

## REVIEW

by Prof. Dr. Snejana Petrova Moncheva, member of the Scientific Jury, according to Order No. 1 from 03.01.2023 of the Director of IO-BAS – retired

according to the procedure for occupying the academic position "Professor", Field of higher education: code 4. "Natural Sciences, Mathematics and Informatics", Professional field 4.3. "Biological Sciences", Scientific specialty: "Hydrobiology", Scientific field: "Macrozoobenthos", published in the State Gazette No. 87/01.11.2022

Dr. Valentina Ruseva Todorova, assoc. prof. in department "Marine Biology and Ecology" (BEM) at IO-BAS, is the only candidate in the open competition.

Dr. Todorova was born on October 14, 1966 in the city of Varna. In 1992, she graduated from Biological Faculty of the "St. Kliment Ohridski" University as a Master in Biology with a specialization in "Hydrobiology and Water Conservation". In the same year, she was appointed as a biologist to the department "Marine Biology and Ecology" (BEM) at IO-BAS, where she is building her creative career to this day. From 1998 to 2011, she successively obtained the academic rank research associate III-I degree, and in 2005 - a PhD in "Hydrobiology". Since 2011, she has been an associate professor at IO-BAS. In parallel with her professional career, assoc. prof. Todorova actively participates in the scientific and administrative management of the institute, as head of the BEM department (2012-2017) and deputy director of research (2017-2021).

### **1. Assessment of the scientific publications of the overall academic development of the candidate**

I am particularly impressed by the precision in the organization of the information, the documents and references and the presentation of the materials with which Dr. Todorova participated in the competition.

Assoc. Todorova presents a list with a total of 90 titles. Of these, 4 publications (8.A.1-4) are related to the PhD degree, 35 (8.B.1-35) - are related to the academic position "associate professor", and are not subject to review under this procedure, but are taken into account in the overall characteristics of the candidate.

In the current procedure, Dr. Todorova participated with 51 titles. Of these, 28 scientific publications (8.B.1\_1-9, 8.B.2\_1-19) are part of the Reference for compliance with the minimum national requirements and those of IO-BAS, referenced in WEB of SCIENCE and SCOPUS, of which 24 have been published in scientific journals, 1 book chapter (8.B.2.19) and 3 in full text from international conferences (8.B.1.2-3-5).

I also accept the publication presented under No. 20 for review, because I consider that the candidate's contribution is distinguishable, evident from the included tables (Table 1, 4) and figures in the text (Fig. 6, 13, 18, 23, 34, 36), which refer to the Bulgarian coast and the Black Sea. In addition presented are 18 other publications not referenced in WEB of SCIENCE and SCOPUS (8.B.3\_1-18) and 4 selected technical reports (8.B.4\_1-4). Of the 18 publications, 1

(8.B.3.12) was printed in a scientific journal, 5 were reports in full text from international conferences (8.B.3\_8-11,14), 12 are scientific and technical reports, of which 1 (8.B.3.2) - of the Geographic Intercalibration Expert Group (GIG) for the Black Sea, 1 (8.B.3.16) - of the International expert group on descriptor 2 of the MSFD) (JRC, EC publishing house, Luxembourg), 1 (8.B.3.17) - of the International expert group to the International Council for the Exploration of the Sea (ICES), and the remaining 9 are interim or final deliverables of Projects funded by the Norwegian Mechanism (8.B.3.1) and the EC - the Operational Program for the Black Sea (ANEMONE – 8.B.3\_3-6), MISIS (8.B.3.15), EMODnet – EUSeaMAP (8.B.3\_13,17,18).

As scientific (*senso stricto*), I accept 36 publications for review. Scientific and technical reports are also subject to analysis as an important component of the applicant's expert activity.

Of the scientific publications, 27 articles were published in specialized scientific journals and periodicals, ranked by quartiles as follows: Q1-10, Q2-3, Q3-3 Q4 -7, 3 - referenced, without Q and 1- without reference in the databases. A significant share of the articles were published in important national and international journals such as *Frontiers in Marine Science* (IF-3.05-4.44), *Molecular ecology* (IF-6.086), *Aquatic Invasions* (IF-2.39), *Ecology and Society* (IF-2.774), *Scientific Reports* (IF-4.379), *Marine Environmental Research* (IF-3.101), *Estuarine, Coastal and Shelf Science* (IF- 2.611), *Acta Zoologica Bulgarica*, etc., most with "open access".

