

## **REVIEW**

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**Subject:** the dissertation to award the educational and scientific degree "Ph.D." in the field of higher education **4. Natural Sciences, Mathematics, and Informatics** professional field **4.3. Biological sciences**  
Ph.D. Program **Zoology**

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Scientific supervisors:

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### **1. General description of the submitted materials**

By Order No RD-21-1554 of 21. 07. 2023 of the Rector of Plovdiv University "Paisii Hilendarski" (PU) I have been appointed as a member of the scientific jury for the procedure for the defense of the dissertation on "Abundance and distribution of cetaceans (Cetacea) in the Bulgarian territorial waters of the Black Sea" for the acquisition of the educational and scientific degree "Doctor" in the field of higher education 4. Natural Sciences, Mathematics, and Informatics, professional field 4.3. Biological sciences, doctoral program in Zoology. The author of the dissertation is Dimitar Vassilev Popov - a Ph.D. student in full-time study at the Department of Zoology of PU with scientific supervisors Assoc. Prof. Dr. Hristo Angelov Dimitrov from PU "P. Hilendarski" and Assoc. Prof. Dr. Marina Dobromirova Panayotova from the Institute of Oceanology, BAS.

The set of materials submitted by Dimitar Popov is in accordance with Article 36 (1) of the Regulations for the Development of the Academic Staff of PU, and includes the following documents:

- Application to the Rector of PU for the disclosure of the procedure for dissertation defense;
- CV in European format;
- the minutes of the departmental council related to the reporting of the readiness for the opening of the procedure and the preliminary discussion of the dissertation;
- Ph.D. Thesis;
- Ph.D. Thesis auto-refutation in Bulgarian and English;
- list of scientific publications on the subject of the dissertation;
- a statement of compliance with the national requirements under the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB)

The applicant has attached a list containing 5 scientific publications as follows: 2 in quartile Q1 journals (*Diversity* with IF (2022)=2.4 and *Frontiers in Marine Science* with IF(2022)=3.7) and 3 in quartiles Q3 and Q4 - *Acta zoologica bulgarica* (with IF (2020)=0.448 and IF(2021)=0.362). Unfortunately, the publications are not attached in full text. On the basis of the submitted publications, the applicant fulfills and exceeds the national requirements according to the LDASRB. In my opinion, the scores have not been calculated correctly, and I cannot determine on what assumptions the numerical values presented are based. According to my calculations for indicator G, the applicant collects the following points: 2x25 pts. for articles in Q1 (*Diversity* and *Frontiers in Marine Science* which for 2022 are Q1); 2x15 pts. for the two articles in *Acta zoologica bulgarica* from 2020 and 1x12 pts. for the article in *Acta zoologica bulgarica* from 2021. So, the points become 92 in total.

## **2. Brief biographical data about the Ph.D. student**

Dimitar Popov graduated from Plovdiv University "P. Hilendarski" in 2003 with a bachelor's in economics. His love for nature clearly prevailed and since 2005 he has been working for the "Green Balkans" Association. In 2011 he started his master's degree in Ecology

at PU. He specializes in statistical methods in ecology, GIS, and environmental legislation. In 2013 he graduated with a Master in Ecology. His professional career is related to the development of a number of conservation projects such as the conservation of nesting bird habitats, radio and satellite telemetry of birds, and cetacean density studies. He has been involved in the development of management plans for protected areas and sites, the preparation of species action plans, and a range of other conservation activities. His overall professional activity reflects his formation as a well-rounded specialist in conservation biology and environmental protection.

### **3. The relevance of the topic and the suitability of the aims and objectives**

Biodiversity conservation and the preservation of the gene pool of natural populations are priority goals for conservation biology and ecology. Increased anthropogenic impact on the environment over the last century has led to an increase in ecological risk and a decrease in the abundance of many natural populations. Therefore, biomonitoring research is of utmost importance for the study and conservation of populations of endemic taxa, rare and understudied species. The assessment of the ecological risk for the populations of endemic cetacean subspecies in the Black Sea is a highly topical scientific problem, as such studies are lacking in Bulgarian zoological science. All three subspecies of the dolphin family found in the Black Sea are included in the IUCN Red List of Threatened Species: the Black Sea common dolphin in the Vulnerable (VU) category, and the Black Sea bottlenose dolphin and the Black Sea Harbour Porpoise in the Endangered (EN) category. Anthropogenic pressures on the biodiversity of the Black Sea and its catchment area, in the form of pollution, extensive fishing, and the massive development of invasive species, have intensified especially in the last three decades. As a result, the number of Black Sea cetaceans declined dramatically until the early 1980s. Even today they are exposed to numerous anthropogenic threats. Their status as endangered species and the important role they play in the Black Sea ecosystem determine the necessity of developing science-based approaches and measures for adequate monitoring and conservation of not only species but also their habitats. In order to assess the ecological risk to the populations of these conservation significant and not well-studied populations, it is first necessary to collect adequate scientific information on their abundance and distribution in the Bulgarian Black Sea area. In this context, the dissertation research is very topical, it fills the big gap in Bulgarian faunistic studies of these species.

