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REVIEW

by Prof. Dr. Petya Pavlova Ivanova, Institute of Oceanology – Bulgarian Academy of Sciences (IO-BAS), Member of the Scientific Jury appointed by Order No. 211/05 August 2026 of the Director of IO-BAS

Subject: PhD thesis entitled "*Technological Solutions for Reducing Discards in Fisheries*", submitted for the award of the educational and scientific degree of Doctor in the field of higher education 4. Natural Sciences, Mathematics and Informatics; professional field 4.3. Biological Sciences; doctoral programme "*Ecology and Ecosystem Conservation*"; research area: "*Sustainable Exploitation and Conservation of Living Marine Resources*".

Author: Yordan Raev Raev

Academic Supervisors: Assoc. Prof. Dr. Violin Raikov and Prof. Dr. Atanas Palazov

Scientific Consultant: Assoc. Prof. Dr. Ivelina Zlateva

1. General description of the materials presented

The set of materials submitted by Yordan Raev Raev complies with Article 33(1) of the Regulations for the Development of the Academic Staff of the Institute of Oceanology – Bulgarian Academy of Sciences and includes the following documents: an application to the Scientific Council requesting the initiation of the PhD thesis defence procedure; an inventory of the submitted documents; a report by the head of the scientific section; minutes of the section meeting; an order for enrolment as a doctoral student; minutes certifying successful completion of the examinations; a certified copy of the Master's degree diploma; a professional curriculum vitae; an updated list of scientific publications and participation in scientific conferences and forums related to the PhD thesis topic, together with copies of the publications; abstracts of the peer-reviewed publications in Bulgarian and English; a citation report; the PhD thesis thesis; abstracts of the PhD thesis in Bulgarian and English; and a report on the plagiarism check performed.

2. Characteristics of the PhD thesis

The PhD thesis thesis submitted by PhD candidate Yordan Raev comprises 156 pages and is structured into the following main sections: Introduction (4 pages); Literature Review (11 pages); Aim, Objectives and Scientific Hypothesis (4 pages); Materials and Methods (46 pages); Results and Discussion (17 pages); Science-Based Recommendations for Improving

Operational Selectivity and the Sustainable Management of Fisheries Targeting Demersal and Near-Demersal Species in Bulgarian Black Sea Waters (20 pages); Summary of Findings (2 pages); Conclusion (4 pages); Scientific Contributions (2 pages); List of Publications Related to the PhD thesis Research (1 page); References (22 pages); Declaration of Originality of the Results and Contributions (1 page); lists of abbreviations, notation, symbols, figures and tables (11 pages); and a Glossary of Key Terms (4 pages).The list of references comprises 218 entries, including 2 in cyrillic script, 201 in latin script and 15 internet sources. The PhD thesis contains 30 figures, 25 tables and 6 appendices. The PhD thesis is relatively well balanced in terms of the structure and length of its individual sections. The largest proportion is devoted to the "Materials and Methods" section (29.5%), which is justified by the applied scientific nature and significance of the research conducted. The aim of the PhD thesis is clearly and appropriately formulated. In accordance with this aim, nine objectives have been defined, and their fulfilment is convincingly demonstrated by the results obtained and the conclusions drawn on their basis.

According to the report on the plagiarism check provided, no evidence of plagiarism was identified in the PhD thesis.

3. Relevance of the topic

Globally, marine ecosystems are increasing pressure driven by population growth, the intensification of fishing activities and rising consumption of marine resources. Among the major challenges of modern fisheries are bycatch and discards, which result in additional fishing mortality and adversely affect the status of fish stocks. This problem is particularly pronounced in trawl fisheries, where the limited selectivity of the fishing gear used leads to the capture of undersized individuals and non-target species. Contemporary concepts of sustainable fisheries management emphasise the need to reduce discards, with fishing gear selectivity increasingly recognised as a key technological and management tool. Despite the significance of this issue, the selectivity of fishing gear in the Bulgarian Black Sea waters remains insufficiently studied. This hinders the development of scientifically sound technical measures applicable to national fishing conditions, as well as the integration of selectivity into fisheries resource management.

The present PhD thesis focuses on the investigation of technological solutions for reducing discards by improving the selectivity of a conventional trawl used to catch demersal and near-demersal species in Bulgarian Black Sea waters. This underscores the relevance of the dissertation from both a scientific and an applied scientific perspective.

4. Literature review and theoretical background of the PhD candidate

The relevance of the topic is clearly outlined and convincingly justified in the Introduction and Literature review of the PhD thesis, which is structured into eight sections. The PhD candidate demonstrates an in-depth understanding of the research problem and, on the basis of a detailed analysis of the scientific literature, an assessment of the current state of the field, and a review of the international, European and national regulatory frameworks, substantiates the need to conduct experimental studies on the operational selectivity of conventional trawl fishing gear used to catch red mullet and whiting in Bulgarian Black Sea waters. The theoretical knowledge acquired has served as a basis for formulating the aim and objectives of the dissertation and for justifying the selected methodology.The approaches adopted in planning and conducting the experiments, as well as in analyzing and presenting the results obtained, demonstrate the PhD candidate's high level of theoretical knowledge, methodological competence, and scientific awareness.

