

# Резюмета

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„Хидрология на Сушата и водните ресурси“, обявен в ДВ, бр. 41 от 03.06.2022 г

## **B 3 Surface water quality conservation in Bulgaria**

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**Abstract:** Water is an important component of the natural environment, a renewable and limited resource vulnerable to various types of pollution. The relevance of research on water quality protection is closely related to sustainable development and anthropogenic impact on the environment. The importance of water quality dynamics and management from socio-economic and scientific point of view, as well as its practical significance are the basis for defining the issues presented in this monograph.

This scientific study focuses on the topic of surface water quality. An overview of the European and Bulgarian legislation in the field of water policy is made, indicating the main challenges and measures related to the use and protection of surface waters. The issue of monitoring, the principles, approaches and methods applied in performing a complex and differentiated assessment, the factors influencing the formation and change of the qualitative characteristics of water bodies in spatial and temporal aspect are touched upon. We also provide an analysis and assessment of the quality of the water in a model study area.

The main topics discussed in the presented work are based on the fact that waters form one of the main ecosystems on Earth. They represent a large set of open and dynamic systems that consume, transform and produce substances and energy, so their interaction with other ecosystems can lead to a number of environmental problems. In this regard, obtaining information on the state and change in the quality of water resources at local, regional, national, and global levels is particularly relevant. The analysis and assessment of the quality of natural waters raises many questions related to their multicomponent and complex interaction, the various processes that take place in them, and last but not least, the influence of natural and anthropogenic factors.

The protection and use of water in a way that adequately meets the needs of modern society requires precise quality monitoring through the application of a scientifically based system for assessment, aligned with the European and national regulations. This assessment can be based both on the ratios between measured values of the content of potential pollutants and their regulated values, and on a complex analysis to determine the quality status of water bodies. The water quality index used in this monograph emphasizes the advantages of complex index assessments compared to differentiated ones. The identification of the state and the change of the qualitative characteristics of the waters can serve as a good basis for making informed decisions in the field of water resources protection. An essential component for achieving highly efficient policies in the field of water management is the implementation of sufficiently reliable monitoring and control through the use of modern means and technologies.

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## **Г7\_1 Assessment of Physical-Chemical Characteristics of Surface Water from Key Sites of the Mesta River: State and Environmental Implications**

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**Abstract:** The anthropogenic source pollution of the Mesta River was assessed during the period 2011 and 2016 in terms of pH, conductivity, chemical oxygen demand (COD), anions and heavy metals in key sites of the Mesta river pointed as: S1 (the Mesta river before the Iztok river); S2 (the Iztok river before the Mesta river); S3 – the river Mesta after the Iztok river); S4 - the river Mesta at Momina Klisura, near Bukovo) and S5 – the river Mesta before the Greece border, after the Matnitsa river. The application of multivariate cluster analysis (CA) for the interpretation of a large and complex data matrix obtained during a monitoring program of surface water in Mesta river is presented in this study. The dataset consists of analytical results from a 6-yr survey conducted in selected points of the river system. The physical-chemical characterization in the water samples were made in accordance with the Directive 2000/60/EU – Water Framework Directive (WFD) and its equivalent criteria transposed into the Water Law (WL) in Bulgaria. In water, concentrations ( $\text{mg L}^{-1}$ ) during 2016 of  $\text{NO}_2$  (0.006 to 0.052),  $\text{NO}_3$  (0.01 to 1.33) and total contents in  $\mu\text{g L}^{-1}$  of Cu ( $<0.002$ ), Pb ( $<0.003$ ), Cu ( $<0.002$ ), Ni ( $<0.003$ ), S ( $<0.05$ ) and Zn ( $<0.02$ ), pH (5.60 to 8.00), electrical conductivity (0.12 to 48.60  $\text{mS cm}^{-1}$ ) were agreed with environmental standards excepted cadmium Ca ( $>0.15 \mu\text{g L}^{-1}$ ) and  $\text{PO}_4^{3-}$  ( $0.15 \text{ mg L}^{-1}$ ). During analyzed period the cadmium concentration was much higher than recommended limit only. In this sense, it was possible to demonstrate relatively good quality of river water even with numbers of industrial and touristic activities in the analyzed area but also to consider a future concept on cadmium sources and their eliminated.

