and IV to the Habitats Directive 92/43/EEC. They were also protected by the International Union for the Conservation of Nature and Natural Resources (IUCN), as well as by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Some species of snakes and tortoises were listed in the Red Book of Bulgaria, as well as protected by the Biological Diversity Act - Appendices II and III.

(Beshkov, 2015). Therefore, all information related to the biology and distribution of these species, as well as the human attitude towards them, should be considered as a valuable factor for their conservation (Stojanov et al., 2011).

In Bulgaria, the legally defined protection status was not sufficient for the effective protection of most species of herpetofauna. They were subject to many risks, mainly of an anthropogenic nature - fragmentation of habitats, use of pesticides, placement of poisonous baits during mass breeding of field animals, parasitosis, contraband imports/exports of specimens, illegal use of venomous snakes for venom extraction, etc. (Biserkov et al., 2005, Biserkov, 2007, Natchev et al., 2017, Tzankov et al., 2017). In the country, especially in the villages, the practice of immediate extermination of snakes was widespread (Georgiev & Nachev, 2015, Marinova et al., 2022). Last but not least, this is also related to two other factors - the lack of information on which authority or organization to address in case of conflict, as well as the lack of adequate and prompt responding structures - be they government bodies or NGOs (Stojanov et al., 2011). Attitudes and behavior towards turtles often have the opposite sign - they were often taken away from their natural environment and kept at home, often with fatal consequences. Myths still exist in our society concerning the healing blood of tortoises (Kuzmanova et al., 2018). In this direction, we performed an analysis of the textbook content in "Biology and Health Education" for the 7th grade (the only textbooks teaching Zoology). Based on our results, we discuss whether the errors in education were due to the lack of interest in students or were already prerequisites in the teaching content and the education programs.

2. Materials and Methods

In the present study, the attitudes toward selected species of reptiles (snakes and turtles) in seventh, ninth, and eleventh grade students were investigated. Extremely negative and extremely positive attitudes toward reptiles have equally unfavorable consequences for the animals.

A survey was performed in the period June-July 2018 in two schools in Shumen town: "Nancho Popovich" and Secondary School "Ioan Exarch of Bulgaria". The survey participants were informed in advance about the purpose of the survey, and the surveys were anonymous - no confidential personal data were collected. The survey was performed during one Biology class (45 min.). The questionnaires were of similar design;

however, some questions were modified in a way to obtain more information from the recipients. Both questionnaires were divided into two sections – open and closed (appendix 1). All calculations were performed using Microsoft Excel (Microsoft Corporation, Microsoft Office Professional Plus, version 19, Redmond, WA, USA).

We provided a detailed analysis of the textbooks used for the education of the students. We studied the content of the textbooks in "Biology and Health Education" for the 7th grade from a total of 4 publishing houses (Valcheva et al., 1993, Naydenova et al., 1996, Angelov et al., 2008, Shishinyova et al., 2014). All the information concerning the biology and ecology of snakes and tortoises was investigated and protocolled.

3. Results

In the present study, a total of 426 questionnaires were filled out, of which 198 investigated attitudes towards snakes and 228 investigated attitudes towards turtles (Table 1 and 2). Students from the same age groups (seventh, ninth, and eleventh grade) participated in both groups of subjects.

Most of the recipients had encountered a snake (87%) or a turtle (77%) at least once in their lives. At the same time, again for both taxa, there was ignorance concerning the zoology of the species that occur in Bulgaria (41% non-answers in the questionnaire for snakes and 71% in the questionnaire for turtles).

The answers to the question "Do you know how many species of poisonous snakes there are in Bulgaria? Can

you list some of them?" most often mentioned the Horned-nosed viper (*Vipera ammodytes*) and the Common European viper (*V. berus*), followed by species that are non-native to the country ("cobra", "python", "anaconda", "black mamba", "rattlesnake", etc.). When answering the question "Do you know what kinds of snakes can be found in your area? If yes, list some of them," answers concerning non-native species were missing.

Some questions were related to knowledge about snakes and how this knowledge regulates human behavior in case of an encounter with them. Here, answers related to avoidance and fear predominate, although in every age group there was also an answer "I will kill it". The youngest students – from the seventh grade – also provided answers like "I will call animal protection" and "I will call to collect it".

