

## **REVIEW**

**by Prof. D.Sc. Georgi Markov - Institute of Biodiversity and Ecosystems  
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of a dissertation for awarding the educational and scientific degree “**doctor**”  
by: field of higher education 4. Natural sciences, mathematics and informatics,  
professional direction 4.3. Biological Sciences  
PhD Program Zoology

**Author:** Dimitar Vasilev Popov

**Topic:** Abundance and distribution of cetaceans (Cetacea) in Bulgarian territorial waters of the Black Sea.

**Research supervisor:** Assoc. Prof. Dr. Hristo Dimitrov, PU, Assoc. Prof. Dr. Marina Panayotova, IO-BAN

### **1. Presentation of the procedure and general description of the materials received for review**

By order No. 21-1554/21 07 2023, I have been appointed as a member of the scientific jury to ensure a procedure for the defense of a dissertation on the topic “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 field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4. Natural sciences, mathematics and informatics, doctoral program “Zoology”.

The author of the dissertation is Dimitar Vassilev Popov – PhD student in full-time study to the department Zoology of the BF of the PU with scientific supervisor Assoc. Prof. Dr. Hristo Dimitrov, PU, Assoc. Prof. Dr. Marina Panayotova, IO-BAS. The set of materials presented by Dimitar Vasilev Popov is in accordance with Article 36 (1) of the Regulations for the Development of the Academic Staff of the PU, includes the following documents:

- request to the Rector of the PU to disclose the procedure for the defense of a dissertation work;
- CV in European format;

- protocol from the departmental council related to reporting the readiness to open the procedure and preliminary discussion of the dissertation work;
- dissertation work;
- abstract of PhD thesis;
- list of scientific publications on the topic of the dissertation;
- copies of scientific publications;
- list of noticed citations;
- declaration of originality and authenticity of the attached documents;

The PhD student has attached 6 publications.

## **2. Brief biographical data of the PhD student**

In the period 2011-2013, Popov studied at PU Plovdiv, gaining knowledge in the fields of general ecology, statistical methods in ecology, GIS and acquired the educational degree "Master of Ecology". The knowledge accumulated in this stage of training allows Popov to successfully join the work of the Green Balkans company, where he is engaged in activities related to research and protection of biological diversity.

## **3. Relevance of the topic and appropriateness of the set goals and tasks**

Of toothed cetaceans found in the Black Sea - from family Delphinidae: The Black Sea common dolphin (*Delphinus delphis ponticus* Barabash, 1935) and the Black Sea bottlenose dolphin (Afala) (*Tursiops truncatus ponticus* Barabash-Nikiforov, 1940), as well as the representative of the family Phocoenidae, the Black Sea porpoise (mutkur) (*Phocoena phocoena relicta* Abel, 1905), on the basis of morphological and genetic studies, are accepted as endemic subspecies (Committee on Taxonomy, 2022). This predetermines their high conservation status and the need to take certain measures for their effective conservation. The not entirely clear knowledge, up to the moment of the study of their numbers in the Bulgarian waters of the Black Sea, also causes the need to study their numbers. It is extremely clear that only after its definition, the proposed measures for the conservation of these species in the Bulgarian waters of the Black Sea would be much more effective in assessing the various threats to their existence.

## **4. Knowing the problem that will be solved in the dissertation assignment**

Popov's good knowledge of the issues related to the dissertation assignment planned for development, supported by her creative assessment, allowed him to build on what actions he should take to successfully solve the goal of his dissertation. He correctly formulates it while at the same time foreseeing the appropriate tasks, the performance of which would lead to its fulfillment.

## **5. Aim of this dissertation**

In general, the topic of the dissertation could be defined as: Seasonal study of numbers, density and distribution of the three species of cetaceans (Cetacea): Black Sea common dolphin (*Delphinus delphis ponticus* Barabash-Nikiforov, 1935), Black Sea bottlenose dolphin (*Tursiops truncatus ponticus* Barabash-Nikiforov, 1940) and the Black Sea porpoise (*Phocoena phocoena relicta* Abel, 1905) in the Bulgarian territorial and internal waters of the Black Sea for a period of six years (2017–2022). In order to achieve this very ambitious task, Popov planned to conduct research using an appropriate methodology allowing the achievement of the set general goal and obtaining an adequate answer to the tasks solved in the dissertation work, which essentially boil down to:

- (i) targeted seasonal surveys using a remote method along a linear transect to establish the density, number and distribution of cetaceans in the Bulgarian territorial waters of the Black Sea;
- (ii) study of bycatch processes in bottom gill nets in turbot fishing;
- (iii) collection of data on both species of dolphins by the method of photo-identification in order to establish residency and adherence to certain areas of groups of dolphins;
- (iv) establishment and analysis of seasonal dynamics in the presence of cetaceans in coastal waters through a permanent passive acoustic survey;
- (v) evaluation of the collected data with a view to establishing the seasonal and spatial distribution of cetaceans in the Bulgarian territorial waters of the Black Sea.

## **6. Research methodology**

The applied research methodology allows obtaining an adequate answer to the tasks solved in the dissertation and, on this basis, to the set general goal. The methods used to analyze the density and distribution of cetaceans in the studied region are correctly describe and also the methods for method of photo-indication of dolphins; method for estimating cetacean bycatch and its mitigation; passive acoustic survey methods.

The research area was also chosen appropriately as its water area covers the sea of the Republic of Bulgaria, including the inland seas waters and the 12-mile marine water area with a total area of 6,358 km<sup>2</sup> opposite the coast strip of the Black Sea, from Cape Sivriburun in the north to the Rezovska River in the south, which sufficiently covers the region of Bulgarian waters in front of the country's territory.

## **7. Characterization and evaluation of the dissertation work**

The dissertation is structured according to the standard requirements, with the necessary sections to include the information enabling its realistic evaluation and assessment of the popular scientific and scientific knowledge contained in it. Thus, its construction is built on a book body that contains 334 pages and includes: 105 tables, 20 photos, 205 figures, 4 appendices and 205 literary sources, of which 55 in Cyrillic and 155 in Latin.

In order to support the conducted research and substantiate their significance for science and practice, Popov has developed his dissertation research in a presentation of information that includes: the basic knowledge on the subject of the research, which proves the necessity of conducting the planned research, a detailed description of the objects of research and the methods of their research, the algorithms used to process the received data specific to each individual research method and the results of the studies themselves and their interpretation in the context of the study. The professional approach to their presentation in the dissertation gives reason to assume that the obtained results are a solid foundation, predetermining the credibility of the material on which the contributions obtained in this research are based.

The section “**Results and discussion**” concentrates the main knowledge obtained during the development of the dissertation work, in which a total of 12 vessel surveys were conducted for the period 2017 – 2022. The results from each study were analyzed separately and presented by species. This clearly outlines the number and distribution of cetaceans in the Bulgarian water area in the studied period. The chosen approach for their preparation and interpretations makes it possible to assume that, by its nature, the dissertation work represents a scientifically sound study.

## **8. Contributions and significance of the development for science and practice**

The contributions and significance of the development for science and practice are clearly highlighted in the “**Conclusions**” section combined with the information presented in the “**Recommendations**” section, and they are:

- It has been proven that the application of the remote method of the linear transect from a vessel in the Bulgarian territorial waters of the Black Sea is suitable for studying the numbers and distribution of cetaceans.
- The cetaceans in Bulgarian territorial waters was assessed and it is found that:

(i) The number of Black Sea porpoise shows seasonal dynamics - highest in spring with a tendency to decrease in summer, as a result of withdrawal to the offshore area and lowest in cold seasons - autumn and winter;

(ii) The number of Black Sea bottlenose dolphin in Bulgarian territorial waters is lowest in spring with a tendency to increase in summer and highest values in autumn and winter;

(iii) The number of the common dolphin in the Bulgarian territorial waters suffers large fluctuations in the spring. It is lowest in summer and highest in autumn.

- A significant contribution of the present research is that the existing ecological network of protected areas from NATURA 2000 in the Bulgarian territorial waters covers the areas of importance for the Black Sea porpoise shows and the Black Sea bottlenose dolphin, but outside its scope remains an area of importance for the Black Sea bottlenose dolphin, located south of Cape Kaliakra. This conclusion predetermines the need to expand the boundaries of the Kaliakra Complex BG0000573 PA in order to cover this area, which will be an adequate real measure to improve the conservation of this species.
- It has been confirmed that the annual level of harbor porpoise bycatch in turbot fishing with bottom gill nets in Bulgarian waters corresponds to the conclusions at the basin level of significantly exceeding even the highest allowable levels of removal of individuals from the population.

