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**OPINION**

by Assoc. prof. Dr. Kremena Blagovestova Stefanova, member of the Scientific Jury, according to Order No. 99 of 04/03/2023 of the Director of IO-BAS on the procedure for occupying the academic position "Professor", Higher Education Area: code 4. "Natural Sciences, Mathematics and Informatics", Professional field: code 4.3. "Biological sciences", Scientific specialty: "Hydrobiology", Scientific direction: "Genetics of hydrobionts ", announced in SG No. 12/ 03. 02.2022

Associate Professor Dr. Petya Pavlova Ivanova is the only candidate in the open competition , working in the Biology and Ecology section on the sea " (IO-BAS ) - laboratory of "Molecular Biology".

- **General data about the applicant, in accordance with the submitted materials**

Assoc.prof. Ivanova graduated high education at the Faculty of Arts of the " St. Kliment " University Ohridski " as Master's degree in biology with specialty " Hydrobiology and Conservation" . on waters " in 1992. A year later, she was appointed to work at the Institute of Fisheries Resources-Varna, where she successively acquired the titles of research associate III-I degree in the interval from 1994 to 2000. In 2003, he defended his doctoral degree in the specialty "Hydrobiology" on the topic "Taxonomy and population infrastructure of some species of the families Cobitidae , Atherinidae and Clupeidae ( Pisces ) in Bulgaria" at the Institute of Zoology, BAS, with scientific supervisor of famous scientist Prof. Ivan Dobrovolov . In 2007, she held the academic position of associate professor in the specialty "Genetics" at IFR. After the establishment of a molecular biology laboratory at IO-BAS under the section, "Biology and Ecology of the Sea", she was appointed to work at IO-BAS (September 2010) as the head of the genetics laboratory, which she further developed as a new research activity of the IO and continues her career development. Specializes in famous it is European laboratories in Italy, the Czech Republic, Portugal, increased her expertise.

Dr. Ivanova actively participates in the scientific-administrative management of the institutes as Head of the "Ichthyology" Section and the " Population Genetics" Laboratory (2004-2010) and as deputy director in IRR (2007-2010), scientific secretary (2015), deputy chairman of the National Assembly (2012-2015), member of the National Assembly of IO-BAS since 2011.

Out of a total of 100 titles that assoc. prof. P. Ivanova was presented in the documents for the competition, 57 articles were included in the current one competition. From there are 29 of them published in specialized scientific editions and one in complete text from international conferences distributed by quartiles are as follows: Q1-4, Q2–7, Q3–12, Q4–6, and 1 - referenced, with SJR.

Obviously, on the base of presented documents and materials I confidently state that there is not discovered data for plagiarism in submitted publications/reports.

- **Research activity and most important scientific contributions of the candidate**

The scientific field in which Prof. Ivanova is developing includes population genetics and molecular taxonomy, and in particular the application of genetic markers to establish and refine the taxonomy of marine and freshwater fish species and other hydrobionts to assess and protect their biodiversity; assessment of interspecific hybridization as one of the negative effects on biodiversity; study of the genetic relatedness of hydrobionts, in the context of their resistance to natural and anthropogenic factors; a multidisciplinary approach in studying the population - genetic structure of economically valuable fish species, as a scientific basis for sustainable exploitation of stocks; assessment of populations of non-native/invasive species and development of strategies for early diagnosis in accordance with European legislative initiatives; genetic identification of the offspring of endangered local fish species in the field of aquaculture; application of an innovative approach (environmental DNA analyses, eDNA) to assess biodiversity and stocks of economically valuable species in the Black Sea.

Undoubtedly, all the results and contributions in Dr. Ivanova's scientific production are particularly significant, original in their nature and could be summarized as follows:

**2.1. Study of the biogeographic distribution of endemic fish species in their modern range and the phylogenetic relationships between them Original** phylogeographic evidence for the degree of genetic differentiation of the endemic species was obtained *Rutilus frisii* ( Nordmann , 1840) in the Black and Caspian Seas, and the joint role of migrations in the changing natural connection between the two basins and gene flow, as an important source of genetic variation for the evolutionary response to climate change, is hypothesized. The phylogenetic relationships within the genus Atherina in the North-East Atlantic and the Mediterranean, and its division into five clearly distinguishable groups: two recognized species (*A. hepsetus* and *A. presbyter*) and three additional lineages (clades) in the species *A. boyeri* are established; presented new data on the relatively high proportion of Mediterranean endemics and different scenarios for the molecular divergence and survival of species in limited refugia (B.1, B.3).