#### **4. Knowledge of the problem**

In the chapter "Literature Review" the Ph.D. student demonstrates an enviable knowledge of the scientific literature on the problem under study. The reference list includes 205 references (55 in Cyrillic and 150 in Latin). Systematically and in a logical interrelation the known results are reviewed, and an analytical analysis of the literature sources considered is performed, which is a good basis for interpretation of the results obtained in the thesis. The comprehensiveness and analytical nature of the literature review demonstrate the doctoral candidate's good theoretical background in the research problems and are a prerequisite for the competent interpretation of the results obtained.

#### **5. Research methodology**

An integrated approach including different survey methods was used in this study to estimate the density and abundance of cetacean populations, such as the remote line transect method and photo-identification from the mark-recapture group of methods. Data were processed with conventional and specialized statistical programs. The use of modern methods adequate to the objectives and tasks contributes to the adequate analysis of the study and sets the standards for better research in Bulgarian zoological studies. I highly appreciate the methodological basis and the research approaches used.

#### **6. Characteristics and evaluation of the Ph.D. thesis**

The dissertation is structured in 9 sections, following the traditional requirements for the type and organization of separate chapters - Introduction (2 p.), Literature Review (12 p.), Aims and Objectives (2 p.), Material and Methods (45 p.), Results (231 p.), Conclusions (3 p.), Recommendations (2 p.), Contributions (1 p.) and References (16 p.). The ratio of the chapters is relatively proportionate to the nature aims and objectives of the study and is in line with common practice. The dissertation has a length of 335 pages and includes 222 figures and 104 tables, which exceeds many times the requirements for the length of such a scientific work. The listed metrical characteristics of the dissertation, the volume of research, the amount of data obtained, and the adequate methods used for the evaluation and analysis of the data guarantee the reliability of the conclusions and contributions drawn.

## **7. Contributions and significance of the Ph.D. thesis for science and practice**

The presented thesis is a pioneering study in the Bulgarian faunistic and ecology of cetaceans in the Black Sea. It brings out significant fundamental and applied scientific contributions. It is based on a huge amount of research work covering a 6-year period (for spring sightings), which guarantees the reliability, comprehensiveness, and significance of the results obtained.

### **Fundamental scientific contributions**

➤ For the first time in Bulgaria, an up-to-date assessment of the population dynamics of the endemic cetacean subspecies - harbour porpoise, bottlenose dolphin, and common dolphin in the Bulgarian Black Sea aquatorium has been made by analyzing the population indices of relative abundance (density) and distribution within a long-term study (6-year period).

➤ For the first time in Bulgaria, the seasonal distribution of harbour porpoise, bottlenose dolphin, and the common dolphin was assessed by mapping the concentration areas of the subspecies.

### **Methodological contributions**

➤ The suitability of the line transect remote sensing method from a vessel for studying the relative abundance and distribution of Cetaceans is demonstrated.

➤ The relevance of the photo-identification method for characterizing the home range of cetaceans (Aphala) is demonstrated.

➤ The suitability of the passive acoustic method for collecting data on the presence of Cetaceans over a long period of time, albeit over a limited area, is demonstrated.

### **Scientific and applied contributions**

➤ The coverage of the existing ecological network of protected areas of NATURA 2000 in the Bulgarian territorial waters in relation to the cetaceans in the Bulgarian Black Sea is characterized. Suggestions are given for the extension of the protected area boundaries in order to improve the conservation of the Aphala.

➤ The study provides a scientifically sound basis for updating the currently accepted threshold values for cetacean abundance and density under criteria D1C2 and D1C4 of the Monitoring Program under Descriptor 1 - Biodiversity (marine mammals) of the MSFD.

➤ For the first time in Bulgaria, the level of harbour porpoise bycatch in the Bulgarian Black Sea turbot fishery has been assessed.

➤ The suitability of a model acoustic repellent device for reducing harbour porpoise bycatch levels in anchored bottom set gillnets for turbot was determined.

➤ The only catalog of individuals by photo-identification of dolphins in Bulgarian waters of the Black Sea has been created and maintained.

➤ Special recommendations have been developed to protect the populations and habitats of cetaceans in the Bulgarian Black Sea.

In conclusion, I can summarize that this is a pioneering study that sets the standards for the study of population characteristics of marine mammals in Bulgaria. It has been carried out at a modern methodological level and I hope it will find its continuation in the future.