The significance of the contributions to science and practice, in addition to the above results, is also enhanced by the knowledge gained in:

(i) The study of three models of acoustic repellent devices showed that only one (PAL) resulted in a significant reduction in bycatch rates of porpoises in anchored bottom gill nets for turbot;

(ii) Studying the range of the Black Sea bottlenose dolphin using the photo-identification method reveals its considerable size;

(iii) The application of passive acoustic monitoring has shown that it is a suitable method of collecting information, for a limited area, but for a long period of time.

- The data from a long-term study (over 5 years) of the number, density and distribution of cetaceans in a certain area of the Black Sea in the Bulgarian water area are also new.

Along with these scientific contributions, the dissertation also contains scientific and applied contributions which can generally be defined as:

(i) Assessment of the annual level of porpoise by-catch in turbot fishing in the Bulgarian waters of the Black Sea;

(ii) Creating and maintaining a catalog of individuals through photo identification of dolphins in the Bulgarian waters of the Black Sea;

(iii) Recommendation to the competent authorities - IARA and MOSV for the implementation of the PAL model as effective in reducing the level of bycatch of porpoise in fishing turbot with anchored bottom gill nets.

## **9. Assessment of dissertation publications**

The publications that reflect the results of the dissertation are 5 articles. All five are the result of an author's collective, consisting on average of 6 people. They have gone through an authoritative evaluation by specialist reviewers in the field of the dissertation assignment and have been published in journals with an impact factor.

## **10. Personal participation of the doctoral student**

Popov's leading personal involvement in the development of these articles is adequately represented by his involvement as first author and is supported by the fact that all publications are closely related to the content of the dissertation assignment.

## **11. Abstract**

The content of the abstract reflects the main sections of the dissertation work. It presents, in a synthesized form, the overall information obtained during the development of the dissertation assignment.

## **12. Critical remarks and recommendations**

I have no significant comments regarding the conducted research and set of materials. In any study, one can always find positions expressed by the author on which different scientists have a different point of view and interpretation. But when presenting such a large-scale study, the discussions on them would seem too insignificant.

## **13. Personal impressions**

I do not have personal impressions of Popov's scientific activity, but a clear idea of his organizational qualities and love for scientific research is gained when reviewing the completed version of his dissertation assignment. Undoubtedly, this is a person devoted to scientific research in the field of nature-protection topics.

## **14. Recommendations for future use of dissertation contributions and results**

For now, this is a pilot study in the Bulgarian waters of the Black Sea, whose scientific, scientific-applied contributions and recommendations are beyond doubt. There is no doubt that the overall structure of the conducted research aims to present an algorithm that provides data on the number, condition and development of stocks and habitats of cetaceans, and their distribution in the

Bulgarian waters of the Black Sea, which can be influenced by changing conditions in the food web, as well as from the direct impact caused by human activities. The transformation of this algorithm into a permanent monitor would help protect the normal development of cetacean stocks in the Bulgarian water area.

## **CONCLUSION**

My general impression of the qualities of Dimitar Popov 's dissertation work gives me reason to conclude that the doctoral student demonstrates the ability to carry out independent scientific and scientific-applied activity, to report and interpret in an appropriate manner the received scientific-applied and scientific data and to draw relevant conclusions. Also, he shows a marked sense for the transformation of scientific knowledge into concrete scientific-applied recommendations.

Based on the review made by Dimitar Popov of the mastery and application of research methods, the logical justification of the conclusions offered in the dissertation development and their significance, I accept that he has developed a dissertation meeting the conditions for obtaining the educational and scientific degree “doctor”.

I confidently give my positive assessment of the conducted research, reflected in the peer-reviewed dissertation work, abstract, achieved results and contributions, and I propose to the honorable Scientific Jury to award the educational and scientific degree “doctor” in the scientific specialty “Zoology” (code 10602) to Dimitar Popov in field of higher education: Natural sciences, mathematics and informatics, Professional direction 4.3. Biological Sciences, PhD program “Zoology”.

Sofia, September, 2023

Reviewer:

/Prof. D.Sc. Georgi Markov/