REVIEW

on a dissertation for obtaining the scientific degree **Doctor** in: field of higher education 4. Natural sciences, mathematics and informatics, professional field 4.4. Earth sciences, scientific specialty Ecology and Ecosystems Protection

Author of the dissertation: **Gradimir Zhelyazkov Gradev**, self-study PhD student at the Department of Agroecology and Environmental Protection at the Agricultural University, Plovdiv

Dissertation topic: *Restoration of the Lesser Kestrel (Falco naumanni, Fleisher, 1818)*

Reviewer: Prof. Dr. Diana Atanasova Kirin, Agricultural University - Plovdiv, field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.4. Earth Sciences, in the scientific specialty Ecology and Ecosystems Protection, appointed a member of the scientific jury with order № RD-16-1318 / 23.11.2021 by the Rector of the Agricultural University.

1. Brief introduction of the candidate.

Gradimir Zhelyazkov Gradev was born in 1979 in the town of Karlovo. The PhD student completed his secondary education in 1998 at the Veterinary Vocational School of Stara Zagora. In 1999 he was admitted to study at the Agricultural University - Plovdiv, where he completed gradually his studies in the Bachelor's degree in Ecology and Environmental Protection and in the Master's degree in Ecology of Settlement Systems, in 2003 and 2004 respectively. He completed both educational and qualification degrees with the defence of diploma theses with topics in the field of avifauna and nature protection: *Species composition of the avifauna of Pomorie Lake, conservation status and restoration of habitats* and *Winter concentrations of the endangered species of small cormorant (Phalacrocorax pygmeus) in the region of Plovdiv*, respectively. In 2018 Gradev was enrolled (Order RD-26-98 / 18.12.2018) in self-study PhD studies at the Department of Agroecology and Environmental Protection, field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.4. Earth Sciences, in the scientific specialty Ecology and Ecosystems Protection, with the topic: *Restoration of the Lesser Kestrel (Falco naumanni Fleisher, 1818)* and research supervisor Assoc. Prof. Dr. Tatyana Bileva. He finished his study with Order RD-26-52 / 26.11.2021, as of 19.11.2021, by which the period of the PhD program, determined by the order of enrolment was completed. Gradev started working at the Federation of Environmental Associations Green Balkans in 1999, while being a student at the

Agricultural University, and he still works there as of now. He started as volunteer and continued as coordinator, associate to the "Avifauna" team, expert, head of projects, ecologist. All projects (a total of 16 projects for a period of 21 years) in the federation, in which Gradimir Gradev participated, were related, with few exceptions, to studies on species composition and protection of representatives of the avifauna. The PhD student states developed skills for teamwork, for communication with various institutions, for the preparation and implementation of various environmental projects. The PhD student states basic competencies in English, developed computer skills, as well as skills for working with specialized software and devices needed for the study of avifauna.

2. Relevance of the problem.

The dissertation deals with the application of methods and measures for the restoration of the globally endangered species of Lesser Kestrel (*Falco naumanni* Fleisher, 1818). The Lesser Kestrel was a ubiquitous, widespread nesting species in Bulgaria until the early 20th century. At the end of the 20th century, however, no definite data on nesting of this species in our country were reported. The last nesting site was registered by Green Balkans in 1989 in the Sakar Mountains, an area located on the border with Greece and Turkey, ie. two countries with some of the largest populations of Lesser Kestrel in Europe to date. It is stated that the extinction of the Lesser Kestrel as a nesting species in Bulgaria is a consequence of complex reasons that led to a drastic contraction of the range of the species from the periphery to the centre. All this makes the current dissertation topic extremely relevant. The developed issues are part of the activities and results obtained for the restoration of the Lesser Kestrel as a nesting species in Bulgaria from the period 2013-2018 in connection with the implementation of the project *Restoration of the Lesser Kestrel* LIFE11 NAT/BG/360, funded by LIFE program of the European Union, implemented jointly with Green Balkans NGO - Stara Zagora.

