

Opinion

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Regarding dissertation with the title:

“Composition, structure and distribution of macrozoobenthos in the riparian zone of the Bulgarian section of the Danube River under conditions of anthropogenic pressure and impact”.

Author: Mila Aleksandrova-Ihtimanska

The presented dissertation work in terms of volume and quality, in my opinion, meets the requirements for a dissertation work for the award of an educational and scientific degree of doctor.

The dissertation is focused on a current topic – what concern the structure of zoobenthos in the riparian zone of the Danube River. The Bulgarian sector of the river is part of several areas of the European ecological network Natura 2000.

The volume of the work is 173 pages. Together with tables and diagrams in the appendices, its volume increases to a significant 213 pages. The dissertation itself includes the standard chapters for this type of work – namely, a Purposeful Introduction with a volume of 1.5 pages. A Literature Review with a volume of 25 pages. In it, a main place is given to the research conducted in different countries and places, in previous periods, by many authors, studying the hydrobiological features of the Danube River and its hydrological regime. The review is successfully connected to the subject of the dissertation. In this part of the dissertation, the genesis of the zoobenthos in the river is also considered.

In my opinion, it is good that the texts of the articles on the procedure are also attached to the documents of the dissertationist. This way, basic information supporting the results obtained and the reasoning made is visible.

The aim of the dissertation is clearly formulated – By studying the composition, structure and distribution of macrozoobenthos in the riparian zone of the Bulgarian section of the Danube River and comparative retrospective analysis of available data, to outline the changes and assess the ecological potential of different sections and habitats, using multimetric indicators for ecological classification. To achieve the aim, several main tasks have been identified:

1. Assessment of the parameters of the existing anthropogenic pressure and impact in the riparian zone of the Bulgarian Danube sector;
2. Determination of model influenced and reference river sections;
3. Study of the taxonomic composition, structure and distribution of benthic invertebrate communities in the studied sector of the river;
4. Identification of macrozoobenthos parameters indicative of different forms of pressure

and impact.

In connection with the set goal and tasks, a well-reasoned working hypothesis has been formulated in my opinion - "Changes in the composition, structure and distribution of macrozoobenthos reflect the impact of various types of anthropogenic pressure, with the impact of hydromorphological pressure being stronger than that associated with the load of biogenic elements and heavy metals."

The chapter Material and Methods is detailed and clearly describes the field and laboratory methods used by the dissertation, as well as various indices and statistical methods used in the dissertation. Its volume is 18 pages. The period in which the samples for the dissertation were collected was 3 years, during low water levels in the river. A total of 54 zoobenthos samples were collected from 29 sampling points in ripals along the Bulgarian section of the Danube River.

In parallel, in situ physicochemical indicators of the water were measured, and an analysis of biogenic elements and heavy metals were provided too.

The figures/photos presented in the annexes with with sampling points help to orientate in the location of the relevant stations that are the subject of the study.

The main part of the dissertation is the chapter "Results and Discussion". It is presented on 96 pages. The part has a separate subchapter examining the physicochemical parameters of the river waters, including geomorphological and hydrological data from different periods and hydrological regimes. A connection is sought between the hydrological regime, the type of substrate and the established zoobenthos organisms.

During the study, over 150 taxa of zoobenthos organisms were registered. Species from the classes Turbellaria, Polychaeta, Oligochaeta, Hirudinea, Gastropoda, Bivalvia and Malacostraca were found in the zoobenthos. Species from the orders Ephemeroptera, Trichoptera and Diptera are also widespread. They show occurrence what related to the relevant types of substrates.

The development of macrophyte growths also favors the development of zoobenthos organisms. I would say that the results concerning the benthic organisms of the ripal zone are interpreted from the perspective of a competent specialist benthologist.

The results are not only processed with several indices to determine the structure of the community, but are also interpreted in detail by the PhD student. The reasoning and conclusions made sound logical and convincing. In my opinion, this is also a positive side of the dissertation.

