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Abstract Book

MONITOX International Symposium „Deltas and Wetlands”

September 15th-17th, 2019

Tulcea, Romania

BSB27-MONITOX

Black Sea Basin interdisciplinary cooperation network for sustainable joint monitoring of environmental toxicants migration, improved evaluation of ecological state and human health impact of harmful substances, and public exposure prevention

Editors

Liliana Teodorof
Antoaneta Ene
Elena Zubcov
Thomas Spanos
Oleg Bogdevich

Editura C.I.T.D.D. Tulcea
2019

CROSS BORDER COOPERATION

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Editors Preface

The **MONITOX International Symposium "Deltas and Wetlands"** is organized by Danube Delta National Institute for Research and Development, Tulcea (DDNI) and Dunarea de Jos University of Galati, (UDJG), Romania, in the frame of the project with code BSB27, *"Black Sea Basin interdisciplinary cooperation network for sustainable joint monitoring of environmental toxicants migration, improved evaluation of ecological state and human health impact of harmful substances, and public exposure prevention" (acronym "MONITOX"),* funded under the EU CBC Joint Operational Programme "Black Sea Basin 2014-2020" framework, in collaboration with the partner institutions - Institute of Zoology, Republic of Moldova (IZ), Eastern Macedonia and Thrace Institute of Technology, Kavala, Greece (EMaTTech), and Institute of Geology and Seismology, Republic of Moldova (IGS).

The Symposium is focused on the current developments on environmental monitoring and management of deltaic and wetland areas with an emphasis on the results obtained so far in the frame of research activities of the Project BSB27. It provides an opportunity for members of the target groups, scientists, decision-makers and stakeholders to meet each other and to establish new relations and partnerships. This fact will promote the cooperation in environmental research and management among countries from the connected regions - Black Sea Basin and the Mediterranean Basin.

Participation is very encouraging, from researchers and specialists members of the project BSB27, to scientists and young researchers representing other institutions from Romania, Republic of Moldova, Greece, Ukraine, Norway and Russian Federation, as well as volunteers – undergraduate students, magisters, doctoral students, alumni. More than 50 abstracts were selected for plenary and poster presentations, covering a wide range of topics grouped in three interrelated sections.

The **sections** of the symposium are:

1. *Monitoring of toxicants in Rivers – Deltas – Seas ecosystems in the Black Sea Basin*
2. *Water quality, human health and biodiversity*
3. *Environmental technologies, restoration and management of aquatic ecosystems*

The editors would like to thank: the authors of the papers, the scientific committee for their assistance in reviewing, EU CBC Joint Operational Programme "Black Sea Basin 2014-2020" for their funding.

We hope that the International Symposium of MONITOX network will provide a suitable background for the exchange of information and ideas in virtually all areas of environmental research specific to deltas and wetlands ecosystems, leading us towards a better scientific and academic interdisciplinary networking in the Black Sea Basin.

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,,Black Sea Basin interdisciplinary cooperation network for sustainable joint monitoring of environmental toxicants migration, improved evaluation of ecological state and human health impact of harmful substances, and public exposure prevention (MONITOX)"

MONITOX International Symposium *Deltas and Wetlands*
PROGRAM

September 15, 2019 (Sunday): Arrival of participants		
17^{30} - 19^{00}	Registration of participants and Welcome Party	
September 16, 2019 (Monday)		
9^{30} - 10^{00}	Registration of participants	
Venue: Hotel Select, Tulcea **PLENARY SESSION** ➢ **Convener: Dr. Chem. Liliana Teodorof, Project coordinator** *Danube Delta National Institute for Research and Development*		
10^{00} – 10^{15}	- Opening ceremony **Dr. Marian Tudor** - General Director, *Danube Delta National Institute for Research and Development* **Prof.dr.eng. Iulian Gabriel Bîrsan** – Rector, *Dunarea de Jos University of Galati*	
Invited Lectures		
➢ **Convener: Prof. Dr. Habil. Antoaneta Ene, Project Manager** *Dunarea de Jos University of Galati* ***Section 1 - Monitoring of Toxicants in Rivers - Deltas - Seas Ecosystems in the Black Sea Basin***		
10^{15}– 10^{30}	**Invited lecturer: Antoaneta Ene** *Dunarea de Jos University of Galati* **Antoaneta Ene**, Elena Zubcov, Thomas Spanos, Oleg Bogdevich, Liliana Teodorof	**Interdisciplinary Cooperation for Ecological Monitoring in the Black Sea Basin**