***2.2.*** **Contributions related to the establishment of molecular-genetic markers for the identification of parental species, hybrid biotypes, taxonomic affiliation and assessment of biodiversity -** skillful application of an original approach (complex of genetic methods and new markers) for precise identification in the genus Cobitis; original data to clarify the taxonomy of Gobidae - first established interspecific hybridization between *Neogobius ( Apollonia ) fluviatilis and Neogobius sirman* _ confirmed the hypothesis of belonging of *N. fluviatilis and N. melanostomus* to subgen Apollonia; established genetic markers for the identification of endangered *Knipowitschia species longecaudata and Knipowitschia Caucasian* ; first morphometric and genetic data on the presence of the endangered freshwater species of kelp ( Umbra crameri ) in the Black Sea; distinguishing the two species of carrageenan ( *Alosa immaculata and A. c aspia* ) and the rarer species *A. fallax* in the Black Sea by original species-specific markers; established allozyme markers for accurate identification of the five IUCN Red List species of sturgeons; for the first time three natural hybrids were identified in the sturgeon from different progenies in the Black Sea and the Danube River ( *Acipenser gueldenstaedti x Acipenser ruthenus* ; *Acipenser ruthenus x Acipenser stellatus and Huso huso x Acipenser ruthenus* ) interpreted as a potential danger of genetic contamination and a threat to their biodiversity; established two species-specific spectra in the turbot with the potential for species

identification in accordance with morphological differences ; established the genetic divergence and phylogenetic relationship of the two mullet species *Mullus barbatus* (Black Sea) and *M. surmuletus* (Mediterranean Sea) and proved their existence as two separate species and for the first time recorded their hybrids in both basins; proven effectiveness of mtDNA marker ( cytochrome C oxidase III) for species identification in the genus Scophthalmus and established the validity, distribution and phylogenetic relationships of three species of turbot ( *Scophthalmus maeoticus , S. maximus and S. Rhombus* ) from the Black and Marmara Seas (B.2, D.7.2, B.6, D.7.1, C.8, D.7.8, D.23, D.24, D.31, D.36 ) .

**2.3. Application of genetic and morphometric markers for the analysis of population-genetic structure, assessment of fish stocks and their effective management** - The spectrum of new data on the population - genetic structure of turbot (*S. maximus*) from the Black and Marmara seas does not strongly suggest phylogeographic genetic differentiation of the populations in the Black Sea, a basis for the role of hydrodynamic factors in spreading the larval stages and formulation of adequate strategies for long-term monitoring and conservation (B.7, D.7.13, D.7.15, D.32, D.40). The original ones complex data for population-genetic structure on mullet (*Mullus barbatus*), argue a hypothetical connection of the low degree of genetic diversity with a combination of overexploitation of the stock, fragmentation of habitats and natural fluctuations in the size of the population (FNI project, No. КП-06-Н41/7/). The three genetically distinct populations of bonito (*Sarda sarda*) in the Black and Marmara Seas, in the Aegean and Mediterranean coasts of Turkey and from the Adriatic Sea, are an important contribution to the introduction of adequate exploitation (D.7.5). Testing of genetic markers (11 non-enzymatic and 16 enzymatic loci ) in strongyla populations *Neogobius melanostomus ( A. m elanostomus )* for the assessment of morphological and biochemical-genetic variability under changes in salinity prove high plasticity, respectively potential for colonization of new habitats, as well as the specificity of two polymorphic enzyme systems for identification of populations of the species. By analyzing the allelic frequencies of the polymorphic esterases loci of the anchovy from the Black and Azov Seas, mixed populations of the Azov and Black Sea anchovies were established for the first time, a basis for the hypothesis that the wintering migration of the Azov anchovy also takes place along the western Black Sea coast, and its northwestern part is an additional water area for reproduction. Specific markers (esterases) indicate high genetic diversity and low genetic differentiation in populations of the black mussel ( *Mytillys galloprovintialis* ), possibly as a result of unrestricted gene flow associated with pelagics larval stages in the life cycle (D.37);

**2.4.** Assessment of the ecological status of fish populations in the Natura 2000 areas of the Bulgarian Black Sea (*Psetta maxima, Sprattus sprattus, Alosa immaculata, Engraulis encrasicolus and Trachurus mediterraneus ponticus* ) with necessary proposals for changes in strategies for monitoring and conservation of stocks (D.7.6)

**2.5.** An **important contribution to the protection of biodiversity** is **the revised up-to-date list of the ichthyofauna** in the Black Sea at the basin level and the gobiid ichthyofauna ( Gobiidae ) in Bulgaria, including their nature protection status (G.7.4, G.28) .

**2.6 . *Contribution to research on invasive and non-native species as a key ecological problem for the Black Sea*** - studies on non-native species from different taxonomic groups (zooplankton - *Mnemiopsi leidyi , B. ovata , A. tonsa and O. davisae* , benthos - *Ra pana venosa* and pillengas (

Liza haematocheila ) in Varna Bay (D.7.9); new data for the identification of pilengas along the Bulgarian coast as markers for differentiation, stock monitoring and assessment of its potential impact on local mullet species (D.33). A list of non-native fish species has been prepared (D.29), a validated list (D.7.19) of the biodiversity of foreign species from the marine waters of Bulgaria and Romania; a catalog of invasive/potentially invasive alien species in the countries part of the Eastern and Southern European Network on Invasive Alien Species (ESENIAS) as a basis for science-based implementation of European policies on EU non-indigenous species.

