

Book of Abstracts

**of the PhD Student Scientific
Session of the FMNS – 2023**

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2023

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PhD Student Scientific Session of the FMNS – 2023

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of the PhD Student Scientific Session of the FMNS – 2023

10th November 2023, Hall 1114

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Age and educational structure of the population in the border municipalities of the Southwest region

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Abstract: The current study focuses on a very specific, discussed and important structure of the population - the age structure. In Bulgaria, as part of the European space, there is a serious problem familiar to this structure - aging of the population. This problem directly affects a number of branches of the economy and social life - employment and workforce structure, pension insurance, economic development, standard of living, health care. This problem manifests itself with different severity on the territory of the country. In the second part, attention is paid to the relationship between education and employment and how the increasing percentage of persons with higher education does not reflect seriously on employment levels. Territorially, the article focuses on the border municipalities. Municipalities that for many years mainly had a protective function and no attention was paid to their economic and social development. 8 municipalities along the western border of the Southwest Region were examined, in which internal differences are observed.

Keywords: age structure, population aging, educational structure, border municipalities, employment

Environmental impact of small hydropower plants in the municipality of Bosilegrad, Western suburbs, Republic of Serbia

Negligible energy benefit and immeasurable environmental damage

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Abstract: In accordance with the National Action Plan for Renewable Energy Production, about 90 small hydropower plants (HPPs) have been built in Serbia so far. A total of 856 small hydropower plants, mostly of the derivation type, are planned to be built in the mountainous regions of Serbia, most of them in protected natural areas (national parks, nature parks, special nature reserves, strict nature reserves). If all these small hydropower plants were built, they would provide only 2-3.5% of Serbia's annual electricity production, but would cause significant environmental damage in the headwaters of many small rivers in hilly-mountainous areas over a distance of more than 2200 km. In the municipality of Bosilegrad alone, 35 potential locations for the construction of small hydropower plants are envisaged. Permits have already been issued for 7 of these, of which 6 are built and operational and the seventh is under construction. The small hydropower plants are located in the southern part of the municipality, close to the border with the Republic of Bulgaria. The planned construction of a large number of small hydropower plants of the derivation type has no rational explanation in the light of the fact that Serbia is the poorest country in the Balkans when it comes to indigenous surface water.

Keywords: small hydropower plants, derivation pipeline, endangered habitats, ecologically sustainable runoff, nature conservation

Important Vulture Sites in the Middle East revealed from GPS tracking migrating Griffon Vultures from the Balkans

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Abstract: Migration is a critical moment in the life of birds, especially for those that have just left the nest. The Griffon Vulture is considered to be a partial migrant, and in Spain, it is estimated that 90% of juveniles leave breeding colonies in the first year. At least 30% of the juveniles from the Spanish population overwinter in Africa. In this study, we present data on the movement of 12 immature Griffon Vultures during their migration to the Middle East. We examined their winter home range using the dynamic Brownian Bridge movement method and calculated the extent of its overlap with protected areas. This is important in the context of taking appropriate measures to protect the species more effectively.

Keywords: Griffon Vulture, migration, GPS tracking, nature conservation

A study of two sympatric populations of *Testudo hermanni boettgeri* and *T. graeca iberica* (Testudines: Testudinidae) in south-western Bulgaria

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Abstract: Although studies on tortoises have been conducted for more than a century in Bulgaria, little to no data have been published on some aspects of their ecology. Moreover, most of the local populations have still not been examined. The purpose of the study was to examine two sympatric populations of *Testudo hermanni* and *T. graeca*. The study was carried out from 2021 to 2023. Here, we present data on the ecology and biology of the two populations. We also provide information on the actual and potential threats to tortoises. The results indicated that *T. hermanni boettgeri* is much more numerous than *T. graeca iberica*. The age structure of both species was very similar, with adults predominating over subadults and juveniles. The sex ratio was slightly in favor of males in the Hermann's Tortoise, whereas it was female-biased in the Spur-thighed Tortoise. The mean home range of the Hermann's Tortoise was smaller compared to other populations of the species. Females had a larger home range than males. The mean home range of the Spur-thighed Tortoise was larger than that of the Hermann's Tortoise and similar to the home range of other populations at the species level. The most significant threat identified was related to partial deforestation within the tortoises' habitat. Overall, the two species seemed to coexist successfully even in the presence of threats, as their numbers did not decline during the study but remained stable.

Keywords: Balkans, ecology, biology, threats, tortoises

Review of the impact of coal fired power plants on the status of the rivers in Bulgaria

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Abstract: The report presents the effect of the activity of the coal fired power plants in South Bulgaria and the negative impact of the wastewaters discharge on the ecological status of the affected rivers: Razmetanitsa River (Struma River catchment – West Aegean district) and Sokolitsa River (Maritsa River catchment, East Aegean district).