5. Materials and methods

The PhD thesis by Yordan Raev is based on the examination of a sufficient number of specimens using appropriate methods. The methodology employed for data collection, processing and analysis is consistent with internationally established approaches to assessing the selectivity of trawl fishing gear and ensures the reproducibility and comparability of the results obtained. A large-scale study was conducted, comprising a total of 203 experimental trawl hauls using the three structural designs of conventional trawl fishing gear under investigation. The PhD thesis examined a total of 299 specimens, including 185 samples of red mullet and 114 samples of whiting. A total of 36,241 individuals were measured, comprising 23,328 red mullet and 12,913 whiting. The data obtained were processed using quantitative and statistical methods that enabled the modelling of selectivity curves and the determination of the principal selectivity parameters. The combination of methodological approaches applied provides an objective assessment of the effectiveness of the design solutions employed and supports the formulation of practically applicable recommendations aimed at reducing discards and improving the sustainability of fishing activities.

In this respect, the methods selected for conducting the PhD thesis research are scientifically sound and undoubtedly enable the production of reliable scientific and applied research results, while also meeting the aim and objectives set out in the PhD thesis.

6. Significance and reliability of the results, interpretations and conclusions

The PhD thesis is impressive in terms of the depth and scope of the research conducted, which contributes to the study of the problem under investigation. The results obtained are significant and provide convincing support for the proposed scientific hypothesis. They are logically substantiated, clearly presented and effectively illustrated with figures and tables. The analysis reveals that the operational selectivity of conventional trawl fishing gear is distinctly species-specific and is determined by the combined effects of the structural characteristics of the codend, the morphological features of the species and the operating conditions. The strong nonlinear relationship established between individual body length and the probability of retention confirms the size-dependent nature of selectivity and demonstrates the applicability of the statistical models used for the quantitative description and assessment of the selectivity process. The validation of the models indicates good agreement between the observed and predicted selectivity parameters, further supporting the reliability and credibility of the results obtained. The practical relevance of the research is particularly noteworthy, as it includes the evaluation of management scenarios and highlights the potential of an integrated approach to safeguarding the reproductive potential of fish stocks and ensuring their sustainable management. A significant finding is also the identified discrepancy between the legally established minimum catch sizes for red mullet and whiting and the biological reference values for sexual maturity in these species, which has implications for the sustainable management and conservation of fish resources in the Black Sea. The PhD candidate's discussion and conclusions demonstrate good skills in interpreting scientific results and comparing them with findings reported by other authors. Overall, I consider the eight conclusions and the scientific and applied research contributions presented in the PhD thesis to be appropriate. They accurately reflect the results achieved and outline prospects for their practical application.

7. Contributions and significance of the research for science and practice

Based on the research conducted, the results obtained and their synthesis, the following contributions can be identified.

The contributions of **original scientific significance** include:

- This PhD thesis represents the first comprehensive study in the Bulgarian sector of the Black Sea to investigate the operational selectivity of conventional trawl fishing gear used to catch red mullet and whiting, linking selectivity to the size structure of catches, discards and the biological reference points of the exploited populations. The low selectivity observed with respect to sexually immature individuals may adversely affect the reproductive potential of these stocks.

The contributions of **scientific and applied significance** are related to:

- The development of a methodology for assessing the operational selectivity of trawl fishing gear used to catch red mullet and whiting under actual operating conditions;
- The development of an analytical approach for assessing the effective mesh opening, incorporating design and operational parameters associated with actual trawling conditions;
- Scientifically substantiated recommendations have been formulated for optimizing the design characteristics of trawl fishing gear used to catch demersal and benthopelagic species in the Black Sea, with the aim of improving selectivity, reducing the capture of sexually immature individuals, and minimizing the quantity of discarded catch;
- The proposal of specific technical and management measures to improve the selectivity of trawl fishing gear;
- Analytical and predictive scenarios have been developed to support management decision-making, enabling the assessment of the effects of different selectivity regimes on the size and age structure of red mullet and whiting stocks;
- The results obtained provide a scientific basis for improving the regulatory framework governing minimum permissible fish landing sizes and the technical requirements for fishing gear used in the Bulgarian waters of the Black Sea.