IOP Conf. Series: Materials Science and Engineering, Euroinvent ICIR 2018, vol. 374, 2018, doi:10.1088/1757-899X/374/1/012093, SJR (Scopus) 0.198, ISSN:1757-8981, E-ISSN:1757-899X

## **Г7\_2 Assessment of the metal concentration in Yantra river within an area with active anthropogenic influence**

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**Abstract:** The anthropogenic pollution of the Yantra River was assessed during six year period (2013– 2018) in terms of metals in key sites along the river, pointed near to industrial activities, municipal effluents and pollution from tributaries in the catchment area. The assessment of metal concentrations in the water samples was made in accordance with Directive 2000/60/EC – Water Framework Directive and its equivalent criteria transposed into the Water

Law in Bulgaria. The results show that the concentrations of metals, such as Hg and Cd, were above the permissible limits of the Bulgarian surface water standard especially in S1 point (the Yantra River near Debeletz). The application of hierarchical cluster analysis for the interpretation of a large and complex dataset obtained during a monitoring program of surface water in the Yantra River is presented in this study. The hierarchical clustering of data shows a correlation between Fe, Mn, Cr, Mg, Ca, Zn, which proves that the increase of Fe concentration could be mainly related to the increased number of the landfills and the unregulated pollution of the catchment area. The overall quality of the Yantra river water corresponds to the descriptive indicator of 'very good' water despite the numerous populated places and industrial activities on the territory of the Yantra River basin. The obtained results would be useful in an in-depth future assessment of the general condition of the Yantra River system.

Forestry ideas, vol.26., №2(60), 2020, ISSN:2603-2996 (Online); 1314-3905 (Print), 326-340. SJR (Scopus):0.115

### **Г8\_1 Quality of the river water in the Danube drainage area**

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**Abstract:** Related issues to the quality of the river water in our country are more popular in recent decades. The availability of good quality water is essential for people, nature and business. In this sense the study of spatial and temporal variations of quality of the river water is very important for the population and for aquatic ecosystems. According to current regulations in our country and preparing the management basin plans the main task is the status of the river flows to be "good ecological" at the end of the period. This article analyzes the quality of the river water in the Danube drainage area. By applying an index of water quality used in many European countries was made a comprehensive assessment.

Shumen University, Proceedings of the 4th International Conference "Geographical Sciences and Education", 30-31.10.2015, 2016

### **Г8\_2 Assessment of the content of heavy metals in the Malak Iskar river basin.**

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**Abstract:** The region of the river Malak Iskar is under anthropogenic pollution for many years. Main pollutants are mines and tailings. The metallurgical factories in Bulgaria have high resource and energy consumption. They are a major pollutant of the environment including river water. However, information about the pollution with heavy metal of surface water is extremely limited. In this regard, the achievement of the main aim of this article is of particular importance.

Proceedings of the Second National Scientific and Technical Conference "Mineral Resources and Sustainable Development", 23.11.2016, STU on Mining, Geology and Metallurgy, ISSN:2534-9295

### **Г8\_3 Nitrate pollution of the river water in the Black sea drainage area**

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**Abstract:** Intensive economic activity on the Bulgarian coast is a reason for serious changes for the worse in the river water quality and in particular their nitrate conditions. For that matter, pollution of river water by nitrates from different sources is a risk to human health. According to the actuality of this problem the article analyzes the quality status of surface river waters of the Bulgarian Black Sea area in terms of their nitrate pollution. The trends in the qualitative characteristics of the river water of nitrate, nitrite and ammonium, both in spatial and temporal aspect is made by applying a comprehensive index of water quality – WQI. The origin of pollutants and sources of nitrate pollution – point and diffuse are determined.

