

REVIEW

by Prof. Dr. Yordanka Tasheva

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of a dissertation for the acquisition of an educational and scientific degree: "Doctor"

**Topic: Optimizing the management of marine coastal macro-waste along the Bulgarian
Black Sea coast**

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Field of higher education: 5. Technical sciences

Professional direction: 5.5. Transport, shipping and aviation

Doctoral program: "Environmental Protection Systems and Devices"

This review was carried out on the basis of Order No. 137/27.02.2026 of the Technical University-Varna and is in accordance with the requirements for preparing a review of a dissertation for the acquisition of a scientific degree of the current Regulations for the admission, training of doctoral students and the acquisition of the educational and scientific degree "doctor" and the scientific degree "doctor of sciences" at the Technical University-Varna.

1. RELEVANCE OF DEVELOPMENTS IN THE DISSERTATION PROBLEM IN A SCIENTIFIC AND SCIENTIFIC-APPLIED RELATIONSHIP. DEGREE AND SCALE OF THE RELEVANCE OF THE PROBLEM AND THE SPECIFIC TASKS DEVELOPED IN THE DISSERTATION

Marine litter is an important environmental problem, characterized by complexity and transboundary nature and is the main subject of a number of international and regional conventions, strategies and national plans. The Republic of Bulgaria, as a member state of the EU, fulfills national and regional commitments on the implementation of the Marine Strategy Framework Directive, but there is an impossibility for the national monitoring to cover all significant areas, in particular Descriptor 10, indicator D10C1.

It is known that marine litter is an ecological, economic, social, health, aesthetic and cultural problem on a global, regional and local scale, with a negative effect on coastal and marine ecosystems, the well-being of societies, especially coastal populations.

Based on the experimental data obtained, as well as I must emphasize the in-depth study of the present work on the distribution and accumulation of marine litter and, accordingly, the conduct of regular monitoring by drone flights, detailed data on the seasonal variability of the accumulation, abundance and typology of marine litter deposited on the shore were obtained on georeferenced images of the coastline. The studies of marine litter were conducted during four seasons. In addition, the collected marine litter material was categorized, quantified in order to determine its composition, seasonal variations and, last but not least, its abundance and diversity.

With the above, I only want to emphasize the significance and relevance of the main goal and objectives set in the dissertation work, as well as to note the innovativeness of the methods used to achieve them.

2. DEGREE OF KNOWLEDGE OF THE RESEARCH PROBLEM AND CRITICAL CONSIDERATION OF THE LITERATURE REVIEW BY THE DISSERTANT

After a careful review of the presented list of literature used in this dissertation, I must emphasize that the latter includes 213 sources, most of which are in Latin. In addition, I was very impressed that the literature used is up-to-date, timely for the period of the last 5 to 10 years. This shows a high level of knowledge of research methods, as well as a comprehensive study of the problem posed in the dissertation.

The literature review and relevant critical analysis regarding the problem posed with marine litter management shows that the doctoral student has successfully coped with the study of the research problem, thus showing a high degree of knowledge and detailed study of the problem posed.

3. THE CHOSEN RESEARCH METHOD ENSURES THE ACHIEVEMENT OF THE PURPOSE AND OBJECTIVES OF THE DISSERTATION

The presented methods and approaches described in the dissertation submitted to me for review are timely, up-to-date, and enable the achievement of the set goal and main tasks. I believe that the methodology chosen and applied by the doctoral student fully ensures the possibility of fully achieving the main goal and tasks.

4. BRIEF ANALYTICAL CHARACTERISTIC OF THE NATURE AND ASSESSMENT OF THE RELIABILITY OF THE MATERIAL ON WHICH THE CONTRIBUTIONS OF THE DISSERTATION ARE BUILT

The dissertation submitted for review has a volume of 145 pages and is structured as follows: introduction, three chapters, conclusions and recommendations, contributions and references.

In the introduction of the dissertation, the doctoral student presents the relevance of the work, the degree of development of the research topic and its importance, as well as the purpose and main tasks of the research are defined.