## **8. Assessment of the publications on the Ph.D. Thesis**

When presenting the materials for the competition, I made a cursory review of the research papers submitted by the Ph.D. student. All of the attached 5 scientific papers were published in journals with impact factor: 2 in quartile Q1 journals (*Diversity* with IF (2022)=2.4 and *Frontiers in Marine Science* with IF(2022)=3.7) and 3 in quartiles Q3 and Q4 - *Acta zoologica bulgarica* (with IF (2020)=0.448 and IF(2021)=0.362). This is an eloquent testimony to the quality of the research papers that reflect the results presented in the thesis. In all publications, the Ph.D. student is the first author, attesting to his leading role in the conception, planning, and conduct of the research. The number of co-authors varies between 4 and 6, reflecting the collective nature of the work and the doctoral student's ability to work in a team and draw knowledge and experience from collaborative work. I hope that the presented results will find a wide resonance among the scientific community due to their significance. So far, only one citation of dissertation results reported in a scientific article has been identified.

## **9. Personal participation of the PhD student**

The Ph.D. thesis is the personal work of the doctoral candidate. He successfully performs a complex analysis of the developed problem, which he analytically interprets and discusses. I can confidently state that today he is a fully developed and prepared modern-level researcher in the field of population biology of marine mammals. During the years of development of the thesis, D. Popov showed diligence, discipline, consistency, and innovation.

## **10. Thesis abstract**

The thesis abstract reflects the methodological, scientific-theoretical, and scientific-applied achievements of the dissertation. It has been prepared in accordance with the requirements of the Regulations for the Development of the Academic Staff of the “P. Hilendarski” University and the national requirements under the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB)

## **11. Critical comments and recommendations**

➤ In my opinion, in the formulation of the main objective of the study, it would be good to add an ecological risk assessment, as this is an essential part of the study and exists as a specific task - for example, from bycatch in bottom-attached gillnets.

➤ The biological and ecological characterization of the species studied should not appear in the Materials and Methods chapter but in the literature review. In this chapter, only the species studied should be mentioned.

➤ For the sake of clarity and conciseness of the presentation, I think it is a better option to apply only the summarized abundance and density tables for each species.

➤ It would be good and correct to mention why non-parametric statistical methods were used. It will be good to state by which analysis was determined that the data did not match a normal distribution. It is puzzling why, since the statistical program SPSS is used, Excel is used for correlation analysis. Why is the frequency of species presence determined by acoustic survey compared between stations using the Mann-Whitney test rather than multiple test e.g., Kruskal-Wallis with subsequent Tukey post-hoc test? Various formulas for calculating bycatch have been given, but it was not clear to me which was the most appropriate and used.

➤ I take the liberty of making some technical and stylistic remarks with a view to the future work of the Ph.D. student:

➤ It is good, after most of the statements made, to cite a source- e.g. in the introduction after the statement that on the basis of morphological and genetic studies Bulgarian Cetaceans are defined as endemic species.

➤ When an author's name is given for a species, it should be after the Latin name of the species, not after the Bulgarian name [item 2.1. - common dolphin (Pallas, 1811)].

➤ In my opinion, the word dolphin hunting does not sound good, it is better to replace it with dolphin hunting.

➤ When referring to abundance data with relevant attributes of descriptive statistics such as SD, 95%CI, etc., we are probably talking about an average.

➤ The breeding period has a time range, it cannot "peak", it is better to say the breeding process is most active during.... (p.38)

➤ Sampling is not an appropriate term when referring to observations along particular transactions.

I have the following clarifying questions for the Ph.D. student:

➤ What is the meaning of the term "ecological barrier" separating 2 populations of the same species (page 33)?

➤ Do the different numbers of sightings- 6 annual in spring, 3 annual in summer, 2 annual in fall, and annual in winter- not introduce different weights in estimating species density? Certainly, I am sympathetic to severe weather in fall and winter.

➤ If the selected transects provide 7% coverage of the possible habitats in the Bulgarian Black Sea area, what is the likelihood of a reliable extrapolation of the data?

➤ The shape, pigmentation, and other characteristics of the dorsal fin would have to be unique to the individual for something like a capture-recapture method to apply. Only one study is cited in the thesis, presumably proving the method's reliability. Is the PhD student aware of any other studies in this aspect? In my opinion, the subjective evaluation is quite high, how to ensure objectivity of observation and discrimination?

## CONCLUSION

This Ph.D. thesis is a work of high scientific level, with significant theoretical and applied achievements in the field of population biology and marine monitoring of



Cetaceans in Bulgaria. It has an original scientific contribution and complies with the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for the Implementation of the LDASRB, and the relevant Regulations of "P. Hilendarski" University. The dissertation work shows that the Ph.D. student Dimitar Popov possesses in-depth theoretical knowledge and professional skills in the scientific specialty "Zoology", demonstrating qualities and skills for conducting independent scientific research.

Because of the above, I confidently give my positive assessment of the research conducted, presented by the above-reviewed dissertation, abstract, achieved results, and contributions, and I propose the honorable scientific jury to award the education and science Ph.D. degree to Dimitar Vassilev Popov in the field of higher education. **4. Natural Sciences, Mathematics, and Informatics**, professional field **4.3. Biological sciences**, Ph.D. Program **Zoology**.

05.09.2023

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Assoc. Prof. T. Chassovnikarova, Ph.D.