The entire scientific output of Prof. Todorova is in English, all articles and reports in full text are co-authored, which I evaluate positively, since monitoring and environmental investigations imply a multidisciplinary approach corresponding to the complexity of interactions and processes in the marine environment. In 12 of the articles in scientific journals and reports, Dr. Todorova is the first or second author. I would like to draw special attention to the fact that in collective papers, especially from large-scale international projects, the common practice is to arrange the co-authors in alphabetical order, therefore the position in the author list is of too relative importance. Analysis of the publications shows that in 15 of these collective articles, Assoc. Todorova is either the sole author (8.B.1\_8,9; 8.B.2\_3,7, 9, 18) or part of a Black Sea/Bulgarian team (8.B.1.7; 8.B.2\_4,5,6,10,11,16,19,20), with a clearly distinguishable contribution of an equivalent co-author.

## **2. Main research topics and most important scientific achievements**

Dr. Todorova's research activity is characterised by an enduring interest in the study of the biodiversity, structure, functional characteristics and ecology of the Black Sea benthos; improvement of research methodology; development of indicator systems for assessment of the ecological state of the Black Sea ecosystem in compliance with the European environmental legislation. The candidate's professional passion is the topic of marine protected areas in various aspects, development and implementation of concepts for marine spatial planning and marine nature conservation.

Special attention in the research activity of Dr. Todorova deserves the creative application of European concepts and policies for the marine environment, in the context of the specificity of

the Black Sea ecosystem and professionalism in the application of scientific results in practical applications.

I accept the self-assessment of the contributions as sufficiently detailed and credible, in compliance with the scope of the candidate's scientific and applied results and achievements.

I consider of particular significance, with an original character the scientific achievements in the following areas:

### **2.1. Biodiversity of marine macrozoobenthos and other marine organisms at the species, population, zoocenotic and habitat level:**

a) accumulated new empirical data and refinement of the classification of national types of benthic biotopes based on species diversity, biomass, abundance and distribution of macrozoobenthic communities in relation to natural abiotic (depth, type of sediment, temperature and dissolved oxygen) and anthropogenic factors (eutrophication, fishing activities, pollutants) (8.B.1.2, 8.B.1.4, 8.B.1.5, 8.B.3.1., 8.B.3.2), harmonized with the European EUNIS classification (8.B.3.13, 8.C.4.3) and the Habitats Directive (8.C.4.1);

b) mapping of bottom habitats of different spatial extent

- created a first-of-the-kind prognostic map of the large-scale bottom habitats of the Bulgarian continental shelf in M 1:250,000 and validation of boundary values of the key environmental factors used in the modeling - wave energy, temperature and dissolved oxygen. (8.B.3.13);

- on a local scale, in the marine protected area "Ropotamo", for the first time in Bulgaria, a large-scale map of the national types of benthic biotopes was created using integrated high-resolution interdisciplinary data, with a methodical contribution to benthic habitat biodiversity mapping (8.V. 1.5, CoCoNet project)

c) new data on shellfish population characteristics, poorly studied in modern conditions, of high environmental and economic importance

- for the first time since the 1960s, in 2021 in the Bulgarian sector of the Black Sea, a remarkable recovery of the population and expansion of the range of the rare mussel *Flexopecten glaber* was found, with detailed information on the distribution and population characteristics of the species. The results are interpreted both in the context of the restoration of the Black Sea from eutrophication, reduced predatory pressure from the invasive species *Rapana venosa* and changing climatic conditions, and as a perspective for the development of a new type of mariculture in the Bulgarian Black Sea (8.B.1.1);

- original results were obtained on the status of *Donax trunculus* wild population by studying the size-weight structure and the fatness index. The determined values of the status indicators (L95 and H95), below the thresholds for the "good" category, indicate overfishing of the population, as a result of the large-scale industrial harvesting of mussels carried out in the period after 2012 (8.B.2.8)

c) contribution to the study of the current state of macroalgal communities and cetaceans

- on the example of the "Ropotamo" protected area (case study under the CoCoNet Project), the original concept of the so-called "functional ecosystem cell" and a set of modern statistical methods (multivariate analysis and MaxEnt model) were applied, as an approach to

analyze the network of Natura 2000 protected areas along the Bulgarian Black Sea coast, with a contribution to the harmonization of concepts and approaches at the European level (8. B.1.6; 8.B.2.20);

