

## OPINION

*From:* **Assoc. Prof. Dr. Yordan Spasov Koshev**, Department of Ecosystem Research, Environmental Risk Assessment and Conservation Biology, Institute of Biodiversity and Ecosystem Research – Bulgarian Academy of Sciences (IBER-BAS)

*Regarding:* evaluation of a dissertation for the acquisition of the educational and scientific degree “Doctor”

*Scientific field:* 4. Natural sciences, mathematics and informatics

*Professional direction:* 4.3. Biological Sciences

*Specialty:* Ecology and Environmental Protection - Behavioral ecology

*University:* SU "St. Kliment Ohridski", Faculty of Biology

*Department:* Ecology and environmental protection

*PhD thesis:* **Influence of human and environment on the behaviour of selected mammal species in captivity- application in zoos and conservation**

*PhD candidate:* **Katerina Toneva Zareva - Simeonova**

*Scientific supervisor:* **Prof. Dr. Daniela Simeonovska - Nikolova**

*Scientific consultant:* **Ch. assist. prof. Dr. Venislava Spasova**

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### **1. Scientific relevance of the Ph.D. dissertation**

Studying the behaviour of captive animals is an essential step in implementing techniques to reduce stress, enrich the environment, improve living conditions and their overall well-being, etc. This type of study is one of the most dynamic and rapidly developing disciplines in zoology worldwide. In Bulgaria, with few exceptions, there is almost no targeted, long-term and in-depth research on key wildlife species observed in our zoological gardens.

The selection of target species is very appropriate. On the one hand, the brown bear (*Ursus arctos*), an emblematic species for Bulgaria and one of the most widely presented mammals in our zoological gardens. On the other hand, the European souslik/ ground squirrel (*Spermophilus citellus*) is still widespread in our country, but it is not well known to the public living in the big urban centres, where a larger part of the country's population is concentrated. Unfortunately, the souslik has never been intently presented in our country. Rodents make up about 1/3 of the Bulgarian mammal fauna, but there is no information that they were part of any zoological collections, with the exception of some alien invasive species that have been successfully acclimatized in our country. Therefore, I think that the initiative of the doctoral student in successfully presenting a rodent from the Bulgarian fauna for the first time in a Bulgarian zoo is truly innovative.

The inclusion of the two species, the objects of the study, is proportional in volume and attention in the dissertation in accordance to their presence in our zoological gardens.

### **2. Summary of the Ph.D. thesis**

This dissertation is constructed within 150 standard pages and further includes 26 pages of three appendices. Sections “Materials and methods”, “Results” and “Discussion” of the dissertation are formulated as separate parts for each scientific publication (or draft) and are logically and inextricably linked.

### **3. Knowledge of the topic**

The Ph.D. candidate has good knowledge of the literature as they have used 297 sources. The literature in Cyrillic is composed of only 20 references and they are placed at the end of the reference list despite the fact that in Bulgaria it is commonly accepted that the Cyrillic literature must be in the beginning.

Some literary sources are cited incorrectly in the text. For example, „Bunnell, F.L., Tait, D.E.N., Fowler, C.W. and Smith, T.D., 1981. Population dynamics of bears—implications. *Ursus*, 13, p.57.“ is cited as „Bunnell & Tait, 1981“ on page 57.

### **4. Structure and methodology of the study**

The Ph.D. candidate has formulated the aims and tasks has prepared working hypotheses in accordance with the unsolved problems presented within the introduction. From then on, the applied methods are fully adequate and relevant to the obtained results.

### **5. Contributions of the dissertation**

The primary merit of this dissertation is in its scientific and applied nature. Such a detailed characterization of the main types of behaviour of two mammal species reared in captivity has been carried out for the first time in our country. From obtained results, specific proposals for amending the legislation have been prepared, examples and guidelines for improving the well-being of bears kept in captivity in our country are given. For the European souslik, data on its behaviour in captivity has been collected for the first time, classical behavioural tests have been applied.

*The following contributions may be highlighted:*

- Providing auditory and olfactory stimuli to a captive brown bear builds knowledge of the species' behaviour while reducing forms of stereotyped behaviour and can be successfully used in rearing this species in captivity.
- The described abnormal stereotypic behaviour in the brown bear - "non-food sucking" successfully elucidates the reasons for its occurrence and suggests approaches for its mitigation in the future.
- In accordance with the currently effective "Action Plan for the Conservation of the European souslik *Spermophilus citellus* in Bulgaria for the period 2022-2031", pilot activities were carried out for breeding and researching the behaviour and activity of the species in captive conditions. These results mark the beginning of ex-situ conservation activities for the species in our country.
- The proposed changes in Ordinance No. 6 of 23.10.2003 are of great practical importance for improving the well-being of captive brown bears in our country.

*I would personally like to add the following contributions to the ones listed by the Ph.D candidate above:*

- The observed entry into summer lethargy transitioning smoothly into hibernation of the two sousliks in the zoo is a rare phenomenon observed by researchers in the wild, but not in such a precise chronology as in studies with phototraps. The contribution of this observation is even greater due to the fact that the animals had unrestricted access to fresh fruits and vegetables and clean fresh water, which is rare in the wild. When considering the of above average temperatures reported for the summer months of 2023, this observation may

have fundamental implications for our knowledge of the species' behavioural and physiological adaptations to climate change and needs further research.