Regarding the information in the textbook by Valcheva et al. (1993), referring to Class Reptilia, there was content of 10 pages (pages 100 – 110), with images located on the majority of the pages. As the images were predominantly of non-native species, information on native species is scarce.

In Naydenova et al.'s (1996) textbook, the information pertaining to Class Reptiles is on pages 84 and 85 – two pages of content to define Class Reptilia.

The textbook by Angelov et al. (2008) and Shishinova et al. (2014) lacks information about Class Reptiles, with the exception of one snake (presumably a crotalid) on page 131 of Shishinova et al. (2014) and a single word "reptiles" above the image.

Questions about the attitude towards snakes	Responses	Responses grade 7 - age 13-14 years	Responses grade 9 - age 15-16 years	Responses grade 11 - 17-18 years	Total % distribution of responses
1. Percentage distribution by classes and age groups		33%	56%	11%	100%
2. Have you ever seen a snake in nature?	Yes	85%	87%	91%	87%
	No	15%	12%	9%	12%
	Unanswered	0%	1%	0%	1%
3. If you see a snake, can you tell if it's poisonous or not?	Yes	18%	29%	40%	27%
	No	80%	70%	59%	72%
	Unanswered	2%	1%	0%	1%
4. Are snakes protected?	Yes, all of them	3%	3%	0%	2%
	Yes, some	38%	53%	73%	50%
	No	12%	6%	0%	8%
	I can not answer	47%	38%	27%	40%
5. Do you know how many species of poisonous snakes there are in Bulgaria? Can you list some of them?"?	two	23%	35%	32%	30%
	four	9%	5%	4%	7%
	more	6%	7%	5%	6%
	I can not answer	62%	53%	59%	57%
6. Would you own a snake as a pet?	Yes, I currently have	0%	0%	0%	0%
	I've had	1%	1%	0%	1%
	Yes, i would if it was up to me	17%	13%	14%	15%
	Not, never	80%	84%	86%	83%
	No answer	2%	2%	0%	1%
7. Are snakes dangerous to humans?	Yes	80%	67%	74%	73%
	No	2%	17%	22%	12%
	I don't know	18%	16%	4%	15%
8. In your opinion, if a snake gets into urban conditions - e.g. you see a snake in the park or on the street, what should be done?	The competent authorities should be called and it should be destroyed immediately	8%	6%	0%	6%
	The competent authorities should be called, it should be caught and released	83%	81%	91%	83%
	I can not answer	9%	12%	9%	11%
9. How you feel about snakes	Negatively	52%	64%	69%	58%
	Neutral	4%	18%	23%	12%

Questions about the attitude towards snakes	Responses	Responses grade 7 - age 13-14 years	Responses grade 9 - age 15-16 years	Responses grade 11 - 17-18 years	Total % distribution of responses
	Positively	3%	4%	8%	6%
	Unanswered	41%	14%	0%	24%
10. Have You or your relative ever killed a snake? If so, what was the reason?	Yes	27%	20%	45%	25%
	No	73%	69%	45%	68%
	Unanswered	0%	11%	10%	7%

Table 1. Answers in the questionnaires concerning the attitude toward snakes

Source: The authors

Questions about the positive attitude towards turtles	Responses	Responses grade 7 - age 13-14 years	Responses grade 9 - age 15-16 years	Responses grade 11 - 17-18 years	Total % distribution of responses
1. Percentage distribution by classes and age groups		51%	39%	10%	100%
2. Do you know what species of turtles inhabit Bulgaria?	Yes No Unanswered	33% 66% 1%	13% 85% 2%	23% 77% 0%	24% 74% 2%
3. Have you ever seen a turtle in nature?	Yes No Unanswered	75% 25% 0%	81% 19% 0%	72% 23% 4%	77% 22% 1%
4. If you see a turtle, can you tell which species it belongs to?	Yes No Unanswered	13% 86% 1%	11% 88% 1%	4% 92% 4%	11% 87% 2%
5. Are turtles protected according to Bulgarian legislation?	Yes No I don't know	68% 15% 17%	82% 12% 6%	77% 23% 0%	75% 15% 10%
6. How would you react if you met a turtle in nature?	I would take her to raise her at home I would leave it where it is Unanswered	15% 83% 3%	10% 90% 0%	18% 82% 0%	13% 86% 1%
7. Would you own a pet turtle?	Yes, I currently have I've had Yes, I would if it was up to me Not, never They didn't answer	2% 19% 46% 33% 0%	2% 20% 44% 34% 0%	0% 32% 23% 36% 9%	2% 21% 42% 34% 1%
8. If you have or have had a pet turtle, where did you get it?	Bought from a pet store We collected it from nature Other - a gift	40% 48% 12%	44% 56% 0%	44% 56% 0%	43% 52% 5%
9. Can turtles be dangerous?	Yes No I don't know	16% 15% 69%	12% 23% 65%	5% 50% 45%	14% 22% 64%
10. Do you know if it's legal to keep a turtle as a pet?	Yes, it is allowed No, it's forbidden There are only certain species that can be	23% 6% 36%	25% 7% 29%	23% 4% 41%	22% 6% 35%