In Chapter 1 entitled: Marine Debris. Management of marine waste, the doctoral student presents the concept of marine waste, having examined the issue in detail in relation to the legal framework at the international, European and regional level, from where it originates and confirms the relevance of the present work. In the second point of Chapter 1, the doctoral student describes in great detail and makes a complete classification of marine litter. The sources of marine litter pollution are also presented, and the key factors in the distribution and accumulation of marine litter are described. In a separate point 1. 5. Management of marine waste, the PhD student summarizes that the management of marine waste, both at the national,

regional (European) and global level, requires the introduction of a system for assessing the state of the marine environment, insofar as it is a consequence of marine waste pollution.

I must emphasize that I was very impressed by the extensive, very detailed and comprehensive literature study and research of the problem carried out by the doctoral student, as well as to emphasize the significance of the literature study carried out, namely: the doctoral student offers in tabular form a way of assessing the state of the environment in order to more effectively manage coastal areas and achieve "Good ecological status".

Chapter 2 "Research methodology and experimental setting" describes the research methods and approaches used in the dissertation work in connection with the implementation of the set goal and main tasks.

Chapter 3 "Experimental studies and analysis of results" presents the obtained experimental data and results. I was very impressed by the quantitative volume of the experimental work carried out by the doctoral student, from where the latter draws an experimentally established conclusion, based and confirmed with relevant literary sources, namely: The drone method offers opportunities for automated data processing for monitoring municipal areas, especially where it is difficult (inaccessibility) or undesirable (protected territories) to make a detour. The combination of drone technology and satellite imagery creates the possibility of combined field conventional monitoring and advanced technologies.

Despite the development of technology, there are still limitations in satellite observation - resolution, detection of floating debris, errors in recognisability and identification of materials. The combined approach of drone technology, satellite imagery and machine algorithms has been shown to offer a significantly more efficient and streamlined alternative to the traditional field survey for monitoring marine debris.

The dissertation continues with Conclusions and recommendations, and at this point a summary is presented of the literature studies, experimental results and, accordingly, the obtained dependencies and influences of the used methods, research approaches of marine waste management, as well as the listed 8 /eight/ number of recommendations in order to optimize the processes of national monitoring of marine waste.

The dissertation work ends with derived scientific and scientific-applied contributions.

5. SCIENTIFIC, SCIENTIFIC-APPLIED AND APPLIED CONTRIBUTIONS OF THE DISSERTATION WORK

Based on the developed dissertation work, obtained experimental results, as well as the conclusions drawn, the relevant scientific and scientific-applied contributions are derived:

As a scientific contribution, the following is presented:

- A methodology was developed and implemented to test the applicability of drone monitoring on marine macro-litter loading on marine sandy beaches by means of parallel conventional monitoring and drone monitoring and a comparative analysis of the results obtained to assess the load in Orlovo Blato landfill.

The following are presented as scientific and applied contributions:

- For the first time, a one-year, four-season monitoring of coastal macro-waste was carried out with the determination of the seasonal dynamics of changes in the water line in the "Orlovo Blato" landfill - part of the "Durankulak - Krapets" beach strip. As a result of the conducted in-situ research, new data were obtained and the composition, density of coastal marine litter, accumulation and seasonal dynamics of accumulation of marine macro-waste deposited on the coast in Orlovo Blato landfill for a one-year period were evaluated;
- Confirmatory data have been obtained proving the key importance of water currents and wind fields in the transport of marine debris deposited along the coast along the northern Black Sea coast;
- The applicability of aerial drone observations for the purposes of ecological monitoring of coastal macro-litter has been proven. The established accuracy when using an aerial drone for the identification of marine coastal litter (approximately 75%) compared to conventional monitoring, which allows the use of UAV observations as a complementary monitoring method with an indicative value of the data obtained and as a means of express detection of hotspots of marine litter pollution;
- A complex of mutually complementary measures is proposed to optimize the methodology for conducting monitoring of coastal macro-waste, including taking into account the density of the waste;
- Measures have been proposed to optimize the "prevention and removal of marine waste pollution" subsystem. A reasoned proposal for positioning technical means for collecting and limiting the spread of marine waste along the Bulgarian Black Sea coast has been presented.