10^{30}- 10^{45}	**Invited lecturer: Eiliv Steinnes** *Norwegian University of Science and Technology, Trondheim, Norway*	**Importance of Chemical Speciation in Environmental Studies**
10^{45}- 11^{00}	**Invited lecturer: Marina Frontasyeva** *Joint Institute of Nuclear Research, Dubna, Russia*	**Study of Temporal Trends of Pollution in the Russian Coastal Areas of the Black Sea by Nuclear and Related Analytical Techniques**
11^{00}- 11^{30}	Coffee break	
11^{30} - 11^{45}	**Invited lecturer: Liliana Teodorof** *Danube Delta National Institute for Research and Development, Romania* **Liliana Teodorof**, Adrian Burada, Cristina Despina, Daniela Seceleanu – Odor, Mihaela Țigănuș, Cosmin Spiridon, Marian Tudor, Antoaneta Ene	**Mercury Concentrations in Surface Waters and Sediments from Target Areas of MONITOX Network**
11^{45} - 12^{00}	**Invited lecturer: Elena Zubcov** *Institute of Zoology, Chisinau, Moldova* **Elena Zubcov**, Ion Toderas, Laurentia Ungureanu, Antoaneta Ene, Thomas Spanos, Liliana Teodorof, Oleg Bogdevici, Nina Bagrin, Natalia Zubcov, Lucia Biletchi, Nadejda Andreev, Victor Ciornea, Nicolai Grosu, Petru Ciorba	**Ecotoxicological Investigations on Water Ecosystems**
➢ **Convener: Prof. dr. Eiliv Steinnes** *Norwegian University of Science and Technology, Trondheim, Norway* ***Section 2 - Water Quality, Human Health and Biodiversity***		
12^{00} - 12^{15}	**Invited lecturer: Octavian Duliu** *University of Bucharest, Romania* **Octavian Duliu,** Romul Margineanu, Carmen Varlam, Constantin Costea	**Natural Radioactivity of the Black Sea Western Shore**
12^{15} - 12^{30}	**Invited lecturer: Ana Pantelică** *Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering* **Ana Pantelică,** Dan Pantelică, Andrei Apostol, Nicoleta Florea, Decebal Iancu	**Ion Beam Analysis Complementary to Instrumental Neutron Activation Analysis on *Gafrarium Tumidium* Marine Clam (IAEA-461 Reference Material)**