3. Purpose, tasks, hypotheses and research methods.

The aim of the dissertation is to study and summarize the process of restoration of the Lesser Kestrel (*Falco naumanni* Fleischer, 1818), as a nesting species in Bulgaria. To achieve this goal, four main tasks were formulated: 1. To analyze the methods and approaches used in the successful restoration of the Lesser Kestrel in Sakar Protected Area BG0002021; 2. To describe the structures and equipment used in the process of restoring the nesting of the species; 3. To trace the numbers, trends and dynamics of the population of the species at national level after its initial recovery; 4. To analyze the achieved results of the species restoration. Due to the proven impossibility of natural restoration of the Lesser Kestrel species on the territory of Bulgaria, the scientific team

adopted and applied the *Guidelines for reintroduction and other conservation translocations of species* prepared by the International Union for Conservation of Nature (IUCN / SSC 2013). After detailed studies, „Sakar" Protected Area BG0002021 was selected as a suitable area for starting the restoration activities of the species as nesting on the territory of Bulgaria. „Byala Reka" Protected Area BG0002019 and „Krumovitsa" Protected Area BG0002012 were also included for pilot and ancillary activities without direct release of birds in them. The following methods adopted for the present study were described: the method of direct release of birds in the wild; the method of artificial nesting; determination of nesting parameters; methods for statistical data processing, as well as the method of marking, tracking with radio and satellite transmitters, virtual observations. The methods and parameters are appropriate, modern, widely used in the world literature and practice in this type of research. The territory around „Lukoil Neftochim Burgas" AD was omitted in the section as an object of study.

4. Visualization and presentation of the obtained results.

The dissertation is presented on 113 pages. This volume includes 3 annexes that contain 18 photos without numbering (4 pages); lists of publications, citations and participation in conferences / congresses (10 pages). Thus, the real part of the dissertation is located on 100 pages. This volume is illustrated with 20 figures (including 7 photos) and 24 tables. The following sections were developed in the dissertation: 1. Introduction (3 pages); 2. Literary review, with the following subsections: 2.1. Distribution of the species in the world; 2.2. Distribution of the species in Europe; 2.3. Distribution of the species in Bulgaria; 2.4. Conservation and legal status; 2.4.1. Conservation status; 2.4.2. Legal status; 2.5. Ecology and biology of the species (22 pages in total); III. Purpose and objectives (1 page); 4. Materials and methods, with the subsections: 4.1. Scope of the study; 4.2. Research methods; 4.2.1. Direct release of birds in the wild; 4.2.2. Artificial nests; 4.2.3. Nesting parameters; 4.2.4. Statistical data processing; 4.2.5. Marking; 4.2.6. Tracking with radio and satellite transmitters; 4.2.7. Visual observations (7 pages in total); 5. Results and discussion, with the subsections: 5.1. Analysis of the methods and approaches used in the successful restoration of the Lesser Kestrel in Sakar Protected Area BG0002021; 5.1.1. Reinforcement of the population; 5.1.2. Habitat model; 5.2. Results of the use of structures and equipment in the process of restoring the nesting of the species; 5.2.1. Module for releasing young Lesser Kestrels and artificial nests; 5.3. Numbers, nesting parameters, trends and dynamics of the species population at national level after its initial recovery; 5.3.1. Estimation of the national number; 5.4. Analysis of the achieved results from the restoration of the species (38 pages in total); 6. Conclusions (3 pages); 7. Recommendations for the practice (2 pages); 8.

Contributions (1 page); Literature (15 pages). A good impression is made by displaying a list of abbreviations at the beginning of the work (2 pages).

