

## REVIEW

by **Associate Professor Dr. Violin Stoyanov Raykov**, Institute of Oceanology - BAS in: "Natural Sciences, Mathematics and Informatics", professional field 4.3 "Biological Sciences", scientific specialty "Ecology and Conservation of Ecosystems", scientific field "Ecology of Marine Fauna" designated as a member of the scientific jury by order No. RD-38-576/03.10.2022.

**on a dissertation work** for obtaining the educational and scientific degree "**Doctor**" in: "Natural sciences, mathematics and informatics", professional direction: 4.3 "Biological Sciences", scientific direction "Hydrobiology - Ichthyology and aquaculture", scientific specialty "Hydrobiology".

**Author of the dissertation: Borislava Kostadinova Margaritova**, full-time doctoral student at Sofia University "St. Kliment Ohridski", Faculty of Biology, Department of "General and Applied Hydrobiology".

### **Dissertation topic:**

"Study of the spawning and feeding habitats of sturgeon fish from the Bulgarian section of the Danube river".

### **Scientific supervisors:**

Associate Professor Dr. Eliza Uzunova and Associate Professor Dr. Lyubomir Kenderov

## **Necessary documents in connection with the announced procedure**

According to the list of documents under the procedure, the following documents are submitted: dissertation, abstract, reference to the contributions of the dissertation work, copies of the publications on the topic, list of participations in scientific forums, resume, copy of the diploma for the acquired master's degree, note of exams taken, report of originality, order of credit and order of extension, report of approbation, reference, order of the scientific jury.

## **General presentation of the procedure and the PhD student**

The set of materials provided to me on an electronic medium is in accordance with the Regulations for the Application of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for its Application, Additional Criteria for the Acquisition of Scientific Degrees and Academic Positions at SU "Kliment Ohridski" and meets the criteria for obtaining the scientific degree "**doctor**".

## **About the PhD student**

Borislava Kostadinova Margaritova successively completes a bachelor's program with a specialty in "Biology" and a master's program with a specialty in "Applied Hydrobiology and Aquaculture" at the Faculty of Biology of SU "Kliment Ohridski".

## **Characteristics of the dissertation work**

The dissertation includes 238 pages, 21 tables, 19 figures and 65 appendices. 279 literary sources are cited, of which 35 are in Cyrillic and 244 are in Latin.

The manuscript is structured excellently and contains: Introduction (2 p.), References (28 p.), aim and tasks (1 p.), Material and methods (p. 14), Results (58 p.), Discussion (35 pages), Deductions and Conclusions (2 pages), Contributions (2 pages), Bibliography (23 pages), Appendices (63 pages), Acknowledgments (3 pages).

The dissertation contains all the necessary chapters, in sufficient volume. No inconsistencies were found between graphs, tables and their names. There are technical errors made, for example, a letter is omitted from the names. It is technically well made and presented.

### **Topical relevance**

Sturgeons are an ancient species of cartilaginous fish that appeared 200 million years ago. The Danube basin has preserved some of the most important populations. Over the years, there has been no thorough monitoring of the sturgeon fish populations in the Danube River and it is difficult to determine the quantitative reduction of their population. Sturgeons are an important component of two large-scale ecosystems, the riverine and the marine.

Knowing their habitats is key and will provide knowledge on how to conserve them. There is a deficiency of information on the subject, such as, "the lack up-to-date data on the food spectrum of sturgeon fish in the Bulgarian section of the Danube", sturgeon feeding and spawning habitats. Determining the quantitative parameters, the qualitative composition, as well as the ecological features of the macrozoobenthos species, the migration routes and behavior of the sturgeon fish, knowledge of the behavior and biology of the Danube sturgeon fish sets important case studies to be solved and places the topic among those relevant for modern society.

### **The choice of the object**

Sturgeons are an excellent subject for this dissertation. In the Danube River, their populations have an important role as an indicator of healthy and complete ecosystems - from an ecological point of view. From an economic point of view, sturgeon fish have a high market value due to two main qualities - caviar and delicate meat. This is precisely what causes over-exploitation and over-fishing, with the aim of illegal export and supply to the European and world markets. The largest exporters of sturgeon caviar are Bulgaria and Romania. These facts determine the need to study and analyze this significant problem and implement strict measures in order to preserve sturgeon populations and their habitats.