Journal "Problems of geography", Volume 1-2, 2016, ISSN:0204-7209, 47-57

### **Г8\_4 Water quality in lakes of Varna and Bourgas**

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**Abstract:** In the Bulgarian Black Sea coast are a number of lakes. In the area are developed agriculture, industry, transport and tourist. Here are of achieving and maintaining a good quality status of lake waters is of particular importance. The main aim of this study is to identify trends of quality water of Varna and Bourgas Lakes.

Journal "News of the Union of Scientists – Varna", Series "Marine Sciences", Union of Scientists - Varna, 2016, ISSN:1314-3379

### **Г8\_5 Split assessment of the quality of water in the river Vacha basin**

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**Abstract:** In hydrological practice there are two types of assessment of the water quality-split and complex. Comprehensive assessments give us detailed information about water quality characteristics. River Vacha is a strategic reserve for water consummation in south part of Bulgaria. In case of water, pollution of the Vacha River is possible to occur a cross-border environmental problem. There fore determination of the river water quality through special chemical ingredients is very important. The purpose of this article is to analyze the main potential pollutants and reasons for changing of the quality characteristics of the river. The analysis is based on correlations between measured concentrations of chemical parameters and legal norms.

Shumen University, Proceedings of the 5th International Conference "Geographical Sciences and Education", 2016, ISBN:978-619-201-172-7

## **Г8\_6 Assessment of the water quality of the small transboundary rivers entering the territory of Bulgaria**

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**Abstract:** The report evaluates the water quality of the small transboundary rivers entering the territory of the country for the last 15 years. A split and complex analysis of the water quality status was carried out, through the use of index assessments. A comparison was made of the compliance of the state of the analysed river waters with the requirements of the current national regulations.

Proceedings of the scientific conference "Geographic aspects of planning and the use of the territory in the conditions of global changes", Varshets, Bulgaria, 23 - 25.09.2016 г. ISBN: 978-619-90446-1-3, 20 - 25.

## **Г8\_7 Comparative assessment of the water quality in the river Osam**

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**Abstract:** This study is an analysis of the qualitative condition of surface waters of the river Osam, conducted on the basis of a comprehensive assessment using water quality index. A comparison between the assessments of the status of river water is made using the reference values of selected physicochemical parameters for water quality according to the criteria of Regulation №7 / 1986 Regulation №4 / 2000 and Regulation № N-4 / 2012

Journal „Science & Technologies“, Volume V, Number 2, 2015. Nautical & Environmental studies, ISSN:1314-4111

## **Г8\_8 Hydrochemical status of Durankulak and Shabla lakes**

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**Abstract:** There are not many natural lakes in Bulgaria. A large group of them are located along the Black Sea coast. The object of the study in this article is the Durankulak and Shabla lakes, and the main objective is to define the hydrochemical status of the two lakes in the period 2008-2016. The research analyzes the parameters: dissolved oxygen, pH, biochemical oxygen demand (BOD<sub>5</sub>), ammonium (N-NH<sub>4</sub>), nitrate (N-NO<sub>3</sub>) and nitrite (N-NO<sub>2</sub>) ions, orthophosphates (P-ortho-PO<sub>4</sub>), conductivity, iron (Fe) and manganese (Mn)

Journal “News of the Union of Scientists – Varna”, Series "Marine Sciences", Union of Scientists - Varna, 2017, ISSN:1314-3379

## **Г8\_9 Assessment of the water quality of the „Pchelina“ reservoir**

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**Abstract:** In this article the quality of the waters of „Pchelina“ reservoir for the period 2007-2015 was analyzed by assessment of some physico-chemical indicators and selected priority substances. The analysis was made in accordance with the Ordinance H-4 of 14.09.2012 on characterization of surface water and the requirements of the Ordinance on environmental quality standards for priority substances and other pollutants from 01.11.2010. An integrated index for water quality, comparative and graphical methods were applied. The indicators, whose values exceed the legal norms and lead to pollution of the water quality of the dam, are determined. The possible sources of pollution of „Pchelina“ reservoir are identified.