12^{30} – 12^{45}	**Invited lecturer: Oleg Bogdevich** *Institute of Geology and Seismology, Chisinau, Republic of Moldova* **Oleg Bogdevich**, Antoaneta Ene, Igor Nicoara, Oleg Cadocinicov, Elena Culighin,Elena Nicolau	**The Characteristic of Sediments Quality of Natural Lakes in Lower Prut Region**
➢ **Convener: Assoc. Prof. dr. Claudia Stihi** *Valahia University of Targoviste, Romania* ***Section 3 - Environmental Technologies, Restoration and Management of Aquatic Ecosystems***		
12^{45} – 13^{00}	**Invited lecturer: Thomas Spanos** *Eastern Macedonia and Thrace Institute of Technology, Kavala, Greece* **Thomas Spanos**, Athanasios Mitas, Antoaneta Ene, Christina Chatzichristou, Konstantinos Dermentzis, Oleg Bogdevich	**Evaluation of Groundwater Quality through Environmetrics. The Case of Kavala Region**
13^{00} – 13^{15}	**Invited lecturer: Ilya Trombitsky** *International Association of River Keepers Eco-Tiras, Chisinau, Republic of Moldova*	**The Dniester River Basin Treaty as a Modern Approach to Transboundary Waters Management in post-Soviet Area**
13^{15} – 13^{30}	**Invited lecturer: George N. Zaimes** *Eastern Macedonia and Thrace Institute of Technology, Drama, Greece;* *UNESCO Chair Con-E-Ect* **George N. Zaimes**, Valasia Iakovoglou, Dimitrios Emmanouloudis, Olga Papantsiou	**WaSec - Innovative Educational Tools for the Sustainable Management of Semi-Aquatic Ecosystems to Promote Water Security in the Eastern Mediterranean**
13^{30} – 14^{30}	Lunch (*Select Restaurant*)	
POSTER SESSION ➢ **Conveners: Dr. Adrian Burada, Prof.dr. Adrian Cîrciumaru** *Danube Delta National Institute for Research and Development, Romania* *Dunarea de Jos University of Galati, Romania*		
14^{30} – 16^{30}	Posters sessions	
16^{30} – 18^{30}	Lessons learnt – open discussions	
19^{30} – 21^{00}	Dinner (*Select Restaurant*)	
September 17 - 18, 2019 (Tuesday-Wednesday)		
9^{30} – 15^{00}	Field trip in the Danube Delta Biosphere Reserve	
September 18, 2019 (Wednesday) - Departure of participants		

Posters

Section 1 - Monitoring of Toxicants in Rivers – Deltas – Seas Ecosystems in the Black Sea Basin

1.	**Elena Zubcov, Natalia Zubcov**	**Monitoring of Trace Metals in the Ontogenesis of Freshwater Fish**
2.	**Antoaneta Ene, Oleg Bogdevich, Elena Zubcov, Yuriy Denga, Thomas Spanos, Ana Pantelică, Marina Frontasyeva, Claudia Stihi, Liliana Teodorof, Adrian Burada, Cristina Despina, Dana Iulia Moraru, Elena Culighin, Alina Sion, Vasile Bașliu, Alina Ceoromila, Simona Sorina Moraru, Florin Sloată**	**Nuclear and Atomic Techniques Used for the Quantification and Mapping of Heavy Metals and Trace Elements in Soils**
3.	**Antoaneta Ene, Adrian Cîrciumaru, Iulian Gabriel Bîrsan, Elena Zubcov,Oleg Bogdevich, Thomas Spanos, Viorel Cartaș, Eugenia Pascu, Violeta Pintilie, Florin Sloată, Nicusor-Daniel Patrascu, Liviu Vodarici, Mădălina Stăvărache**	**Radioactivity Levels in Selected Areas of the Black Sea Basin in Romania, Republic of Moldova and Greece**
4.	**Adrian Burada, Cristina Despina, Daniela Seceleanu – Odor, Mihaela Țigănuș, Liliana Teodorof, Antoaneta Ene, Marian Tudor**	**Nutrient Level in Surface Water near Urban Agglomerations. Case Atudy: Confluence Area Siret - Danube -Prut**
5.	**Claudia Stihi, Antoaneta Ene, Marina Frontasyeva, Cristiana Radulescu**	**Romanian Heavy Metal Atmospheric Deposition Studies with Biomonitoring and Analytical Techniques Network**
6.	**Cristiana Radulescu, Claudia Stihi, Petre Bretcan, Danut Tanislav, Ioana Daniela Dulama**	**Ground-Waters Chemical Characterization by Analytical Techniques and Statistical Approaches**
7.	**Aida Vasile, Antoaneta Ene, Gabriela Bahrim**	**Microbiological Quality and Contamination Level of Danube River Water in Ostrov-Isaccea Sector, South-Eastern Part of Romania**
8.	**Elena Enachi, Carmen Chițescu, Gabriela Bahrim, Antoaneta Ene**	**Monitoring of Emerging Pollutants from Aquatic Ecosystems - Antibiotics, Endocrine Disruptors and Contraceptives**
9.	**Cristina Despina, Liliana Teodorof, Adrian Burada, Daniela Seceleanu-Odor, Mihaela Țigănuș, Cosmin Spiridon, Iuliana-Mihaela Tudor, Marian Tudor, Antoaneta Ene**	**Application of Inductively Coupled Plasma Mass Spectrometry (ICP-MS) in the Field of Environmental Protection**