Questions about the positive attitude towards turtles	Responses	Responses grade 7 - age 13-14 years	Responses grade 9 - age 15-16 years	Responses grade 11 - 17-18 years	Total % distribution of responses
	grown, and all others are strictly prohibited I don't know	35%	39%	32%	37%
11. In your opinion, if a turtle gets into urban conditions - e.g., you see a turtle in the park or on the street, what should be done?	The competent authorities should be called and it should be destroyed immediately	0%	0%	4%	0.4%
	The competent authorities should be called, she should be caught and released	85%	80%	82%	82%
	I can take her home and keep her as a pet	5%	7%	4%	6%
	I can not answer	10%	13%	10%	12%
11. Describe how you feel about turtles	Negatively	6%	3%	0%	4%
	Neutral	10%	12%	14%	11%
	Positively	60%	57%	76%	60%
	Unanswered	24%	28%	10%	25%
12. Do you know any superstitions related to turtles? If yes - describe briefly?	Those related to turtle blood	1%	7%	5%	3%
	Others	1%	1%	0%	1%
	Unanswered	98%	92%	95%	96%
13. Have you, or your relatives, killed a turtle? If so, what was the reason?	Yes	3%	2%	0%	2%
	No	97%	83%	95%	92%
	Unanswered	0%	15%	5%	6%

Table 2. Answers in the questionnaires concerning the attitude toward turtles

Source: The authors

4. Discussion

Ever since the work of Carson (1987), "Silent Spring" (which started the environmental movement on a global scale), a special emphasis on our attitudes towards the surrounding nature and different animal species has been provided. According to Kellert's study (1984) on the willingness to protect endangered species, less than half (43%) of respondents agreed to protect snakes, followed by spiders (34%). Ophidiophobia (fear of snakes) is indicated as one of the most common

phobias worldwide (Brewer, 2001, Knight, 2008). It was, according to some studies, evolutionarily determined (Ohman & Mineka, 2001). Not only fear, but also our aesthetic appreciation is relevant to the acceptance/non-acceptance of some animals (Stokes, 2007, Knight, 2008, Ceriaco, 2012). This is a quite natural dependence, considering that the beauty of nature is one of the most sought and appreciated ecosystem services, both in the field of ecotourism and on a daily level, as well as one of the most preferred objects of painting and literature (Stokke & Haukeland, 2017). In his research on attitudes towards animals, Kellert (1984) found that despite the fear of large

predators (e.g., lions), they were highly valued because they were perceived as beautiful. Attitudes towards their protection and survival were positive. The results of Pihno's study (2014) were similar. But positive attitudes can also have a huge impact on biodiversity conservation, with just as devastating an effect as a negative attitude. Kellert (1979, 1984) defined the following typology of basic human attitudes toward animals as: naturalistic, ecological, humanistic, moral, scientific, aesthetic, utilitarian, dominionist, negativist, and neutral. For most, the common attitudes were found to be humanistic, moralistic, utilitarian, and negative, with the negative (expressed in fear, disgust, dislike) being directly related to the desire/unwillingness to protect species.

Our surveys largely demonstrated a lack of knowledge, skills, and attitudes, largely leading to actions that are in direct violation of the texts of the Biodiversity Act, the Animal Protection Act, and other regulatory documents. At the same time, however, the attitudes regarding the inclusion in the educational program of classes related to practices concerning environmental protection were strongly positive in both surveys – 80% of respondents answered "Yes" in the question card about snakes, and 84% answered "Yes" in the question card for turtles. The need for education for sustainable development in the field of protection and conservation of species (as well as habitats) was widely recognized (Preslavska, 2019, Prokop, 2009, Schlegel & Rupf, 2010). According to Trombulak et al. (2004), education in conservation biology should be one of the most important goals of any society. Similar conclusions were found in various studies on attitudes towards endangered species (Prokop, 2009, Randler & Prokop, 2012, Reynolds et al., 2018).