### **Target**

The aim of the present dissertation, which is clearly and precisely formulated, is related to identification of the potential spawning and feeding habitats of sturgeon fish in the Bulgarian section of the Danube River with a view to their future protection and restoration. To achieve this, three research tasks have been identified.

### **Results**

The results from the conducted research are presented systematically in several subsections. Detailed information on the species composition, numbers and size of sturgeon fish is presented. The age structure of the sturgeon fish is also determined. The data for the linear-

weight dependences and the condition factor are presented in a tabular form. The migrations of adult sturgeon specimens to spawning grounds are researched. Values of abiotic factors in potential spawning habitats are noted. The sturgeon spawning sites have been located, and the research indicates that no sturgeon eggs and larvae detected by ichthyoplankton nets over the seven-year study period. This fact reinforces the need for this in-depth study and substantiates the importance of the working hypothesis of the present dissertation.

### **Literary awareness and theoretical preparation of the candidate**

The dissertant has analyzed all the available literature on the problem under consideration, which shows her excellent literary awareness and theoretical background. The author has focused on understudied issues in order to achieve the main objective of the present work.

### **Methodical approach**

The sturgeon research method follows the fish monitoring methodology of the National System for Monitoring the Status of Biological Diversity (NSMSBR). The methodology was successfully selected and this helped the dissertant to purposefully follow the set tasks. A specific approach was selected: "An approach for monitoring sturgeon fish in the Danube". The nutritional spectrum of sturgeon fish was studied by a non-invasive method - by "gastric lavage". The methodological part is suitably illustrated by presenting tables and graphs. The detailed study of the water parameters, which enriches the scientific research, is noteworthy.

### **Data analysis**

The data from the conducted scientific research are thoroughly and clearly presented. The comprehensiveness, duration as well as the spatial coverage of the conducted research is impressive. The numbers of sturgeon fish was analyzed consistently as fishing effort per unit area, the relative growth rate was calculated, the size structure and linear-weight dependences of the sturgeon fish, the trophic base, as well as the degree of accessibility of the fish to the prey were analyzed. Appropriate methods were used for graphical and tabular data analysis. Nonparametric analysis of variance was applied. The graphics are technically well made. The information is presented in an appropriate manner and demonstrates a thorough insight of the research. Emphasis is placed on improving the legislative framework, restoration programs and scientific research, communication with fishing communities and control authorities, combating illegal trade and poaching.

### **Significance and cogency of the obtained results, interpretations and conclusions**

The list of results obtained is impressive and successfully presented characteristic of the handwriting of an experienced scientist and researcher with ideas. The results are presented in detail, convincingly and consistently. The assigned tasks have been met. The end has justified the means of scientific research.

### **Conclusions**

As a result of the conducted analyses, 7 conclusions were formulated. I find these conclusions correctly drawn and reflecting the obtained results. A persistent tendency towards the reduction of sturgeon fish populations in the Bulgarian section of the Danube River is

confirmed. These findings could serve as a signal to focus common efforts in solving the problem.

### **Nature of scientific contributions**

The scientific contributions are well categorized, but in a general category where scientific and scientifically applied are united. Contributions 4, 5, 9 and 10 can be categorized as scientific; 1, 2,3,6,7 and 8 as scientifically applicable contributions.

### **Notes and recommendations**

I have no critical remarks about the dissertation thus submitted for my review. I recommend the author to continue her research and collaboration with the responsible institutions, fishing communities and the non-governmental sector.

### **Scientific works reflecting the dissertation research**

Three publications directly related to the subject of the dissertation work are presented. Three reports and one poster from international and national conferences are also presented. The research for this dissertation was carried out within the framework of the enviable eight projects! I believe that a tremendous amount of work has been done, both by the author and by the entire team on the experimental and analytical work on the topic of the dissertation.

### **Conclusion**

The dissertant shows consistency in revealing and interpreting patterns, analysis of results and has the writing of an experienced researcher, so necessary for Bulgarian ichthyological science. I confidently recommend to the esteemed Committee the awarding of the educational and scientific degree "Doctor" to Borislava Kostadinova Margaritova "Natural sciences, mathematics and informatics", professional direction 4.3 "Biological sciences", the scientific specialty "Hydrobiology - Ichthyology and aquaculture".

29.11.2022

Prepared by:

/ Associate Professor Violin Stoyanov Raykov/