10.	**Cosmin Spiridon, Adrian Burada, Liliana Teodorof, Cristina Despina, Daniela Seceleanu-Odor, Marian Tudor, Antoaneta Ene, Lucian-Puiu Georgescu**	**Spatial Distribution of Phytoplankton in Razim Lake**
11.	**Daniela Seceleanu-Odor, Cristina Despina, Adrian Burada, Liliana Teodorof, Mihaela Țigănuș, Cosmin Spiridon, Antoaneta Ene, Marian Tudor**	**Percentage Distribution of Nitrogen Forms in Aquatic Complex Somova-Parches in 2018**
12.	**Sophia Mitkidou, Nikolaos Kokkinos, Konstantinos Trompakas**	**Forensic Fingerprinting of Biomarkers for Oil Spill Characterization: The Case Study of Kavala, Greece**
13.	**Nikolaos Kamidis, Georgios Sylaios, Argyris Sapounidis, Nikolaos Stamatis, Manos Koutrakis**	**Investigating the Quality of Nestos River System**
14.	**Liubovi Lebedenco, Elena Zubcov, Laurenția Ungureanu, Nadejda Andreev**	**The use of *Daphnia magna* Straus, 1820 as a Test Object in Ecotoxicological Studies**
15.	**Daria Tumanova, Laurenția Ungureanu, Nadejda Andreev, Antoaneta Ene, Liliana Teodorof**	**Diversity of Phytoplankton and Water Quality in the Danube River During Spring 2019**

Section 2 - Water Quality, Human Health and Biodiversity

16.	**Elena Zubcov, Natalia Zubcov, Laurentia Ungureanu, Nina Bagrin, Olga Jurminskaia, Lucia Biletchi, Nadejda Andreev, Daria Tumanova**	**Influence of Trace Metals and Biogenic Elements on the Production Processes and Biochemical Oxygen Consumption-CBO5 (in situ and Laboratory Modelling)**
17.	**Ilya Trombitsky, Alexander Moshu**	**Dependence of Endangered Wetland Fish Species *Umbra krameri* Dniester Population from Hydropower Development**
18.	**Tatiana Siniaeva, Dumitru Sireţeanu**	**Experience of Transboundary Cooperation of Sanitary Epidemiological Services of Moldova and Ukraine on Water and Health Issues of Dniester River**
19.	**Dumitru Bulat, Denis Bulat, Ion Toderaș, Marin Usatîi,Laurenția Ungureanu, Antoaneta Ene, Elena Zubcov**	**Comparative Aspects of Ichtyofauna of Dniester and Prut Rivers**
20.	**Alexandru Moshu, Ilya Trombitsky**	**On the Parasites Diversity of *Umbra krameri* (Esociformes) from the Lower Dniester**

21.	**Aurel Năstase**	**Fish Fauna from Freshwater in Danube Delta**
22.	**Denis Bulat, Dumitru Bulat, Elena Zubcov, Marin Usatîi, Lucia Biletchi, Nadejda Andreev**	**The Gobiidae Family in Aquatic Ecosystems of the Republic of Moldova**
23.	**Iasemin Suliman, Iuliana-Mihaela Tudor, Lucica Tofan**	**Assessment of Water Quality in Flowing Ecosystems from Danube Delta Biosphere Reserve Based on Zooplankton Community**
24.	**Luiza Florea**	**Evaluation of Fish Community Importance Species from ROSCI0105 Lower Prut Floodplain**
25.	**Luiza Florea**	**The Commercial Fishing in the Prut River**
26.	**Antoaneta Ene, Dana Iulia Moraru, Steluța Gosav, Romana Drașovean, Alina Sion, Florina Cristiana Căpriță**	**Analysis of Physical-Chemical and Radiological Parameters of Surface and Groundwater from Lower Danube Region, Galati County**
27.	**Olga Jurminskaia, Elena Zubcov, Nina Bagrin, Lucia Biletchi, Antoaneta Ene, Liliana Teodorof**	**The Use of DO-BOD Correlation to Assess the Biochemical Potential of Water Ecosystem**
28.	**Roman Corobov, Ghennadi Sirodoev**	**Change in Climate of the Prut River Basin**
29.	**Aikaterini Mitska, Aspasia Deligianni, Chrysanthi Kostopoulou, Thomas Spanos**	**The Potable Water Quality of Kavala, Northern Greece**