Unfortunately, our analysis of the textbook content indicated on severe flaws. In the textbooks for "Biology and Health Education" for the 7th grade of Angelov et al. (2008) and Shishinyova et al. (2014), there is no description of the Reptile class (actually almost no information on Vertebrates). In another "Biology" textbook for the 7th grade, on page 85, five species of snakes that inhabit Bulgaria were listed and described, however the information is insufficient and confusing. There were no illustrations, except one drawing of *Dolichophis caspius* of very low quality and wrong coloration. One figure of foreign species of snake was attached (an unknown python species). This is directly related to the answers of the question "Do you know how many species of poisonous snakes there are in Bulgaria?". The results indicate that the students did not have the knowledge to answer correctly. Perhaps the

confusion that appeared was based on the contradictory information about poisonous snakes provided in the textbooks. There were no images of *V. ammodytes* and *V. berus*. The only morphological information was about the "scale horn" on the tip of the snout of *V. ammodytes*. Information concerning the differentiation of poisonous from non-venomous snake was lacking. In the textbook of Valcheva et al. (1993), on page 101 there was one photograph of a male *V. ammodytes*. The typical dorsal coloration of the body was well visible on the image, however it was not described in the text. In the text was mentioned the "horn" on the "head", but on the picture this structure could not be distinguished. The common European viper was not mentioned. On the same page, non-native reptilian species (the chameleon and the Indian cobra) were described. On page 108 there were images of monitor lizards, king cobra, Indian python, Nile crocodile and crested crocodile. From the local species of reptiles, information was available only for the oviparous lizard, however the image does not correspond to the habitus of that lizard.

Concerning the turtles, the content was also lacking or was rather confusing. In Naydenova et al. (1996) on page 85 was described that land and swamp turtles inhabit Bulgaria, without specifying how many species live in the country. No pictures were provided. In Valcheva et al. (1993) there was one drawing of *Emys orbicularis* (rather unprecise), and one picture of unknown elephant tortoise. Information on local species was scarce and actually misleading. The authors mentioned that "Bulgaria is inhabited both from aquatic turtles, as well as from land tortoises – the common pond turtle, the mauritanian turtle and land greeck tortoise and others". We cannot guess, which exactly species represented the "Mauritanian turtle", but the official names of all turtle species were wrong. Valcheva et al. (1993) presented the only information concerning protection status of the reptiles. These discrepancies were directly related to the question "If you see a turtle, can you identify which species it belongs to?", and the results of our survey showed that the majority of the students cannot determine the species.

The "social attitude" is one of the main terms in socioecology and was recognized as a powerful tool in relation to restoration and conservation ecology (Alves, 2012). Allport (1935) summarized that attitude is a state of psychoneurological readiness established on the basis of knowledge and experience. It exerts a guiding and/or dynamic influence on the individual's response to all objects or situations with which it is associated. Each person has certain attitudes towards the world,

and to a large extent, our reactions, actions, and decisions are predetermined by what type of social attitude we have towards the object in question. According to the three-component model of social attitude, it consists of emotional components, cognitive components, and volitional behavioral components. Social attitudes can also be determined using the one-component model, which explains their structure through the ambiguous positive or negative feeling of a given attitude towards a given object. According to this model, the main thing is the emotion, the attitude towards the object of the attitude, the assessment of whether the observed is good or bad for the observer. This assessment also determines our actions, within the defined normative frameworks (Todorova, 1995).