Journal "Problems of geography", Volume 1-2, 2017, ISSN:0204-7209, 62-69

## **Г8\_10 Land use as a factor for the change of water quality in the Osam river basin**

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**Abstract:** The article assesses the impact of land use on the change of the water quality in the Osam river basin. At four monitoring points the values of ten indicators are analyzed: dissolved oxygen, hydrogen (pH), electrical conductivity, ammonium nitrate (N-NH<sub>4</sub>), nitrate nitrogen (N-NO<sub>3</sub>), nitrite nitrogen (P-ortho-PO<sub>4</sub>), total phosphorus, biochemical oxygen demand (BOD<sub>5</sub>), which are compared with their reference values, regulated in Ordinance № H-4/2012 for characterization of surface water. A statistical analysis of data from land surveying for land cover and land use in 1990, 2006 and 2012 was made. Geographical information systems (GIS) analyzed the spatial distribution and the quantitative characteristics of the land use in the catchment area of Osam river

Journal "Problems of geography", Volume 4, 2017, ISSN:0204-7209, 15-27

## **Г8\_11 Water quality of the Varbitsa river - current status and trends of the changes.**

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**Abstract:** Progressive pollution of basins in Bulgaria, including the rivers leads to a number of socio-economic and environmental problems, while at same time having negative consequences for the health of people. The implementation of the Water Framework Directive (WFD 2000/60/EC) in the context of an intensive and complex anthropogenic load on the river systems in the country necessitates an up-to-date evaluation of the water quality. The choice of the Varbitsa river as a subject of study in this article is a result by the specific hydrological and developed versatile economic activity characteristic of the catchment area. The status and the trends in the change of the quality of the river waters are established by analysis of selected indicators, set out in the requirements of Ordinance H-4/14.09.2012 on characterization of

surface water and Ordinance on environmental quality standards for priority substances and some other pollutants from 1.11.2010. Statistical, comparative-analytical and graphical methods have been implemented to achieve this goal.

Proceedings of the national conference with international participation "Science and Society 2017", Union of Scientists - Kardzhali, Volume VI, 2017, ISSN:1314-3425

## **Г8\_12 Index assessment of the water quality – a case study of Bulgarian rivers**

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**Abstract:** Development and implementation of indexation methods used in the assessment of surface water quality (pollution) is particularly relevant in recent years. Currently, hydrological practice actively uses several dozen indices. The existence of so many indices offers the possibility of testing and choosing those that provide a complete and thorough characterization of the anthropogenic impact as well as the types and forms of pollution in selected rivers in Bulgaria. We calculated four indices: the Water Quality Index – WQI, the Combinatorial Index of Water Pollution – CIP, the Index of Water Pollution – IWP and the Index of Oxygen Balance in river water – IOB for the Bulgarian rivers: the Topolnitsa River, the Vacha River, the Lesnenska River and the Provadiyska River. The results show that complex (index) methods are very effective methods for assessing the quality of river water, especially in the context of anthropogenic impact. Uniform indices also allow to compare the water quality status of different rivers and regions

Journal „Geography and Tourism“, Vol. 5, 2, 2017, ISSN:2353-4524, 41-49

## **Г8\_13 Water quality in selected Bulgarian ports areas in the Danube**

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**Abstract:** Human activity in port areas causes significant water pollution. Close to the ports are a number of industrial and agricultural productions, transport activities are being carried out and the settlements are a significant source of waste water. In this sense, the most important indicator of the impact of society on water is their quality. The main aim of the present study is to identify the water quality status and its change in selected port areas in the Bulgarian section of the Danube for the period 2000-2015. In accordance with the requirements of the Water Framework Directive and the Bulgarian water legislation analyzed and evaluated 16 physicochemical indicators at six points. The article mentions the main sources of pollution of river waters and proposes measures for improvement and preservation of their quality.

Journal „SocioBrains“, ISSN 2367-5721 Issue 41, January 2018