Section 3 - Environmental Technologies, Restoration and Management of Aquatic Ecosystems

30.	**Laura Alexandrov**	**Spatial Interaction between Marine Fisheries and Aquaculture with other Maritime Activities and Uses**
31.	**Tatiana Siniaeva, Ilya Trombitsky, Eugen Prutean, Ivan Ignatiev**	**Environmental Platform as an Approach to Solve the Transboundary Dniester River Management Issues and Promote Sustainable Decisions**
32.	**Valasia Iakovoglou, Georgios Giatas, Georgios Pagonis, Anastasia Savvopoulou, Iordanis Kasapidis, Pavlos Kiourtziadis, George N. Zaimes**	**Assessing and Restoring Urban Riparian Areas to Improve the Quality of Life of Urban Dwellers**

33.	**Antoaneta Ene, Violeta Pintilie**	**Radon and Thoron Activity Concentrations in Selected Indoor Environments in Lower Danube and Danube Delta Region, Romania**
34.	**Ana Pantelica, Antoaneta Ene**	**PIXE Analysis of Elemental Content in River and Underground Water**
35.	**Oleg Bogdevich, Igor Nicoara, Oleg Cadocinicov, Elena Culighin, Evgenii Isicico, Victor Jeleapov**	**The Application of GIS Technology for Environmental Risk Assessment from Toxic Substances**
36.	**Olga Cazanteva, Ghennadi Sirodoev**	**Fragmentation and Flow Regulation of the Prut River Systems**
37.	**Cristian Trifanov, Adrian Burada, Liliana Teodorof**	**Visualizing the Chemical Parameters in surface Water of the Danube River. Case Study: Danube River Km 175 – Km 67**
38.	**Paschalis Koutalakis, Ourania Tzoraki, George N. Zaimes**	**Detecting Riverbank Changes with Remote Sensing Tools. Case study: Aggitis River in Greece**
39.	**Antoaneta Ene, Steluța Gosav**	**Capabilities of FT-IR Spectroscopy for the Investigation of Microplastics in Environmental Samples and Personal Care and Cosmetic Products**
40.	**Christina Chatzichristou, Ioannis Kalavrouziotis, Thomas Spanos**	**Reuse of Treated Municipal Wastewater Effluents for Irrigation in Protected Areas: The Case of Nestos Delta Region**
41.	**Vilson Topi, Thomas Spanos, Christina Chatzichristou**	**Quantitative and Semi-quantitative Analysis using Inductively Coupled Plasma- Mass Spectrometry (ICP-MS)**
42.	**Sorina-Simona Arbanas (Moraru), Antoaneta Ene, Steluta Gosav, Dana Iulia Moraru**	**Intensive Agricultural Practices and Industrial Activities Influence on Soil Fertility of Agroecosystems from Prut and Siret Lowlands, SE Romania**
43.	**Achilleas Ntaoutis, Georgia Soukou, Emmanouela Apostolidou, Thomas Spanos**	**A Bibliographic Survey of the Existence of Radon in the Greek Territory**

List of abstracts

Section 1 - Monitoring of Toxicants in Rivers – Deltas – Seas Ecosystems in the Black Sea Basin

Section 2 - Water Quality, Human Health and Biodiversity

Section 3 - Environmental Technologies, Restoration and Management of Aquatic Ecosystems

ABSTRACTS

➢ *Section 1 - Monitoring of Toxicants in Rivers – Deltas – Seas Ecosystems in the Black Sea Basin*

S1.01. Interdisciplinary Cooperation for Ecological Monitoring in the Black Sea Basin