- The innovative approaches of studying the behaviour of sousliks via the "open field" and "exploration of a novel object" methods provide initial, albeit incomplete, information about the behaviour of sousliks placed in such classic rodent behaviour analysis tests. Although the data needs further analysis, it provides information on individual differences in confinement behaviour that has never been reported before.

## **6. Scientific publications on the topic of the dissertation**

Two scientific publications were presented on the topic of the dissertation in which the Ph.D. candidate is leading author with co-authorship with their supervisor and consultant. The publications are in scientific journals with an impact factor of 2,4 (SJR = Q1) and 0,5 (SJR = Q4), respectively. With that, the minimum criteria for awarding the educational and scientific degree of "Doctor".

## **7. Critical notes and questions**

In describing the individual sections I have marked some critical notes, to which I would appreciate and answer.

Here I will mention some fundamental notes and questions towards the Ph.D. candidate:

1. To avoid individual differences in behaviour, shouldn't each experimental brown bear individual be exposed to the same stimulus multiple times over a period of time to avoid habituation and thus minimize momentary variation in behaviour?
2. What is the origin of the proposed conspecific sounds and which subspecies of brown bear are they from? It is known that sometimes animals have dialects of the sounds they make, which may not match those of bears kept in zoos in our country.
3. Without detracting from the proposal in Appendix 3 "Catalogue of suitable forms of environmental enrichment for brown bears in the conditions in Bulgarian zoos", it is not a result stemming from this dissertation (with the exception of points II.6., III.1. and III. 3), but part of standard practice of breeding mammals in zoos around the world. In chapter IV "Evaluation of the level of well-being of brown bears bred in captivity in Bulgaria" an analysis of the state of the conditions under which bears are bred in our country is made, but these detailed proposals in the mentioned catalogue do not follow from it. It is necessary to cite the literature used when preparing the catalogue.
4. For this reason (see point above) I also disagree with contribution No. 6 regarding a prepared catalogue with suitable forms of environmental enrichment for brown bears, applicable in the current conditions of Bulgarian zoos, because it is not entirely a result of the studies in the dissertation.
5. In the electronic version of the dissertation and the abstract, there are no internal references (links) from the table of contents to the sections, as well as between the literature in the text to the bibliography, the mentioning of figures and tables in the text and the graphs themselves, which makes navigating the document very difficult.
6. When do you plan to fully process the data for the European souslik and publish it?
7. Do you plan to increase the souslik enclosure by releasing more animals and proceed with their captive breeding for future conservation activities?

## **8. Assessment of the synopsis and fulfilment of the minimum national requirements**

The abstract faithfully reflects the content of the dissertation work. As a critical note, I would point out that the abstract is not a summary of the dissertation, but a dissertation shortened by half. The dissertation has a volume of 128 pages (without the literature or appendices). The abstract, instead of presenting a brief synthesis of the dissertation, is simply a reduced copy of it to just over 50% or 58 pages.

The poster presented on page 57 in the abstract "Simeonovska-Nikolova D., Spasova V., Dimitrov K., Zareva-Simeonova K., 2020. Is there a future for the Romanian hamster, *Mesocricetus newtoni* in Bulgaria?" International Scientific Conference on Restoration of Conservation-Reliant Species and Habitats, 6th November 2020, p. 24, poster RS-8" is not within the topic of the dissertation work.

In the abstract, there is no reference to the exams passed or accumulated credits, which are an integral part of the training process for acquiring the educational and scientific degree of "doctor". This part of the assessment is done during the pre-defense and the Ph.D. candidate is admitted to the exam.

The Ph.D. candidate has fulfilled the minimum requirements according to the national scientometric indicators, namely according to indicator "A", has submitted a Dissertation work for awarding the educational and scientific degree "doctor" (50 points) and according to indicator "D" – has presented two publications (Q1 and Q4) , which make a total of 37 points.

## **9. Motivated conclusions**

I know the PhD candidate as an employee, and then as the head of the Ecological Scientific and Educational Centre at "Zoological garden - Sofia". My personal impressions of her work are that she shows independence, persistence and purposefulness in her scientific research.

The notes and recommendations made here are not intended to detract from the dissertation work, but are intended only to assist the doctoral student by offering directions for future scientific work.

The dissertation work of Katerina Toneva Zareva-Simeonova is a modern scientific study with original scientific and applied science contributions. In terms of structure and content, the presented dissertation fully complies with the requirements of the Development of Academic Staff Act, the Regulations for its implementation and the Regulations for the terms and conditions for acquiring scientific degrees and for holding academic positions at SU "St. Kliment Ohridski".

**I positively evaluate the dissertation work of Katerina Toneva Zareva-Simeonova and I strongly support awarding her the educational and scientific degree “Doctor” in professional direction 4.3. Biological Sciences (Ecology and Environmental Protection).**

24.05.2024  
Sofia City

Opinion prepared by:  
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