- the distribution and abundance of macroalgae communities were mapped and analyzed, with a focus on previously unstudied *Phyllophora crispa* communities in the lower infralittoral zone on *Ostrea edulis* biogenic reefs. The four groups of macroalgal communities identified at depths between 10 and 17 m were dominated by *Phyllophora crispa*, *Apoglossum ruscifolium*, *Zanardinia typus* and *Gelidium spp.*, with different preferences for areas with specific depth ranges, slope and curvature, and a higher occurrence of *P. crispa* on biogenic reefs. The observed distribution of *P. crispa*, attributed to the Natura 2000 network of protected areas along the Bulgarian Black Sea coast, shows that the connectivity of the populations of the species in the established network is insufficient within this functional ecosystem cell;

- obtained up-to-date synthesized data on the distribution, habitat preferences and abundance of the three Black Sea species of cetaceans in the Bulgarian marine area (8.B.2.13, 8.B.2.15)

## **2.2 Studies of non-native species as a key ecological problem for the Black Sea in several aspects:**

- an inventory of the existing information on the biodiversity of alien species from the marine waters of Bulgaria and Romania and a validated list prepared, as a basis for scientifically based implementation of European policies on invasive alien species (8.B.2.1) and determination of the threshold values for good status according to the criterion "number of newly introduced non-native species" of the MSFD for three marine areas - coastal waters, shelf and open sea (8.B.4.3);

- in addition to the two already published new species *Dyspanopeus sayi*, *Hemigrapsus sanguineus*, the validated list also includes three new species for the Black Sea/Bulgarian waters: *Arcuatula senhousia* (8.B.2.7), *Dipolydora quadrilobata*, *Polydora cornuta* (8.B.2.1 - Supplementary material);

- pioneering for the Black Sea, through an ecosystem approach, alternatives for the management of the invasive species *Rapana venosa* have been investigated to achieve a good environmental state, a good economic state and low management costs, with scientific arguments provided for sustainable management of the population of *R. venosa* both as an invasive species and as a valuable economic resource. (8.B.1.8);

- developed an original indicator of the impact of *R. venosa* on mussel populations with a confident scientifically based threshold for a "good state" of the ratio of prey/predator biomass (8.B.3.1, 8.B.4.3) and for the first time the spatial extent of its negative impact in front of the Bulgarian coast (with a depth limit of 35 m) (8.B.4.4)

## **2.3. An original approach was developed along with assessment of the impact of mobile bottom fishing gear, as a key anthropogenic pressure, on the ecological state of bottom habitats in the Bulgarian Black Sea shelf.**

The determined threshold value for high/low pressure ( $SAR \geq 0.2$ ) indicates that the seabed is in good state if physical disturbance from fishing occurs less often than once every five years, and with the widest spatial extent of high pressure are circumlittoral silts and mixed sediments (in  $> 20\%$  of their area) (8.B.1.3, 8.B.3.7, 8.B.4.3).

**2.4. Development of knowledge and assessment of ecosystem services of benthic habitats in European seas, as a relatively new interdisciplinary field (between ecology and economics) of research worldwide.** The information on 56 types of European marine bottom biotopes, and their related goods, services, sensitivity issues and environmental protection status is systematized, and for each biotope the categories “goods and services” are evaluated in three classes "High", "Low" and "Negligible"/Not applicable /Unknown' as an important tool for marine spatial management (8.B.1.9, CoCoNET project).

**2.5. Contribution to the development of a science-based strategy for nature conservation in ecological networks of marine protected areas**

- a holistic conservation approach is proposed to build a well-connected system of marine protected areas, based on a complex of factors - physical oceanographic connectivity (currents, circulation), beta-diversity and genetic connectivity of multiple species with diverse characteristics of life cycles. The results for the genetic structure of a group of benthic species (*Mytilus galloprovincialis*, *Tritia neritea*, *Scorpaena porcus*, *Zostera noltei*) were interpreted in the context of their life cycle and larval stages duration, as a mechanism for the presence of genetically divergent populations at a local scale for the Black Sea ( the snail *T. neritea*, 8.B.2.4) or complete absence of genetic differentiation with homogeneous genetic structure (*M. galloprovincialis*, (8.B.2.16); the fish *S. porcus* (8.B.2.5). Genomics of the seagrass *Z. noltei* is complicated due to short-distance dispersal by seeds and sporadic long-distance dispersal by floating vegetative propagules (8.B.2.9).(8.B.2.20, CoCoNET project)