Finally, the dissertation presents 12 conclusions and recommendations of a scientific and scientifically-applied nature. In my opinion, they correspond to the reasoning made in the dissertation. They are aimed at the composition and structure of the studied zoobenthos complexes, the dominant species and their changes over the years of research and in previous studies. The most basic in my opinion are:

1. The taxonomic composition and abundance of macrozoobenthos in the ripal zone of the Bulgarian section of the Danube River is representative of the entire Bulgarian-Romanian section of the river and can be successfully used to characterize the entire sector.
2. In the ripal zone of the main riverbed, the composition of the bottom substrate is largely influenced by coastal embankments, while the arms of the islands are less influenced by human activity.
3. The percentage distribution of the substrate has a leading role in the distribution of macrozoobenthic communities, with classes of primary aquatic organisms showing significant connectivity with a larger number of substrate types compared to secondary aquatic organisms.
6. The hydrological regime has a strong impact on the concentrations of dissolved oxygen and phosphorus in the water, with high water levels, the incoming dissolved organic matter from the floodplain terrace on the one hand increasing turbidity, and on the other hand, the inflow of phosphorus associated with organic matter into the water.
7. Heavy metal pollution in the water is equally high at stations downstream of tributaries and after cities, while their accumulation in sediments is greater at stations downstream of tributaries.
8. Despite the large number of species established in the modern period (2012 – 2014), the richness of supraspecies taxa remains lower than observed in the previous studies.
9. The stations in the arms of the islands, as well as the Novo Selo, Dolni Tsibar, Svishtov and Ruse stations from the main riverbed stand out as the least influenced by anthropogenic pressure.
11. The assessment of the ecological potential showed that in low water conditions, the majority of the stations in the arms of the islands and a significant part of those in the main riverbed fall into the “Good” ecological potential.

In my opinion, the dissertation increases its contribution by mentioning two contributions of a confirmatory nature, which are in connection with previous studies of this exceptional in importance and number of studies conducted European river. In this way, the connection with knowledge obtained in previous studies is emphasized. Four original scientific and applied scientific contributions are listed separately.

The list of references in the dissertation includes 27 titles in Cyrillic and 188 in Latin. At the end of the list are the relevant standards and regulations that were used in the work – 24 in number.

I have some questions and notes about the dissertation that I will share here:

The dissertation candidate has presented two publications on her work – one is a publication in the journal *Acta Zoologica Bulgarica*, and the other is a full-text publication from the 11th Ecology Seminar with international participation. I did not find them in the literature list at the end of the work, and I think it would be good to include them there as well. This

emphasizes their connection with the dissertation.

A separate list shows 12 citations of the publications on the dissertation. There is a list of three participations in scientific forums where results related to the dissertation work were presented too.

I could not find in the text of the work and in the appendices the geographical coordinates of the stations from which samples were taken. Their presence would only facilitate subsequent research and comparisons of possible changes in benthic organisms from the ripal zone of the river.

Why were absolutely quantitative devices not used for sampling in the ripal zone, such as a Surber frame or a Hess bottom sampler, but the relatively quantitative Euro kicking net was preferred?

The remarks made and the questions I asked do not belittle the contribution of the dissertation work under consideration and do not call them into question. Their purpose is to give the colleague the opportunity to discuss them, and to serve her in subsequent building-up publications, which I hope will follow in the near future in scientific periodicals.

Conclusion:

Based on the briefly stated and discussed results and conclusions contained in the dissertation work, I believe that it meets the requirements of the Law of the Development of Academic Staff in the Republic of Bulgaria and the Regulations for its implementation. My opinion about the work submitted by Mila Ihtimanska is positive. I believe that it can be admitted in its current form to defense and be successfully defended before a scientific jury. I believe that the results obtained contain a lot of material for processing and discussion, which I wish my colleague Mila Ihtimanska to publish in scientific journals.

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