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The paper presents a synthesis of results obtained by the INPOLDE international network created in the frame of MIS ETC 1676 Project (Romania, Republic of Moldova, Ukraine) concerning the monitoring of the ecological state of the border areas in Danube River and Danube Delta. Maps of pollution of water, sediments, soils and biota with trace metals and persistent organic pollutants (OCPs, total and individual PCBs and PAHs) were built using ArcGIS software. Also, preliminary results of the interdisciplinary studies performedin the first year of implementation of BSB27-MONITOX project on a large range of classes of toxic pollutants (TOXs) in an extended target area in the Black Sea Basin (BSB) (including NE part of Greece) are emphasized, as well as the assessment of toxicants' impact upon human health using a risk calculator. The in-depth study of processes occurring in large, interconnected river basins and evaluation of people exposure to toxics can be accomplished only in partnership, through cooperation based on knowledge, exchange of good practices and interdisciplinary research, conducted only in transnational networks. One of the project goals are the integration of the chemical, radioactivity, biological and microbiological measurements, in order to establish the surface water quality classes for the first time based on an *integrated ecotoxicological quality index*, with important impact on human health.

The set of ecological indicators which are routinely monitored in the frame of national monitoring systems does not include yet the emerging toxicants, such as pharmaceutical residues and metabolites, which are actually found in wastewater, surface water and groundwater. These are specified in EU-wide water monitoring Directive 2013/39/EU, which amended Water Framework Directive 2000/60/EC, and required a strategic approach to the pollution of water by pharmaceutical substances. In the future the national monitoring systems at EU level will have to implement such indicators for emerging contaminants which might be appropriate for prioritization. Moreover, at Union level, it is foreseen to set environment quality standards (EQS) for newly identified substances, revising EQS for some existing substances in line with the scientific progress, and setting biota EQS for some pollutants.

The developed strategy, knowledge and common solutions for improved joint environmental monitoring will lead to a better informing of various stakeholders on the existent levels of TOXs in the region, together with the understanding of complex processes which take place during TOXs migration, accumulation in food chains, and understanding of the influence of toxicants and hazardous wastes on ecological state and human health.

Acknowledgement: We acknowledge the funding from ENPI project code MIS ETC 1676 INPOLDE (2013-2015), Joint Operational Programme Romania-Ukraine-Republic of Moldova 2007-2013, and ENI project with eMS code BSB27 MONITOX (2018-2021), Joint Operational Programme Black Sea Basin 2014-2020.

S1.02. Importance of Chemical Speciation in Environmental Studies

Eiliv Steinnes

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The behavior of a chemical element in natural ecosystems depends on the physicochemical form in which the element occurs. In an aquatic system the distribution of the element between the water and the sediment is in many cases strongly dependent on the chemical form in which it occurs in the water phase, *i.e.* as free anion or cation, in a soluble complex, or incorporated in colloids. The chemical speciation of the element, *i.e.* its distribution among different physico-chemical forms, often determines its mobility in the system and its uptake in organisms living there. More over different forms of an

element may differ strongly in their bioavailability and eco-toxicity. Studies related to trace elements in aquatic ecosystems should therefore preferably be conducted in a way not only registering total levels of the element in different parts of the system but also, if possible, distinguishing between different chemical species in which the element occurs. Most analytical techniques employed in studies of trace elements in aquatic systems determinethe total concentration of the element and not its distribution among different physicochemical forms. In such cases it may be necessary to subject the sample to separation procedures before the element determination. Elements likely to occur in two or more different chemical forms in natural water include chromium, iron, arsenic, selenium, molybdenum, antimony, iodine, mercury, and uranium. The bioavailability and toxicity of such elements may depend strongly on their distribution among different chemical forms. Some examples of speciation studies related to trace elements in aquatic systems will be presented.