- critical analysis of legislative instruments for the protection and management of marine coastal areas in European seas and assessment of their effectiveness, potential for synergies and contradictions. Recommendations are made to overcome the fragmented approach to the management of marine ecosystems and related goods and services. (8.B.1.7, project COST – MarCons).

**2.6. Development of the scientific basis for macrozoobenthos ecological status assessment and the status of the marine environment in relation to benthic habitats and seabed integrity**

An original contribution to the development of classification systems for macrozoobenthos ecological status assessment, by deriving the type-specific reference conditions for all benthic habitats, characteristic of the sediments of the Bulgarian Black Sea shelf and coast, and assessing the area and proportion of each type of habitat in good/poor status (8.B.1.2, 8.B.1.4, 8.B.3.1, 8.B.3.2, 8.B.4.3).

### **3. Scientific - applied achievements, projects, expert activity and citations**

A distinctive feature of assoc. prof. Todorova's research activity, which deserves special attention, is its scientific and practical importance at a national, regional (for the Black Sea) and European scale, extremely useful for the preparation of a number of strategic documents, in service of various institutions such as the Black Sea basin Directorate, Ministry of environment and water, Black Sea Commission and EC.

- at a national level, Assoc. Todorova is a leading expert with an indisputable contribution to the implementation of European environmental directives: Habitats Directive, Water

Framework Directive (WFD), Marine Strategy Framework Directive (MSFD) (B.3.1, 8.B. 3.2, 8.B.4.3);

- As a national expert in the Black Sea GIG, she coordinated the intercalibration of the BQE macrozoobenthos in the common types of coastal waters of Bulgaria and Romania, (8.B.3.2), and the results were included in Decision (EU) 2018/229 for the Member States classification systems;

- Leader (ISMEIMP project coordinator) in the development of improved monitoring programs according to Art. 11 of the MSFD and representative monitoring networks embedded in the Maritime Strategy of Bulgaria (Decision of the Council of Ministers No. 1111/29.12.2016);

- Leading role in the preparation of the Reports "Initial assessment of the state of the marine environment" for the first reporting period 2006-2011 of MSFD (8.B.4.2) and "Update of the first part of the Marine Strategy" for the second reporting period 2012-2017 of MSFD (8.B.4.3), which Bulgaria, as a member state, is obliged to present to the EC;

- Coordination and methodological contribution to the development of the "Black Sea Guide for Monitoring and Assessment" regarding the implementation of a methodological framework for the Black Sea harmonized with European policy requirements (8.B.3.4, ANEMONE project, WP leader);

- Missionary role for the expansion of the NATURA 2000 marine protected areas network in the Bulgarian Black Sea area (expansion of 6 and designation of 3 new zones), achieving a fourfold expansion of marine Natura 2000 sites (8.B.4.1; Decision No. 660 of November 1, 2013 of the Council of Ministers);

- Significant contribution to the development of a Common framework and Guidelines for monitoring and evaluation of spatially managed areas, tested in nine marine areas of 13 European countries, including the Bulgarian Black Sea, also applicable for the development of new marine spatial plans (8.B.2.6 , MESMA project).

A recognition of the high level expertise of Dr. Todorova is her participation in a number of advisory bodies and working groups to various ministries and organizations (besides those already mentioned) - Advisory Group on the Convention on Biological Diversity to the BSC , Technical Group on Benthic Habitats and Seabed Integrity - TG SEABED to the EC, National Council for Biological Diversity to the Minister of Environment and Water, Advisory and Coordination Council for Environmental Protection of the Black Sea, Advisory Council on Maritime Spatial Planning to the Ministry of the MRDPW.

The large-scale project activity of Dr. Todorova is also impressive, as well as her management and expert functions. In the period 2011-2022, she participated in the implementation of a total of 29 Projects, out of which 14 - national projects/contracts of IO-BAS and two personal expert contracts, and 15 International projects and one personal expert contract, with various sources of funding. She has been a coordinator of two of the national projects and for 3 of the International projects she was IO-BAS coordinator. She has been WP/Task leader, a member of the Management Committee etc. in a number of projects.