8. Assessment of publications related to the PhD thesis

The PhD candidate has submitted an updated list of four publications, two of which include results and analyses related to the subject of the PhD thesis. One of these publications appeared in a Scopus-indexed journal ranked in the fourth quartile (Q4). The second publication, for which the PhD candidate is the sole author, has been accepted for publication in the peer-reviewed proceedings of the *Eighteenth International Conference on Marine*

Sciences and Technologies. The proceedings are not ranked in an SJR/JCR quartile. Confirmation of acceptance has been provided in the form of an official document issued by the publisher. In addition, the results of the PhD thesis have been presented at a scientific conference.

9. Personal contribution of the PhD candidate

The submitted declaration of originality and authenticity confirms that the analyses, results obtained, and conclusions formulated in the dissertation research were carried out with the personal involvement of Yordan Raev. The significant contribution of the scientific supervisor, Assoc. Prof. Ivelina Zlateva, PhD, should also be emphasized, as her expert guidance was an essential factor in ensuring the high quality of the research.

10. Autoreferat

The autoreferat comprises 32 pages and is structured in accordance with the requirements of the Regulations for the Development of the Academic Staff of the Institute of Oceanology - Bulgarian Academy of Sciences. It reflects the main results, analyses, conclusions and contributions of the PhD thesis research. The summary of the PhD thesis in English at the end of the autoreferat is provided.

11. Critical remarks

I have several critical remarks that do not diminish the significance of the PhD thesis :

- regarding the structure of the PhD thesis: The section "Aim, Objectives and Hypothesis" should not include subsections such as the object and subject of the research, the methodological framework of the study, and the expected scientific outcome. The first three topics should be incorporated into the chapter "Materials and Methods". This chapter would also benefit from a more logical structure, beginning with the planning and implementation of the experiment. At the end of the chapters "Materials and Methods", "Results and Discussion", and "Scientifically Based Recommendations for Improving Operational Selectivity and the Sustainable Management of Fisheries Targeting Demersal and Near-Demersal Species in Bulgarian Black Sea Waters", conclusions are presented that largely duplicate the content of the chapter "Summary of Conclusions". The separate section devoted to scientifically based recommendations should instead be included as a

subsection of "Results". Furthermore, I see no need for a separate "Conclusion" following the already presented "Summary of Conclusions".

- regarding species nomenclature: When referring to red mullet and whiting, it is unnecessary to provide their English common names (p. 24); their Latin scientific names in parentheses would suffice. In numerous places in the text, tables and figures (pp. 17, 28, 29, 30, 31, 55, 56 and 65), the name "Black Sea red mullet" is incorrectly used instead of simply "red mullet". Similarly, "Black Sea whiting" is used on p. 89 instead of "whiting". The Latin species name of whiting is also incorrectly capitalised in several places (pp. 24, 33 and 70). These are considered technical errors.

- regarding the citation of the author's own publications: In future work, the author should exercise greater precision when reporting citations of his scientific publications. The citation report submitted by the author lists seven citations, of which six are self-citations and only one is a citation by another author.

12. Recommendations for the future application of the PhD thesis 's contributions and results

1. Given that only two publications relate to the PhD thesis topic, I would recommend that the PhD candidate increase his publication output by disseminating the research findings in specialised scientific journals and presenting them at scientific conferences, with a view to ensuring their wider dissemination.

2. The methodology developed for assessing the operational selectivity of trawl fishing gear used to catch red mullet and whiting, together with the proposed management scenarios for improving selectivity, reducing bycatch and minimising discards, as well as the substantiated need to update the regulatory framework concerning minimum catch sizes, should be presented to the relevant decision-making institutions, such as the Ministry of Agriculture and Food and the Executive Agency for Fisheries and Aquaculture. This would enable the findings to be taken into consideration in the future development and improvement of measures for the management and conservation of fish resources in Bulgarian Black Sea waters.

3. I recommend that, in his future scientific and applied research, the author continue investigating fishing gear selectivity and extend the scope of his studies to include other

commercially important species. This would broaden the scientific basis for the development and improvement of technical measures for regulating fisheries along the Bulgarian coast.

CONCLUSION

The PhD thesis contains scientific and applied-scientific results that represent an original contribution to science and comply with all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the Academic Staff Development Act, and the relevant Regulations of the Institute of Oceanology - Bulgarian Academy of Sciences.

The PhD thesis demonstrates that the PhD candidate, Yordan Raev Raev, has theoretical knowledge and professional skills in the field of sustainable exploitation and conservation of commercially valuable fish species in the Black Sea, while demonstrating the competencies required to conduct independent scientific research.

In view of the above, I confidently provide a ***positive evaluation*** of the conducted research, as presented in the reviewed PhD thesis, autoreferat, achieved results, and contributions, and ***I recommend to the esteemed scientific jury that the educational and scientific degree of "Doctor"*** be awarded to Yordan Raev Raev in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.3. Biological Sciences, doctoral programme "*Ecology and Ecosystem Conservation*".

16.10.2026 г.

Reviewer: .....

Prof. Dr. Petya Ivanova