

STATEMENT

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Chairman of the Scientific Jury, in accordance with Order No 268/10.12.2020 of the Director of the Institute of Oceanology – Bulgarian Academy of Sciences (IO-BAS), Varna

Subject: Defense of a thesis and acquisition of educational and scientific degree *PhD* of Elitsa Valentinova Hineva, doctoral student at the Marine Biology and Ecology Department (IO-BAS) on the topic: *Ecological factors limiting the distribution of the seagrasses of the genus Zostera in the sublittoral zone of Burgas Bay (the Black Sea): importance of wind waves and epiphyte abundance*, in the Higher educational area cipher 4: Natural Sciences, Mathematics and Informatics; professional area cipher 4.3: Biological Sciences; research specialty: Ecology and Ecosystem Protection; scientific field: Macrophytobenthos. Scientific consultant Prof. Snejana Moncheva

The PhD thesis of Elitsa Hineva represents a thorough study on the distribution of sea grasses of the genus *Zostera* in the sublittoral zone of Burgas Bay under the influence of environmental factors: wind turbulence and epiphyte abundance. Studies on the Bulgarian coast are insufficient and undoubtedly the thesis is significant due to the fact that the condition of the grass communities is a good indicator of the environmental status, as their disappearance or deterioration is a signal for negative changes. Establishing the effect of wind waves on the distribution of seagrass in the study area allows to explain their specific distribution, which would lead to the formulation of more targeted measures for their conservation. In this sense, the thesis is up-to-date not only scientifically but also by a scientific-applied perspective.

The thesis, built at a high scientific level, has a volume of 247 pages, divided into chapters: Introduction, Literary review, Purpose and objectives of the study, Material and methods, Results and discussion, Summary results and conclusions, Contributions, List of publications on the topic of the dissertation, Literature Review and Appendices. The required ratio between the volumes of the main chapters is observed, and the results and discussion are of predominant importance. It is perfectly illustrated with 66 figures, 23 tables (excluding those in the

Appendix). The list of cited literature includes 211 titles, of which 38 in Cyrillic, 173 in Latin and 4 Internet sources.

All chapters are well and comprehensively presented. The significance of the topic is well outlined and justified in the Literature Review. It is divided into two parts in order to present in detail the issue, its study on a global and regional scale. The emphasis in the first part is on the importance of wind turbulence as a factor limiting the spread of aquatic angiosperms. Here, the PhD student Elitsa Hineva demonstrates in-depth knowledge of modeling as an approach to studying the wave impact on phytobenthos communities. The mechanisms of influence of eutrophication on the development of seagrass, the importance of epiphytes for their basiphytes are also analyzed.

The aim of the thesis is clearly formulated, the tasks are specific and presented in a logical sequence. **The working hypotheses** (3) and antitheses are clearly and correctly formulated, as well as successfully proven in the presented work.

The chapter **Material and Methods** of the research is described in details and gives a good idea of the methodology used. Innovative modelling methods for estimating the wave impact are applied. The experiment for an assessment of the periphyton overgrowth allows the achievement of the goal and obtaining an answer to the set tasks. A total of 65 qualitative samples (diatoms) of natural and artificial substrate and 223 quantitative samples have been analyzed. The applied new statistical methods, mathematical modeling, mapping (GIS) and photographic material as well allows obtaining significant scientific results. The precisely made figures, the informative tables make a positive impression worthy high evaluation also.

The depth of the analysis, understanding of the matter and the reasoned presentation of the results prove the awareness, the competence of the doctoral student, as well as her independence in interpreting the data. The results are discussed and competently summarized in the conclusions of the dissertation - 14 conclusions are formulated, which logically correspond to the set goals and objectives.

The following **scientific and applied results** can be noted: The results of the wave impact have a practical application for preliminary analysis of the risk of negative changes in the development of alternative scenarios for the management of the studied areas in Burgas Bay. Due to their protective status, the areas Foros, Chengene Skele, Vromos and, in part, Gradina,

are highly sensitive to anthropogenic pressure. The territory of Burgas Bay is highly vulnerable to possible spills and pressures due to sea-based activities. The two most vulnerable areas to the accumulation of pollutants are in close proximity to the sources of risk ports - Bourgas and Rosenets. Empirical models have been obtained that can be used to predict the presence of marine angiosperms in unexplored coastal areas, offering the same wave climate conditions as the area for which they were derived. Threshold values of the maximum allowable epiphytic load are derived, depending on the epiphytic layer of light reached. Qualitative composition (relative number) of the epiphytes is proposed as an indicator of the environmental conditions.

The results have original character and represent one of the strengths of the thesis. No plagiarism was found.

The most important **scientific contribution** of the thesis is the proven limitation of the upper limit of distribution of marine angiosperms by wind waves in the areas: Nessebar Bay, Sozopol Bay, Foros Bay. Statistical models of the relationship between the upper limit of grass fields and waves have been obtained, which can be applied to unexplored areas with the same or similar wave exposure. The study on the presence of communities of marine angiosperms in different regions of the Bulgarian Black Sea coast with contribution to the optimization of the monitoring programs is of emphasized **scientific and applied importance**.

The main part of the results of the thesis are summarized and presented in 6 publications, published in proceedings of scientific conferences and peer-reviewed scientific journals. In all publications, the Elica Hineva is a corresponding author, which shows and emphasizes her independence and competence and gives me the reason to accept her personal contribution as indisputable. I would like to emphasize the expert guidance of her scientific consultant Prof. Dr. Snejana Moncheva, for her useful advices and fruitful discussions that are the basis of such a well-structured work with important conclusions.

I have no significant critical remarks on the thesis. The material and methodology of the research include physico-geographical and ecological characteristics of Burgas Bay, which in my opinion should be reflected in the literature review. Some insignificant technical errors have been noticed, which do not underestimate the quality of the presented thesis.

Based on the above, I believe that the required scientometric criteria of IO-BAS for awarding the educational and scientific degree *PhD* are fully met.

CONCLUSION

The presented thesis is a comprehensive and completed work, which in content, volume and structure fully meets all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, as well as the specific requirements of the Rules of IO-BAS, Varna for its application.

The thesis includes scientific and applied contributions and represents a reliable basis for future studies of a fundamental nature and practical orientation.

On this basis, I would like to recommend to the members of the Scientific Jury to award the doctoral student Elitsa Valentinova Hineva the educational and scientific degree *PhD* in the field of the Higher educational area cipher 4: Natural Sciences, Mathematics and Informatics; professional area cipher 4.3: Biological Sciences; research specialty: Ecology and Ecosystem Protection

March 15, 2021

Kremena Stefanova