

## REVIEW

by *Professor Mariyana Vladimirova Filipova-Marinova,*

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Member of the Scientific Selection Committee by Order No. 58 from 1<sup>st</sup> of March 2024 of the Director of the Institute of Oceanology, Bulgarian Academy of Sciences – Varna on a competition for filling the academic position “**Associate Professor**” in the research speciality “**Ecology and Protection of the Ecosystems**”, research area “**Ecology and Molecular taxonomy of marine organisms**”, Professional area: 4.3. Biological Sciences, Higher educational area: 4. Natural Sciences, Mathematics and Informatics, published in the *State Gazette*, **issue 1 dated 02<sup>nd</sup> of January 2024**.

In the announced competition for the academic position "**Associate Professor**" in the research speciality "**Ecology and Protection of the Ecosystems**", the only candidate is **Dr. Nina Stoycheva Dzhembekova** from the section "Biology and Ecology of the Sea" at IO-BAS.

### *1. General data on the career and thematic development of the applicant*

Chief Assistant Professor Nina Stoycheva Dzhembekova was graduated with a Master's degree in "Ecology and Environmental Protection" at the Technical University of Varna in 2004. She worked as an ecologist at "Albena" AD between 2005 and 2009. In 2013, she was enrolled as a full-time PhD student at the Institute of Oceanology – BAS – Varna and obtained her PhD degree in Hydrobiology with a thesis on the topic "*Molecular taxonomy and ecology of potentially toxic phytoplankton species in the Black Sea*". Since 2019 and currently, Dr. Nina Dzhembekova works as a chief assistant professor at the "Biology and Ecology of the Sea" section at IO - BAS - Varna. She specialized at prominent scientists such as Dr. Satoshi Nagai (Research Center for Bioinformatics and Biosciences, Yokohama, Japan), Prof. Ivan Atanassov (AgrobioInstitute, Sofia, Bulgaria) and Dr. Marco Berzano (Marche Polytechnic University, Ancona, Italy) where she learned the most modern molecular methods for identification and monitoring of phytoplankton species (including toxic species), which she subsequently successfully applied in her research practice.

Nina Dzhembekova is a holder of Japanese Association of University Women International Fellowship for 2015, winner of the First Prize of the BAS "Best Publication" contest on the topic of the dissertation, announced in connection with the 150th anniversary of the Bulgarian Academy of Sciences, as well as the Badge of Honor "45 years IO-BAS" for the development of the scientific

field "Molecular taxonomy of phytoplankton" at IO-BAS and on the occasion of the institute's anniversary. She is a member of the International Society for the Study of Harmful Algae (ISSHA).

## ***2. Opinion regarding the presence or absence of plagiarism in the publications submitted for evaluation***

**No evidence of plagiarism** was found when reviewing the submitted materials for this competition.

## ***3. Major topic of the applicant's research and major scientific contributions to each***

The self-assessment of scientific contributions presented is **accepted** as **sufficiently detailed, excellently-structured and proper**. Dr. Nina Dzhembekova's research activities are characterized by a strong interest in the **interdisciplinary approaches** and **diverse research methods** (including **molecular biology**), and the ability to work on **actual topics of practical importance to the World's Biological Science**.

The main and most significant **research contributions** of the applicant are:

### ***Original research contributions:***

- ✓ For the first time, with the application of molecular genetic methods, the species diversity of the potentially toxic genus *Pseudo-nitzschia* in the Bulgarian Black Sea area was analyzed. A new representative of the genus species was registered for the Black Sea - *Pseudo-nitzschia linea* and a new species for the Bulgarian waters - *P. calliantha* (with proven toxigenic potential in the Black Sea) and a variety – *P. pungens* var. *aveirensis*.
- ✓ An inventory of *Pseudo-nitzschia* blooms throughout the Black Sea basin was performed by analyzing a significant set of unpublished (1283 records from 205 stations) and published data for the period 1959–2019. The studies of the relationship between *Pseudo-nitzschia* blooms and key variables of environment demonstrate the possibility of bloom events to develop at any time of the year under different ecological regimes.
- ✓ New data for the Black Sea related to phytoplankton biodiversity (including potentially toxic species) in sediment samples from different locations were obtained by applying an innovative approach - DNA metabarcoding. For the first time, an integrated study of the distribution of toxic phytoplankton species in the Black Sea (through microscopic analysis and DNA metabarcoding) and phycotoxins has been applied, allowing an assessment of the real toxigenic potential of the Black Sea isolates and the formulation of a statistically based hypothesis about the phycotoxin-producing species
- ✓ By applying different statistical methods, the relationship between the different cyst morphotypes of the bloom-forming complex *Scrippsiella acuminata* and environmental variable parameters such as salinity, temperature and nutrients was assessed. It has been demonstrated that

the dominance of the dinoflagellate species in planktonic communities is largely due to benthic-pelagic coupling.