***2.7. Contribution to the development of modern mariculture in Bulgaria*** The key criteria for determining the geospatial suitability of areas for the development of mariculture in the context of the modern AZA concept (allocated areas for aquaculture ) and the application of the European directive on spatial marine planning have been derived for the first time, as modern strategy for the development of mariculture in the Black Sea and identified 5 areas with potential for sturgeon breeding (D.7.17).

**3. Scientific and applied achievements**

**3.1** . Studies related to refining the taxonomy and population structure of marine biota , including non-native species, also have an important methodological and applied contribution to sustainable management, rational exploitation, development of mariculture, protection of biodiversity and implementation of European environmental policies. Special attention should be paid to the applied new generation sequencing for the analysis of the "visible" and "hidden" diversity of microalgae off the Bulgarian coast with potential as a tool for more effective programs for monitoring the plankton community in the Black Sea and assessing the ecological risk of harmful blooms. The deposited genetic sequences in turbot and phytoplankton species are a contribution to the enrichment of the global genetic database (www.ncbi.nlm.nih.gov/genbank).

**3.2.** Assessment of marine waste and hot spots of its disposal in the Bulgarian sector of the Black Sea based on new modern data, as a basis for creating a strategy for management and mitigation of impact on marine ecosystems and human health (D.7.18) and developed legal recommendations to deal with plastic pollution in the Danube region.

**4 . Project, expert activity and citations**

Prof. Ivanova proves her multi-spectral expertise with her participation in a number of **advisory bodies and working groups** to various ministries, departments and international organizations, e.g. Member of the interdepartmental coordination working group to the Convention on Biological Diversity, MoEW; National Interdepartmental Working Group at the MoEW in connection with Regulation (EU) No. 1143/20, Member of the Scientific and Technical Council for Fisheries and Aquaculture Ministry of Agriculture, Expert Council for "Livestock Breeding", SCA; Member of the working group on protection of sturgeon populations in the Danube and the Black Sea (DSTF); Aquatic Genetic Resources for Food and Agriculture, FAO, Balkan Environmental Association (BAENA).

Recognition of Dr. Ivanova's international scientific authority is her active participation in the boards of 4 international scientific journals, also guest editor of special editions of Frontiers of Marine Science and Journal of Marine Sciences and Engineering, Representative for Bulgaria of

European Reference Genome Atlas (ERGA), as well as a large number of reviews of scientific articles (over 50) and 2 books for the last years, for more than 15 international editions, which is indisputable.

Assoc. Prof. Ivanova is an active participant in the institute's **project activities. For the last 10 years she has participated in the implementation of a total of 41 projects, of which 19 are national scientific projects (MES, FNI) and contracted tasks of IO-BAS,** financed by IARA-MAZH, PUDOOS, Ministry of Education and Culture and 22 international, with different sources of funding (EC RP, H2020, MARE, EASME, INTERREG, CBC- Black Sea , inter-academic exchange (EBR) and others.). She is the head of two of the national projects, and the funds attracted for the projects coordinated by the candidate are BGN 276,000.

The provided reference of **citations** in scientific publications includes 373 citations of 45 publications, of which referenced and indexed in the SCOPU S database - 273 in journals with IF and/or SJR and 35 - in books, conference proceedings of 39 publications, and the remaining 65 the citations are in scientific publications not indexed in international databases. Undoubtedly, Assoc. Prof. Ivanova is well known in the international scientific community.

**5. Training of young scientists**

Asoc, Prof. Ivanova is the supervisor of 2 diploma students and 2 doctoral students - Venelin Nikolov (dismissed, with the right to defend in 2014) and Nina Dzembekova (co-supervisor), successfully defended in 2018.

**6. Evaluation of the applicant's compliance with the minimum national requirements, quantitative criteria and scientometric indicators**

The analysis of the certificate of conformity of Dr. Ivanova's creative activity shows that it not only completely covers, but also significantly exceeds the minimum national requirements under Art. 2b, para. 2 and 3, respectively, to the requirements under Art. 2b, para. 5, ZRASRB and PURPONSZAD in IO-BAS (Appendix to Art. 1a) for the position "Professor", in all groups of indicators, with a total number of points more than 3 times higher than the minimum ones.

**CONCLUSION**

The in-depth work over the years, the significant results and contributions of the scientific research activity and the recognized authority of Assoc. Prof. Ivanova of national and international level, together with the attached additional documents, unequivocally confirm compliance with the criteria for the academic "Professor" position.

Everything exposed so far gives me reason convinced to confirm mine **positive evaluation** and yes I recommend on respect the people members of N. Zh Yes they vote **" FOR"** the award on the academic position " professor " of Prof. Dr. Petya Pavlova Ivanova by area on high education 4. Natural sciences, mathematics and informatics, professionally direction 4.3. Biologically Sciences, Scientific specialty: "Hydrobiology ", Scientific direction: "Genetics of hydrobionts " and yes bring in proposal for the choice her in the National Assembly of IO-BAS.

30.05.2023

city of Varna / Assoc. prof. Dr. K. Stefanova /