S1.03. Study of Temporal Trends of Pollution in the Russian Coastal Areas of the Black Sea by Nuclear and Related Analytical Techniques

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Ecological state assessments of coastal areas are a worldwide important task in management of the coastal environment. The present study is focused on analysis of key patterns of elemental concentration levels in aquatic organisms/biomonitors from a model coastal area of the Black Sea at the Taman peninsula. The objects of research were seawater and freshwater, bottom sediments, coastal soils and macrophytes (algae and aquatic plants) of the Krasnodar Region, RF, (*Cystoseira barbata, Cystoseira crinita, Cladophora seriace, Ulva rigida, Polysiphonia elongata, Enteromorpha intetinalis, Ceramium rubrum, Padina pavonica,* the species of higher hydrophytes: *Zoostera noltii, Zoostera marina, Zannichellia palustris, Ruppia cirrhosa, Stuckenia pectinata, Potamogeton pectinatus, Phragmites communis, Carex* and *Ceratophyllum demersum*) which were collected at different distances from the coast. Three complementary analytical techniques: neutron activation analysis (INAA), atomic absorption spectrometry (AAS) and X-ray fluorescence analysis (XRF) were used for determination of concentrations of 10-15 macro and 20-25-trace elements.

The study confirmed the uniformity in the character of concentrations / dispersion of elements by bottom sediments in the model zones of the Russian Black Sea coastline, regardless of the increase in distance from the coastline. All biomonitors showed their own specificity in the accumulation of mineral elements. Similar patterns of concentration and dispersion were found for different morphophysiological parts of macrophytes (root system and supra-bottom green part) of all studied species. Sites of background, polluted and in moderate pollution state among analyzed sites of the Russian coastal zone were proposed. The observed key patterns of elemental accumulation in aquatic plants-biomonitors, bottom sediments, and soils may be used in the future coastal environmental management and special ecological studies.

Acknowledgement: This study was carried out in collaboration with the Faculty of Biology of Moscow State University and Institute of Oceanography of Russian Academy of Sciences in the framework of the IAEA CRP "Study of Temporal Trends of Pollution in Selected Coastal Areas by the Application of Isotopes and Nuclear Tools" (Contract K41016).

S1.04. Ecotoxicological Investigations on Water Ecosystems

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Ecotoxicology „is the field of study that integrates the ecological and toxicological effects of chemical pollutants on populations, communities of ecosystems and their "fate" in the environment (transport, disintegration)". Ecotoxicology has three major objectives: knowledge and determination of the environmental fate and distribution of chemicals; acquiring ecological and toxicological data for risk assessment and environmental management; developing bases (empirical or theoretical) for enriching and improving knowledge on behavioral effects of toxic chemicals in the living system. These

objectives allow aquatic ecotoxicology to cover broad topics, including ecological, toxicological and systematization issues.

Ecological issues includes research of the status of ecosystems - physico-geographic parameters, abiotic and biotic factors at ecosystem level, communities, populations, diversity, ecological indices, biomass, production, age, sex, resistance, tolerance of the hydrobionts community etc.

Toxicological aspects provides studies on the sources of pollution, physico-chemical parameters, effects of elimination, detoxification or increased toxic effects in the environment of various pollutants of concern, ways of exposures, dose-effect, metabolism and elimination of the pollutants.

And the third stage - provides systematization, assessment, hazard identification, risk estimation, development of remediation measures for the living environment and detoxification of toxic pollutants.

Multiannual investigations, in Republic of Moldova, allowed carrying out a multi-factorial analysis of the quantitative parameters of the weight of the main factors. The dynamics of migration of trace metals in the accumulation of rivers and lakes from Moldova was determined with quantitative estimation of the weight of the natural factors (hydrological, biological) and anthropic parameters (pollution, river dams, etc.) in the processes of migration and prognosis of metal flows in the investigated ecosystems.

Acknowledgement: The study was performed within the projects:15.817.02.27A AQUASYS, 18.51.07.08A/PS, BSB 027 MONITOX, BSB 165 HYDROECONEX, DANUBIUS RI, MIS ETC 1150 and MIS ETC 1676.