✓ A set of different approaches (flowcytometry, whole genome sequencing, metagenomics and qPCR) was applied to study the distribution and ecology of picocyanobacteria (*Synechococcus*) in different Black Sea areas. The ability of the Black Sea strains to survive in different conditions (both oxygen- and light-rich, as well as aphotic and anoxic conditions) has been experimentally proven, requiring a reconsideration of the ecological role of *Synechococcus* in the deep sea zone. Heterogeneity was found in the distribution of the different *Synechococcus* phylotypes across ecological niches.

✓ Biodiversity and colonization of diatom communities in different substrates and habitats in the Antarctic were studied. Species richness, diversity and evenness indices were assessed. Two new to science *Halamphora* species were distinguished: *Halamphora kenderoviana* sp. nov. and *Halamphora moncheviana* sp. nov., that were found during a survey of the marine benthic diatom flora on the coasts off Livingston Island, and data on their ecology and distribution were provided.

✓ Original contributions related to the study of the Black Sea microbiome through an innovative metagenomic approach were obtained. The presence of antibiotic resistance genes (ARGs) and metal resistance genes in the Black Sea was investigated for the first time using qPCR and metagenomic analyses. Different types of resistance genes were registered, suggesting the presence of multidrug resistant bacteria in different Black Sea areas, including deep water zone layers. The results revealing the Black Sea as a reservoir of ARGs are of extreme importance, given the significant consequences of antibiotic resistance for human health and the essential role of the environment in its transmission, spread and development.

✓ For the first time, an integrated approach (molecular genetics and morphology) was applied to assess the population genetic structure of the turbot (*Scophthalmus maximus*) off the Black Sea Bulgarian coast, and significant intraspecific morphometric variations were determined, but a low level of genetic differentiation was recorded between the examined populations. In addition, a habitat suitability model for *S. maximus* in the Bulgarian Black Sea region was developed. The results obtained are essential for the conservation and effective management of Black Sea turbot stocks.

✓ For the first time, a multidisciplinary approach (genetic, morphological, biochemical and chemical analyses) was applied to study the health status and adaptive potential of two populations of red mullet (*Mullus barbatus*) in the Bulgarian Black Sea waters. Data were obtained on genetic diversity, the presence of heavy metals and microplastic particles in the gastrointestinal tract of specimens from both populations, as well as levels of oxidative stress.

✓ The first data on the genetic and morphological diversity of garfish (*Belone belone*) from the Bulgarian Black Sea coast were obtained.

***Confirmative research contributions:***

✓ An updated list of invasive and alien species in the Mediterranean and the Black Sea has been prepared. Given the significant ecological effects that invasive species can cause, the results are key to developing an early warning system and taking effective management measures.

***Research contributions with applied character:***

✓ Innovative methodologies and technologies to improve marine biodiversity indicators and monitoring methods are reviewed. Their application in marine monitoring under the Marine Strategy Framework Directive is discussed through case studies. The advantages of new technologies in terms of accuracy and efficiency have been demonstrated.

✓ The potential of the innovative metagenetic approach to study the microalgal diversity in the water column and sediment in the Black Sea has been analyzed and the prospect of the new approach for precise species identification and especially for detecting species causing harmful blooms has been confirmed.

✓ An integrated approach (classical morphological identification and DNA metabarcoding) has been applied to study the biodiversity of dinoflagellate cysts in surface Black Sea sediment samples. The potential of the parallel application of morphological and molecular methods for a more reliable taxonomic assessment of phytoplankton biodiversity in marine sediments has been confirmed.