According to the so-called "Theorem of Thomas," if people define situations as real, they become real in their consequences" (Thomas & Thomas, 1928). When people believe in something, they act on their beliefs – constructively or destructively (Link et al., 1999). According to Fishbein's model for predicting behavioral intentions, a person's behavior is determined by three independent components – social attitudes; regulation; and motivation (Cohen et al., 1972). Humans act according to their attitudes, within legally defined norms, and depending on whether they are motivated or not. Practical experience and appropriate training lead to a change in negative attitudes (Ballouard et al., 2012, Reynolds et al., 2018). In our research, two trends were clearly evident:

- A strongly expressed negative attitude towards snakes, which presumably results in destructive behavior towards them. The lack of knowledge about snakes, the widespread perception that they are dangerous and a threat to humans, places us within the "Thomas Theorem" – if we consider them dangerous, then they are dangerous and should be destroyed to eliminate this threat. The lack of knowledge about organizations that could be of help in a particular situation (if, for example, we see a snake in the yard or another urban environment) is a key factor for annihilation;
- An overly positive attitude towards turtles, considered to be nice, small animals suitable for pets, was clearly demonstrated. This attitude has severe negative consequences for the animals, since, as we have seen from the survey results, a high percentage of respondents took wild animals from their natural habitat. Such animals were usually kept in an enclosed yard, often fed unsuitable food, and have low survival rates.

5. Conclusion

The present study demonstrated alarming levels of ignorance among Bulgarian school students concerning the biology and ecology of reptiles. Keeping in mind the high protection status of all reptiles and the high anthropogenic pressure on their populations, we highly recommend the improvement of the quality of school textbooks by providing precise information and high-quality images of the local herpetofauna. The vast majority (up to 95%) of the students responded that they want more classes including environmental education. In our opinion, the educational plans have to be revised in response to the needs of the students, even in case other biological disciplines need to be reduced in their normatives.

Acknowledgements

This work was supported by the Bulgarian Ministry of Education and Science under grant no. RD-08-108/30.01.2024.

References

- Allport, G. W. (1935). Attitudes. In a handbook of social psychology. In Murchison, C. (ed), Clark University Press. Worcester, Mass, (pp. 798 – 844). Scibrid.
- Alves, R. (2012). Relationships between fauna and people and the role of ethnozoology in animal conservation. *Ethnobiology and Conservation*, 1, 1-69. <https://doi.org/10.15451/ec201281.2169>
- Angelov, P., Angelova, R., Kukurina, S., Petrova, A. (2008). Biology and Health Education – 7 th grade. Bulgaria, Sofia, *Prosveta*, pp. 139.
- Ballouard, J. M., Provost, G., Barré, D., & Bonnet, X. (2012). Influence of a Field Trip on the Attitude of Schoolchildren toward Unpopular Organisms: An Experience with Snakes. *Journal of Herpetology* 46(3), 423 – 428, <https://doi.org/10.1670/11-118>
- Biodiversity Act. Pron. DV. No. 77 of 08/09/2002; last change DV. No. 98 of 27.11.2018. Convention for the Conservation of Wild European Flora and Fauna and Natural Habitats (Bern Convention). Ratified by the Supreme Court decision, SG No. 13 of 1991. Pub. Dv. no. 23 of 10.03.1991. Retrieved from: <https://rm.coe.int/1680078aff>
- Beshkov, V. (2015). Red Data Book of the Republic of Bulgaria, Animals. In Golemanski, V., et al. (Eds.) BAS & MoEW, Sofia, Vol.2, 202-207, pp. 375.
- Biserkov, V. (Ed), (2007). A Field Guide to Amphibians and Reptiles of Bulgaria. Sofia, *Green Balkans*, pp.196.