The data of the basic physicochemical parameters (pH, Dissolved Oxygen, Oxygen Saturation, E-conductivity, Biological Oxygen Demand), Ammonium Nitrogen, Nitrate Nitrogen, Nitrite Nitrogen, Total Nitrogen, Orthophosphates as Phosphorus, Total Phosphorus, Calcium (Calcium Carbonate Hardness), Total Suspended Substances); specific pollutants (Iron, Manganese, Copper, Zinc, Aluminum, Chromium, Arsenic, Free cyanides, Polychlorinated biphenyls, Uranium, Total α -activity, Total β -activity, etc) defined in national water legislation .; Sulphates, Chlorides, priority substances according to the Directive 2013/39/ and Biotic Index based on the biological quality element - macrozoobenthos, measured before and after the discharge points from coal fired power plants in the Struma and Maritsa catchments during the period 2013-2022, were reviewed and analysed. A relation between the exceeded values of the monitored parameters and pollutants, and the deterioration of the ecological status of the observed surface water bodies was established.

Within the scope of the study, a monitoring program was developed, which includes monitoring sites on rivers directly affected by the activities of the CFPPs - 2 sites on Sokolitsa River, Maritsa River catchment, East Aegean district, 2 sites on Kamenitsa River, 3 sites on Razmetaznitsa River and 2 sites on Kudin dol nullah, Struma River catchment, West Aegean district. In the summer of this (2023) year. own field measurements and samplings of surface water from selected sites, including physico-chemical parameters, lanalyzes of heavy metals in matrix „water“ and matrix „sediments“ and determination of a Biotic index have been started and carried out.

Keywords: coal combustion, wastewater discharge, ecological status, water pollutants - heavy metals and hazardous substances.

A single chamber microbial fuel cell as a biosensor for monitoring the organic load of wastewater

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Abstract: The aim of this study is to develop a single chamber MFCs (SCMFC) as a biosensor for simultaneous measurement of both biological oxygen demand (BOD) and chemical oxygen demand (COD), which will significantly shorten the analysis time. These two parameters are basic for the wastewater quality. SCMFC with carbon felt anodes and air-breathing cathodes separated by a Zirfon membrane were used in the experiments. The experiment was carried out simultaneously with different concentrations of COD in the measurement range from 0 to 1000 mg/L with the use of synthetic wastewater and activated sludge from the Municipal Wastewater Treatment Plant (WWTP) – Blagoevgrad, served as anolyte. The MFCs were run consequently at open circuit (OC) and close circuit (CC) modes using wastewater with different COD concentrations. A linear correlation between the generated current and the BOD/COD values was established, demonstrating the applicability of the used MFC setup as a biosensor. The developed structure based on MFC working as a biosensor was tested in real conditions with a real sample of wastewater from the Ruse WWTP.

Keywords: microbial fuel cell, biosensor, biological oxygen demand, chemical oxygen demand, wastewater treatment, single chamber microbial fuel cell.

Optimization and validation of the sample preparation procedure. Separation of the measurement uncertainty contributions from sampling, homogeneity, sample preparation and measurement

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Abstract: In almost all of the cases of environmental analysis, the biggest sources of measurement uncertainty (MU) are associated with the sampling and sample preparation. The validation of each step of the analytical procedure is an ISO/IEC 17025:2017 requirement. The sample preparation is a step, critically influencing the analytical result, but not producing numerical data itself. Therefore, its separate validation is not a trivial task and practically never done. The sample preparation might affect both MU and bias of the analytical results and the scale of the influence depends on the laboratory sample homogeneity. Revealing of such hidden contributions might provide an additional possibility for optimization of the entire analytical procedure in terms of the "Green Chemistry" principles for reducing of wastes, materials used and cost.

Validation of sample preparation procedure in terms of MU and bias contributions, as well as, the effects of sampling and sample homogeneity are subject of the presented research recently in progress. As a case of study, a sediment samples collected from four sites were selected. Microwave digestion procedure was applied for varying sample size and reagent volumes to study the effect on MU contribution. Two approaches based on matrix CRM and homogenized laboratory sample with analyte additions were tested for evaluation of the bias due to sample preparation. Laboratory subsampling and digestion were performed according to experimental design allowing evaluation of MU at each level. Different approaches for the MU evaluation were applied and compared.

Keywords: uncertainty, homogeneity, optimization, green chemistry, validation

The constructivist approach to STEM education in mathematics in the context of the learning content in grades V and VI

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Abstract: The implementation of a constructivist approach to STEM education in mathematics is related to such characteristics of the educational content as: a) presence of clear inter-subject connections; b) opportunities for pragmatic reformulation of learning tasks by teachers and directing them to students; c) opportunities for independent pragmatic reformulation of learning tasks by students; d) opportunities for independent research and applied activity by students. In this article, a review of the learning content in mathematics in the V and VI grades is made from the point of view of the possibilities of applying the constructivist approach to STEM education in mathematics. The specified characteristics of the learning content are analyzed by looking at: some of the topics; the questions and tasks for students' independent work, the orientation device.

Keywords: mathematics, constructivist approach, STEM education