✓ A new element: Potentially toxic phytoplankton species, within the indicator Harmful Phytoplankton Blooms (Descriptor 5 - Eutrophication) was tested for the analysis of the state of the marine environment in 2017 through an integrated approach: quantitative microscopic data and metabarcoding. A better resolution of the molecular method for species detection has been found. The applicability of the new element has been assessed and recommendations have been made for future use in Black Sea monitoring within the MSFD.

✓ Strategic Research and Innovation Agenda for the Black Sea has been developed, aiming to identify priorities at the national and regional level for the development of programs for a sustainable blue economy, as well as generating scientific knowledge for taking scientifically proved solutions to address the fundamental Black Sea challenges.

***4. Significance of the results obtained***

The analysis of scientometric data from the research production submitted for review is in **full compliance** with the *Rules on the Conditions and Procedures for Acquisition of Educational and Scientific Degrees and Occupation of Academic Positions at IO-BAS*.

**I fully accept the evidence presented by Chief Assistant Professor Nina Stoycheva Dzhembekova, PhD to meet the national minimal requirements for the PhD Degree and the Associate Professor Academic Position.**

The review of the reference submitted by the participant in the competition for compliance with the national minimal requirements and the requirements of the regulations of the IO-BAS for occupying the academic position "Associate professor" in Scientific Area 4. "Natural Sciences, Mathematics and Informatics", Professional filed: 4.3. Biological Sciences, shows **an excess of the minimal required points**, as follows:

- Group of indicators "A": 50 points (required 50 points);
- group of indicators "B": 132 points (required 100 points);
- group of indicators "Г": 267 points (required 220 points);
- group of indicators "Д": 528 points (required 60 points).

The applicant has attached a list of a total of 36 titles (34 of which are scientific publications), grouped according to the required indicators. Of these, five are presented for the acquisition of the educational and scientific degree "PhD" (PhD Thesis and scientific publications), four scientific publications are for the acquisition of the academic position "Chief assistant professor", thus they are not subject to review under this competition, but are taken into consideration in the general characteristics of the candidate. In the current competition, 27 titles are presented, of which 21 are part of the reference for compliance with the minimum national requirements and those of IO-BAS (Indicators B4 and Г7). Indicator B4. Scientific publications in journals that are referenced and indexed in world academic research databases (Web of Science and Scopus) includes seven publications. Three of them are in journals with quartile Q1, one with Q2, one with Q3, one with Q4 and one with SJR without Q. According to Indicator Г7. Scientific publications in journals that are referenced and indexed in world academic research databases (Web of Science and Scopus), outside of the habilitation work, 15 publications are presented, distributed by quartiles as follows: Q1– 3, Q2 – 6, Q3 – 4, Q4 – 1 and one publication with more than 30 authors, thus not included in formation of the points required according to the minimal national requirements and the requirements of IO-BAS, but was considered in the scientific contributions. Additionally, three publications in journals not referenced or indexed in the world academic research databases (Web of Science and Scopus), one scientific-technical report and one strategic document (strategic program) were also included, also contributing to the expert activity of the candidate.

The publications presented in the competition are in collectives of authors, in a significant part with international participation, an indicator of good scientific cooperation, extremely important when conducting large-scale multidisciplinary research. In eight of the publications presented in the competition, Dr. Dzhembekova is the lead author (in six – first and in two – second).

The authors' reference of the citations in scientific publications contains 264 citing sources, referenced and indexed in world academic research databases (Web of Science and Scopus), of 20 cited publications. The high number of citations is an indicator of the relevance of the research and the quality of her research production.

#### **5. Demonstrated research skills and most significant scientific achievements**

A major focus of Dr. Dzhebekova's scientific work is the study of phytoplankton biodiversity in the Black Sea, the taxonomy and ecology of potentially toxic and bloom-forming species; the application of an integrated approach combining molecular methods with classic morphological methods, precision of the taxonomic affiliation, including the determination of new species for the basin; the study of phycotoxins and the evaluation of the toxigenic potential of the Black Sea isolates; the study of the distribution of potentially toxic and bloom-forming species and bloom events, including the biogeographical distribution of resting benthic stages and benthic-pelagic interactions.