With all her scientific and expert activity, Todorova demonstrated undeniable skills to mobilize, coordinate and represent research teams. Recognition of the effective contribution of

Dr. Todorova in projects and expert groups is both the co-authorship in a number of joint publications, interim and final projects reports, scientific and technical reports, in some of which as a coordinator (mentioned above in the review). The funds raised only for the projects coordinated by the candidate are nearly two million leva (1,933,257 leva), which is an indisputable contribution to the development of the research activity of IO-BAS, including the scientific and technical infrastructure. Within the project, MASRI she has been the supervisor of one full-time PhD student (dismissed with the right of defense).

For the successful implementation of the ISMEIMP project, the team led by Dr. Valentina Todorova was awarded by the Municipality of Varna with the "Varna" Award in 2018.

The author self-assessment list of citations in scientific publications, referenced and indexed in the scientific database SCOPUS includes 337 citations of 28 publications with the participation of the candidate. I accept 336 (#42 is a repeat of #36, probably a technical error). It is worth noting that with the exception of 9 citations from Bulgarian authors, all the others are by international research teams, some of the articles have been cited between 20-80 times, an indisputable certificate for the quality and relevance of candidate's scientific production and recognition by the international scientific community.

I have known Valentina Todorova since the start of her career at IO-BAS and have common experience through our joint scientific activity and as a member of the management team of IO-BAS. My personal impressions are of a responsible colleague and collaborator, fighting for institutional causes with dignity and professionalism, a motivated, precise, competent researcher, ambitious in her scientific interests, with a significant contribution to the research advancement at IO-BAS and the Black Sea.

#### **4. Assessment of the applicant's compliance with the minimum national requirements, quantitative criteria and scientometric indicators**

The analysis of Dr. Todorova scientific performance shows that it not only fully covers, but significantly exceeds the minimum national requirements for the position "Professor" under Art. 2b, para. 2 and 3, respectively, Art. 2b, para. 5, ZRASRB and PURPONSZAD of IO-BAS (Appendix to Art. 1a), regarding all groups of criteria as follows: for the publication activity >1.5 times, citations and projects > 5 times, with a total number of points more than 3 times higher than the normative minimum.

#### **Compliance with the minimum required points by groups of criteria for AP "Professor"**

<b>Group</b>	<b>Criteria</b>	<b>Min points</b>	<b>V.Todorova</b>
<b>A</b>	1.PhD thesis	<b>50</b>	<b>50</b>
<b>B</b>	4. Habilitation thesis - scientific publications referenced and indexed in international scientific databases (Web of Science and Scopus)/ <b>publications 8.B.1 1-9.</b>	<b>100</b>	<b>148</b>
<b>Г</b>	7.Scientific publications referenced and indexed in international scientific databases (Web of Science and Scopus) not included in the " Habilitation thesis	<b>220</b>	<b>346</b>


	8. Book chapter Total points of criteria 7 and 8 (publications 8.B.2_1-19)		
Д	11. Citations in scientific publications, monographs, collective reprints and patents referenced and indexed in international scientific database Scopus	120	674
Е	Total points of criteria 14-18	150	787
Total number of points		640	2005

## CONCLUSION

Dr. Todorova's accomplishment presents up-to-date scientific and applied achievements with original contributions corresponding to an established expert with a clearly defined research profile in the field of bottom zoo -cenoses biodiversity, habitats and ecosystem investigations in the Black Sea, of a high recognition at national and international scale. The application documents in the competition are fully in compliance to the mandatory and specific requirements for the academic position "professor".

All the above give ground for my positive assessment and firm recommendation to the Honorable members of the Jury to vote **FOR** the promotion decision of Dr. Valentina Ruseva Todorova to the academic post "Professor" in the Field of higher education: code 4. "Natural Sciences, Mathematics and Informatics", Professional field 4.3. "Biological Sciences", Scientific specialty: "Hydrobiology", Scientific field: "Macrozoobenthos" and to propose to the Scientific Council of IO-BAS a positive statement for her appointment.

28.02.2023  
Varna

Reviewer:   
/prof., dr. Snejana Moncheva/