6. ASSESSMENT OF THE DEGREE TO WHICH THE DISSERTATION WORK AND THE SCIENTIFIC CONTRIBUTIONS PRESENTED CAN BE CONSIDERED AS THE RESULT OF THE INDEPENDENT RESEARCH ACTIVITY OF THE DOCTORAL STUDENT

Based on my work submitted for review and the scientific publications presented on the subject, I confidently recommend and boldly give my positive assessment of the dissertationability of the presented work and the full readiness of the doctoral student to present and defend the research work properly carried out.

I must emphasize, once again, the enormous experimental work that has been carried out, giving due credit not only to the doctoral student, but also to her supervisor, under whose expert guidance, I once again emphasize research work of a dissertation nature, with not only educational, but also high scientific and scientific-applied value.

7. EVALUATION OF DISSERTATION PUBLICATIONS

The PhD student has presented a list of 3 /three/ initial publications co-authored with her supervisor, one of which is in Scopus, and the other 2 are in journals included in the NACID reference list. It should be noted that one of the publications was presented at the International

Scientific Conference - UNITEH, 24. Of the publications that were presented, I found 2 citations.

8. USE OF THE RESULTS OF THE DISSERTATION IN SCIENTIFIC AND SOCIAL PRACTICE

In the presented dissertation work and abstract, I do not find specific examples of application in scientific practice, but the dissertation work itself, its relevance, main goals and tasks, as well as the subsequently proposed conclusions and recommendations for optimizing the management of marine waste give me reason to believe that in the future the present work will be of interest and its results will be used, both in scientific, aka and in social practice. Moreover, the main results have been disseminated and published, and also received recognition in the scientific community.

9. RECOMMENDATIONS FOR FUTURE USE OF THE SCIENTIFIC AND SCIENTIFIC-APPLIED CONTRIBUTIONS

On the basis of the proposed complex of complementary measures to optimize the methodology for conducting monitoring of coastal macro-waste with the inclusion of consideration of the density of waste, it will create the possibility of obtaining more complete, real and competent data and results, not only for the researched object in the dissertation work, but also for research, research and monitoring of the entire Black Sea coast.

From the measures proposed in the dissertation work to optimize the subsystem "prevention and removal of pollution with marine waste", a reasoned proposal for positioning technical means for collecting and limiting the spread of marine waste along the Bulgarian Black Sea coast has been derived.

10. ABSTRACT

The content of the presented abstract fully reflects the structure, main results and accordingly prepared contributions from the dissertation research. It clearly presents the purpose and main tasks of the dissertation work, the methods and approaches used, the conclusions and the scientific contributions. Its volume is within the permissible limits and allows for a reasoned and complete presentation of the dissertation work. It should be noted that the style and language of the exposition are clear, precise and scientifically sound. The abstract of the present dissertation was prepared in accordance with the established academic requirements and in accordance with the Law on the Development of the Academic Staff in Bulgaria, the Rules for its Application, as well as the current Rules for the Admission, Training of Doctoral Students and the Acquisition of the Educational and Scientific Degree "Doctor" and the Scientific Degree "Doctor of Sciences" of the Technical University-Varna.

11. CRITICAL NOTES ON THE DISSERTATION, INCLUDING THE CANDIDATE'S LITERARY AWARENESS

I have the following recommendation for the presented dissertation work:

In order to present it more clearly to the scientific world and emphasize, not only the relevance, but also the high importance of the current dissertation work, I recommend that some of the contributions be specified and brought out as essential conclusions from the present study.

CONCLUSION

The work presented to me for review, the topicality of the problem considered in the dissertation, as well as the presented publications of the doctoral student on the subject give me reason to conclude that the educational part of the dissertation has been fulfilled. Based on the presented results and relevant contributions presented in the dissertation, I consider that the latter meets the requirements of the Law on the Development of the Academic Staff in Bulgaria, the Regulations for its Application, as well as the current Regulations for the admission, training of doctoral students and the acquisition of the educational and scientific degree "Doctor" and the scientific degree "Doctor of Sciences" of the Technical University-Varna.

The above gives me reason to confidently give my positive assessment of the work of mag. eng. Miroslava Damyanova Robinson and to propose to the Honorable Scientific Jury to award her the ESD "Doctor" in the doctoral program: "Systems and devices for environmental protection", professional direction: 5.5. Transport, shipping and aviation, field of higher education: 5. Technical sciences.

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/Prof. Yordanka Tasheva, PhD/