The pilot study of the Black Sea microbiome with metagenomic methods and the application of a set of different approaches (flow cytometry, whole-genome sequencing, metagenomics and qPCR) to study the distribution and ecology of picocyanobacteria (*Synechococcus*) in different areas in the Black Sea deserves attention. An additional aspect of the research is the assessment of the population genetic structure of economically valuable fish species, with a contribution to the protection and effective management of their stocks in the region. Contributions to the knowledge of the biodiversity of diatom communities in the Antarctic are also highlighted, including the identification of species new to science, the obtaining of the first Black Sea data on the presence of antibiotic resistance genes and metal resistance genes, as well as the assessment of invasive species. Some of the obtained results on Genus *Pseudo-nitzschia* are a significant scientific contribution, given the impossible differentiation of toxic from harmless species using conventional methods, and have received recognition at the institutional level as the most significant scientific achievement of IO-BAS for 2017. DNA metabarcoding of the Black Sea phytoplankton was selected as the most significant scientific achievement of IO-BAS for 2018. The differentiation of two new *Halamphora* species is selected as the most significant scientific achievement of IO-BAS for the year 2019 and for the year 2022.

#### **6. Demonstrated skills or abilities for conducting research**

Dr. Dzhebekova participated in a large number of international (13) and national (7) scientific research projects (leader of two of the projects), that proves her intensive scientific-organizational and expert activity, and ability to work in a team. Her participation in national and international scientific forums helps for active popularization of the results of the conducted research.

### ***7. Profile of the research work***

The main research profile of Dr. Nina Dzhembekova is in the field of ecology and molecular methods for the study of marine organisms, with a focus on the investigation of phytoplankton biodiversity and taxonomy, phytoplankton blooms and monitoring of potentially toxic species. The results of these studies have been published in specialized and renowned international scientific journals, referenced and indexed in Web of Science/Scopus, such as Harmful Algae, Toxins, Frontiers in Marine Science, Frontiers in Microbiology, The ISME journal, Biodiversity Data Journal and others.

The work of Chief Assistant Professor Nina Stoycheva Dzhembekova, PhD reflects **contemporary scientific and applied projects** with original and confirmational contributions, **skillful use** of interdisciplinary research methods and comparative approaches, and presents her convincingly as: an established **specialist with a clearly defined profile** in the markedly innovative field of cutting-edge Natural Sciences: Molecular Taxonomy; **key expert: ecologist** and **professional creator with** institutionally, nationally and internationally **recognized authority**.

### ***8. Applicant's educational and pedagogical activity and role in the training of young scientific staff***

Chief Assistant Professor Nina Stoycheva Dzhembekova, PhD participates in the educational projects of IO-BAS for the European Researchers' Night. This participation along with fluency in molecular biological methods represents a reliable basis for the leading role of the future habilitated specialist in the **training of new staff** for the validation and development of diatomology as a new scientific area for IO-BAS.

### ***9. Critical notes and recommendations***

As a matter of fact, **I have no** critical notes on the applicant's scientific output. I find the layout of the documents submitted for competition as **a model**, combining **exceptional precision and high scientific style**. I recommend to Dr. Dzhembekova to enlarge her future scientific work with a molecular-taxonomic study of the microfossil flora and fauna of the Black Sea basin, because these are of high value for paleoecological science.

### ***10. Conclusion***

Chief Assistant Professor Nina Stoycheva Dzhembekova, PhD participates in the competition for the academic position "Associate Professor" with **sufficient as volume and quality scientific production**, which determines the appearance of her research field: Ecology and Molecular Taxonomy of marine organisms. The materials submitted for review contain **diverse and detailed information**, both on research interests, results and achievements, as well as on academic, expert and teaching activities, and the applicant's professional biography, in **full compliance (even**

**exceeding)** with the conditions and national minimum eligibility criteria of the academic position “Associate Professor”, formulated in the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Ordinance for the implementation of the Law, and the internal academic rules and criteria, adopted by the Scientific Council of IO-BAS-Varna.

**The above mentioned gives me a reason to recommend convinced the honorable members of the Scientific Selection Committee of this competition and the respected members of the Scientific Council of the Institute of Oceanology of the BAS - Varna to vote "YES" for the election of Chief Assistant Professor Nina Stoycheva Dzhembekova, PhD in the competition for the academic position “Associate Professor” in research speciality “Ecology and Protection of the Ecosystems”.**

29.04.2024

Reviewer: **Заличен на основание ЗЗЛД**

Varna

(Prof. Mariyana Filipova-Marinova, Dr. Sci. Biol.)