5. Discussion of the results and used literature.

The "Literary Review" section is focused on the research of authors from Bulgaria and other countries on the distribution and migration of the Lesser Kestrel in the world, Europe and Bulgaria. The conservation status of the species in the time up to the present stage is described. The wording "2.4. Conservation and legal status" is incorrect. Conservation status is based on certain documents of national or international law. Therefore, it should be presented with subsections for conservation status in Bulgaria and internationally. The subsection "Ecology and Biology of the Species" follows, which should be more correct to be entitled "Biology and Ecology of the Species". This subsection is more appropriate to be first in the section. Data on the taxonomic position of the species are missing. Data on biology and ecology are also given in the other subsections. They should be systematized in this subsection. When first quoting the Latin names of the species, the author's name(s) written in accordance with the International Code on Zoological Nomenclature must be presented in the scientific literature, e.g. on page 16 the correct spelling should be *Falco tinnunculus* Linnaeus, 1758. In Table 3, page 15 there are no data for the Czech Republic and Greece. It is recommended that these countries be mentioned only in the text, provided that there are no data, which are clearly missing also for other EU countries! The terminology in Bulgarian language shall be used, not foreign words or literally English words and expressions or they shall be used /added, for example, in brackets. When quoting the authors, first those in Cyrillic shall be quoted, and then in Latin, following also the chronologic order. In the scientific literature, the word "Table" is written in its entirety and not as "Tab.", in plus it is grammatically incorrect, while the word "Figure" is allowed to be abbreviated as "Fig.", both in the text and in the title of these images, etc. These remarks also apply to the following sections of the paper. The aim of the research is formulated as *Study and summarizing the process of restoration of the Lesser Kestrel (Falco naumanni Fleischer, 1818), as a nesting species in Bulgaria*. The mentioned 4 main tasks are sufficient and are formulated clearly and precisely. The approach and research methods are relatively well described. The "Statistical data processing" subsection is more appropriate to be presented last. The nesting parameters are very well selected and presented. In the "Results" section, the subsections regarding the analysis of methods and approaches, as well as the description of the used structures and equipment are well discussed, as the data obtained by Gradev as a member of the above-mentioned Green Balkans project are interpreted with the results of similar studies on the Lesser Kestrel in other countries by different authors or with regard to biologically and ecologically similar species of birds of prey in Bulgaria. The presented and discussed results

with applied statistical approach in "5.3. Number, nesting parameters, trends and dynamics of the population of the species at the national level after its initial recovery" subsection have very serious research importance. The obtained results regarding the adopted parameters ("Materials and Methods" section) are presented and discussed very well and reflect the effectiveness of the measures taken to restore the species as nesting in Bulgaria. The author and the team from Green Balkans achieve even better results than those in Spain and France (Table 20, page 63) in terms of hatch size, reproductive result and rate. However, some inaccuracies and incompleteness exist. On page 54, Table 6 is in fact Table 7. Data on returned birds in 2019 should be added to Table 7, which would complete the data on the fate of released birds in 2018 and in general on the period 2013-2018. I assume that the last column of Table 8, page 55, is redundant because in the last two columns the data and indicators are identical, except for the values for 2018, which I perceive as a technical error! Another disadvantage of the subsection is the simultaneous presentation of the same data, both tabularly and graphically, which is not admissible for scientific research. The data should be presented at most to the second character, which is not actually applied to the data from Tables 12-17 of pages 58-59 and page 61, as well as to the values quoted from them in the text. The assessment of the national number of the nesting population shows a gradation for the period of the study, which confirms the effectiveness of the applied approaches, methods and measures for recovery. It is stated that over 60% of the observed nesting pairs use artificial nests. The analysis of the achieved results Gradev performes on the basis of 671 marked birds, as well as placed radio transmitters to 6 birds and satellite transmitters to the same number. For the first time in Bulgaria the team research the wandering, migration and wintering of the Lesser Kestrel, which leads to new knowledge about the species, related to overnight stays, migration routes, places of concentrations of individuals, wintering places of the Bulgarian population. The author proves the connection between the nesting populations of the Lesser Kestrel in Bulgaria, Turkey and Greece, as well as the relations between the separate nesting colonies of the Lesser Kestrel in Bulgaria. Not without significance for the good results achieved is the international cooperation and experience, implemented and gained in the realization of international projects and events. Activities to improve the food habitats of the species were also carried out. The results of the research work are summarized in 16 conclusions. The conclusions comprehensively outline the main results achieved. The presented recommendations for the practice are relevant and in close accordance with the achieved results. The literature list includes 113 literature sources. 16 literature sources cited in the text are not identified in this list. At the same time, the list contains 17 sources that are not cited in the text. Literary sources are not presented uniformly by categories, nor are they written according to the requirements in the scientific literature.