- Biserkov, V., Petrov, B., Naumov, B., Beshkov, V., Dobrev, D., Dukhalov, D., Stoev, P., Hristov, K., Ivanchev, I. (2005). Amphibian and Reptilian Biodiversity Conservation - Achievements and Challenges Ahead. In Petrova, A. (ed.) Bulgarian Herpetological Society, Sofia, Bulgarian Biodiversity Platform, pp. 283-292. [in Bulgarian]. Retrieved from https://www.researchgate.net/publication/316831995_Opazvaniya_na_ozonobraznizhenieto_na_yedrovnite_fondove_i_postizenia_i_predstoashi_zadaci
- Brewer, J. (2001). Snakes Top List of Americans' Fears. Gallup News Service. Retrieved from <https://news.gallup.com/poll/1891/snakes-top-list-americans-fears.aspx>
- Carson, R. (1987). Silent Spring, Zemizdat, Sofia, pp. 276
- Ceríaco, L. M. (2012). Human attitudes towards herpetofauna: The influence of folklore and negative values on the conservation of amphibians and reptiles in Portugal. *Journal of Ethnobiology Ethnomedicine*, 8(1), 8. <https://doi.org/10.1186/1746-4269-8-8>
- Cohen, J. B., Fishbein, M., & Ahtola, O., T. (1972). The Nature and Uses of Expectancy-Value Models in Consumer Attitude Research. *Journal of Marketing Research*, 9(4), 456-460., <https://doi.org/10.1177/002224377200900420>
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES, Retrieved from <https://cites.org/eng>
- Convention on International Trade in Endangered Species of Wild Fauna and Flora: Appendices I, II and III: valid from 25 November 2023
- Council Directive 92/43/EEC of 21 May 1992 on the protection of natural habitats and wild flora and fauna. Retrieved from <https://eur-lex.europa.eu/legal-content/BG/TXT/?uri=CELEX%3A31992L0043>
- Deng, Z., Xia, X., Zhang, M., Chen, X., Ding, X., Zhang, B., Deng, G., Yang, D. (2024). Predicting the Spatial Distribution of the Mangshan Pit Viper (*Protobothrops mangshanensis*) under Climate Change Scenarios Using MaxEnt Modeling. *Forests*, 15, (4), 723. <https://doi.org/10.3390/f15040723>
- Georgiev, G., Natchev, N. (2015). The Mysterious Strangers - The Reptiles, BulgarianZoologyChannel.
- International Union for Conservation of Nature, IUCN, Retrieved from <https://www.iucn.org/>
- IUCN Red List of Threatened Species, Retrieved from <https://www.iucnredlist.org>
- Kellert, S. R. (1979). Public attitudes toward critical wildlife and natural habitat issues: Phase I, U.S. Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C.
- Kellert, S.R. (1984). American attitudes toward and knowledge of animals: An update. In Fox, W. M. & Mickle, D. L. (eds.), *Advances in animal welfare science*, 85, (pp. 177-213). Washington, DC: The Humane Society of the United States.
- Knight, A. J. (2008). "Bats, snakes and spiders, Oh my!" How aesthetic and negativistic attitudes, and other factors inhibit reptile conservation support. *Journal of Environmental Psychology*, 28(1), 94-103., <https://doi.org/10.1016/j.jenvp.2007.10.001>
- Kotsiotis, V.J., Rapti, A., Liordos, V. (2022). Public attitudes towards venomous and nonvenomous snakes. *Science of The Total Environment*, 831, 154918. <https://doi.org/10.1016/j.scitotenv.2022.154918>
- Kuzmanova, Y., Natcheva, I., Koleva, V., Popgeorgiev, G., Slavchev, M., & Natchev, N. (2018). Public awareness of risks and recent marketing dynamics of Pond sliders (*Trachemys scripta*, Schoepff, 1792) in NE Bulgaria. *Zoology and Ecology*, 329-336. <https://doi.org/10.1080/21658005.2018.1521675>
- Larson, L.K., Clark, A.G. J., Bateman, L. H., Enloe, A., Hughes, B. (2024). To kill or not to kill? Exploring normative beliefs and attitudes. *Biological Conservation*, 290, 110399. <https://doi.org/10.1016/j.biocon.2023.110399>
- Link, B. G., Monahan, J., Stueve, A., and Cullen, T. F. (1999). "Real in Their Consequences: A Sociological Approach to Understanding the Association between Psychotic Symptoms and Violence." *American Sociological Review*, 64, (2), 316-328. <https://doi.org/10.1177/000312249906400213>
- Maarten, H. J. (2012). Human Emotions Toward Wildlife, Human Dimensions of Wildlife: *An International Journal*, 17(1), 1-3, <https://doi.org/10.1080/10871209.2012.653674>
- Marinova, P., Koynova, T., Tsvetkov, R., Natchev, N. (2022). New data on the presence of the Blotched snake (*Elaphe sauromates* Pallas, 1814) in the region of Shumen town (Bulgaria), with emphasis on the negative human attitude toward the species. *Acta Scientifica Naturalis*, 9(2), 20-24, <https://doi.org/10.2478/asn-2022-0011>
- Naydenova, L., Popov, V., Koyumdzhieva, M., Paspaleva, M. (1996). Biology - 7 th grade, Bulgaria, Sofia, *Anubis*, pp. 127, [In Bulgarian]
- Natchev, N., Telenchev, I., Mladenov, V., Georgieva, R., Redl, E. (2017). Data of the herpetofauna-vehicle collisions in the region of Burgas city (SE Bulgaria). 55-th Annual Scientific Conference of Ruse University. Reports awarded with "Best Paper" *Crystal Prize*, 128-132.
- Ohman, A., & Mineka, S. (2001). Fears, phobias, and preparedness: Toward an evolved module of fear and