6. Contributions of the dissertation.

The contributions of the dissertation are formulated in 2 categories:

Scientific contributions

5 formulations for scientific contributions are presented.

Applied science contributions

The applied science contributions are 5. To a large extent they overlap with the conclusions and scientific contributions.

Both categories of contributions are rather inference. They largely complement and overlap each other. They are not formulated in such a way as to express the scientific and applied science significance of the obtained results, respectively.

7. Critical remarks and questions.

Critical remarks: 1. To approach with greater responsibility the structuring and technical design of the dissertation as a scientific work. Technical and spelling errors have not been eliminated. 2. The lists of publications, participation in conferences / congresses, and the list of citations are not part of the content of the dissertation. If they are applied in this format, they must be exported after the "Literature" and "Annexes" sections. 3. Most of the submitted photo material is more appropriate not to be in the dissertation, but to illustrate the presentation. 4. Most of the critical remarks mentioned in the review were mentioned during the discussion of the draft dissertation.

Questions: 1. What are the reasons for the unsuccessful reproduction of the Lesser Kestrel in Bulgaria after the end of the 20th century, provided that this was not the case in the past and the species was distinguished as widespread in the wild?

2. How have ecosystem conditions changed since the end of the 20th century? Is there evidence of drastic changes that could hinder the successful reproduction?

3. Are there any registered released specimens in Bulgaria that have settled permanently and are breeding successfully in Greece / Turkey? What are the main differences in the conditions of the habitats in Greece / Turkey compared to those in Bulgaria?

4. How do the reported lowest values for the hatch in 2018 affect those of the following years?

5. How often is the Lesser Kestrel monitored in Bulgaria and what are the data after 2018 to now in terms of nesting parameters?

8. Published articles and citations.

The PhD student presents a list and full text of 10 publications in connection with the topic of the dissertation. 4 of them were published in indexed scientific journals, of which 2 journals have Q_1 (№№ 9, 13; SJR_{total} = 1.47; a total of 5.21 points), and the rest - with Q_4 (№№ 11, 14; SJR_{total} = 0.34; a total of 10.66 points). 2 scientific publications were published in conference proceedings (№№ 4, 15; a total of 11.66). 2 publications were published in Scientific Papers of the Agricultural University (№№ 1, 3; a total of 10 points). Gradev participated in 2 national student conferences, 3 national scientific conferences and 4 international conferences. Attached are 5 abstracts (№№ 5, 6, 8, 11, 12), published in connection with participation in conferences. The author presents 16 citations. The PhD student is a member of the team having developed an Action Plan for the protection of the Lesser Kestrel (*Falco naumanni*) in Bulgaria 2021-2030, approved by Order RD-772 / 24.09.2020 of the Minister of Environment. Gradev also participated as a co-author with Simeon Marin and Wolfgang Baumgart in an atlas of birds of prey and falcons, in which in 2019 most of the data and illustrations contained in the dissertation were published. Other material (№ 10) in connection with the dissertation was co-authored in the European Atlas of Nesting Birds. The scientific production of the PhD student significantly exceeds the required 30 points under the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations of the Agricultural University for its application. The presented dissertation abstract objectively reflects the structure and content of the dissertation.

CONCLUSION:

Based on the different research methods learned and applied by the PhD student, correctly performed experiments, summaries and conclusions, I believe that the presented dissertation meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations of the Agricultural University for its application, which gives me reason to evaluate it POSITIVE.

I would like to suggest to the esteemed Scientific Jury to vote positively and to award Gradimir Zhelyazkov Gradev the scientific degree **Doctor** in the scientific specialty Ecology and Ecosystems Protection.

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Plovdiv