- fear learning. *Psychological Review*, 108(3), 483–522. <https://doi.org/10.1037/0033-295X.108.3.483>
- Prakash, S., & Verma, A. K. (2022). Anthropogenic Activities and Biodiversity Threats. *International Journal of Biological Innovations, IJBI*, 4(1), 94–103, <https://doi.org/10.46505/IJBI.2022.4110>
 - Prokop, P., Ozel, M., & Usak, M. (2009). Cross-Cultural Comparison of Student Attitudes toward Snakes. *Society & Animals*, 17(3), 224–240. <https://doi.org/10.1163/156853009x445398>
 - Preslavskaja – Bancheva, N. (2019). Modern Approaches to Organizing Educational Activities in Protected Areas *Ekocentrik*, Sofia, pp. 150 [in Bulgarian]
 - Rawat, U., & Agarwal, N. (2015). Biodiversity: Concept, threats and conservation. *Environment Conservation Journal*, 16(3), 19–28. <https://doi.org/10.36953/ECJ.2015.16303>
 - Randler, C., Hummel, E., & Prokop, P. (2012). Practical Work at School Reduces Disgust and Fear of Unpopular Animals. *Society & Animals*, 20(1), 61–74. <https://doi.org/10.1163/156853012x614369>
 - Reynolds, B., Salamander, T. & Wilson, T. (2018). A Walk in the Woods: Changing Student Attitudes toward Amphibians and Reptiles. *Creative Education*, 9, 182–191. <https://doi.org/10.4236/ce.2018.92014>
 - Schlegel, J., & Rupf, R. (2010). Attitudes towards potential animal flagship species in nature conservation: A survey among students of different educational institutions. *Journal for Nature Conservation*, 18, 278–290. <https://doi.org/10.1016/j.jnc.2009.12.002>
 - Stokes, D. L. (2007). Things We Like: Human Preferences among Similar Organisms and Implications for Conservation. *Human Ecology*, 35, 361–369. <https://doi.org/10.1007/s10745-006-9056-7>
 - Stokke, K. B., & Haukeland, J. V. (2017). Balancing tourism development and nature protection across national park borders – a case study of a coastal protected area in Norway. *Journal of Environmental Planning and Management*, 1–15. <https://doi.org/10.1080/09640568.2017.1388772>
 - Stojanov, A., Tzankov, N., Naumov, B. (2011). Die amphibien und reptilien Bulgariens. Chimaira, Frankfurt am Main, Germany, pp. 582.
 - Thomas, W. I. & Thomas, S. D. (1928). The Child in America: Behavior Problems and Programs. New York: Knopf, pp. 583.
 - Todorova, E. (1995). Social Psychology, VSU, Varna, pp. 364.
 - Trombulak, S. C., Omland, K. S., Robinson, J. A., Lusk, J. J., Fleischner, T. L., Brown, G., & Domroese, M. (2004). Principles of conservation biology: Recommended guidelines for conservation literacy from the Education Committee of the Society for Conservation Biology. *Conservation Biology*, 18(5), 1180–1190.
 - Tzankov, N. D., Popgeorgiev, G.S., Kornilev, YV. (2017). The Nose-horned Viper *Vipera Ammodytes Montandoni* in Bulgaria. Viper Specialist Group (VSG) Blog. The Nose-horned Viper (*Vipera Ammodytes Montandoni*) in Bulgaria | The Orianne Society (blog)., access at 2017.02.19.
 - Shishinyova, M., Pavlova – Tonkova, D., Vrajalieva, I., Bancheva, L. (2014). Biology and Health Education – 7 th grade., Bulgaria, Sofia: *Anubis*, pp. 130.
 - Valcheva, N., Tomova, S., Panayotov A (1993). Zoology 7 th grade., Bulgaria, Sofia: *Geya – Libris*, pp. 144.

Declarations

Funding: This work was supported by the Bulgarian Ministry of Education and Science under grant no No. RD-08-108/30.01.2024.

Potential competing interests: No potential competing interests to declare.