S1.05. Mercury Concentrations in Surface Waters and Sediments from Target Areas of MONITOX Network

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The evaluation of mercury concentrations in surface waters and sediments is the main objective of this study. Once in the environment, this toxic element can be transformed by bacteria from a less toxic compound, the inorganic mercury, to a more toxic organic form, with harmful effects, when present in fish and wildlife in general, where could bioaccumulate and biomagnify. People may be exposed to mercury in any of its forms under different circumstances, like consumption of fish. The evaluation of this metal, respond to MONITOX project objectives, being one of the toxicants to be studied in MONITOX Network. In 2019, during the national and joint trip, there were taken 36 surface water samples and 32 sediment samples. After microwave digestion, the samples were analyzed using the cold vapour flameless atomic absorbtion FIAS instrument,that assures full automation, high speed of analysis and minimum sample consumption.

The concentrations were reported to Romanian legislation and it can be observed that the mercury concentrations from the surface waters are between 0.1 µg/L - 0.3 µg/L (values corresponding for very good ecological status and good ecological status) and for sediments are below the quality standard of 0.3 mg/kg. Comparing the results, it can be observed relatively low concentrations from Calarasi to Galati, followed by an increasing from Galati to the Black Sea. Also, it were computed the Pearson correlation coefficients, between the mercury concentrations determined in surface waters and sediments samples and it was observed good correlation, that indicates the increasing of mercury concentrations in surface waters determined the increasing of mercury concentrations in sediments.

Acknowledgement: We acknowledge the funding from ENI project eMS code BSB27 MONITOX (2018-2021), Joint Operational Programme Black Sea Basin 2014 - 2020.

S1.06. Monitoring of Trace Metals in the Ontogenesis of Freshwater Fish

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The study of metal accumulation in fish represents one of the most actual directions of ecology, being a component of the ecological status of water ecosystems monitoring. Due to the fact that trace metals may have a negative impact on the environment a number of metals are included in the list of main pollutants, with an established allowable concentration limit.

The investigation of metal accumulation in fish at the moment is developed in several directions: 1) revealing of the accumulative capacity of fish and establishment of the main factors, which determine the accumulation of chemical elements in fish; 2) quantification of the metal influence on fish growth and development during ontogenesis; 3) investigation of metal accumulation in fish, as well in nutritional product.

The investigations mentioned above are actual, especially for the Republic of Moldova, where rivers and water accumulation reservoirs are subject to negative human activity, resulting in a continuing diminution of the number and biomass of valuable fish species.

The current study is focused on the influence of metals on developmentand gametogenesis in breeding fish**.** The period of early ontogenesis is the most vulnerable period in fish development.Mature fish posses a rather developed mechanism that regulates the processes of accumulation and redistribution of microelements between different organs, depending on the plastic and generative metabolism of fish.

The laws of the metals accumulation dynamics in organs and tissues of fish from different aquatic ecosystems on the diverse ontogenetic phases, and the dependence on the process of environmental conditions served for the elaboration of theoretical bases on resistance and level of tolerance in ichthyofauna and will significantly contribute to elucidation of some aspects of the fundamental and practical character in regard to aquatic ecosystems, assessment of the ecological situation, environmental protection and rational utilization of biological resources.

Acknowledgement: The study was performed within the projects:15.817.02.27A-AQUASYS, 18.51.07.08A/PS,BSB 165 HYDROECONEX, BSB 027 MONITOX, DANUBIUS-RI, MIS ETC 1676, MIS ETC 1150.

S1.07. Nuclear and Atomic Techniques Used for the Quantification and Mapping of Heavy Metals and Trace Elements in Soils

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The paper presents a synthesis of results obtained by long-term international collaboration in the field of applying nuclear and atomic analytical techniques for the quantification of heavy metals and trace elements in soil material. The multistage research aimed at the development of a system of complex monitoring heavy metals, trace elements, rare earths and radionuclides in Lower Danube Euroregion in order to control the state of the environment, to provide rational use of natural resources and to prevent hazardous impacts on human and animals, health of the main anthropogenic sources.

Accurate monitoring of metal concentrations in environmental samples is of great importance in order to minimize health hazards resulting from exposure to such a large spectrum of toxic substances. For this purpose, it is essential to employ different high sensibility and precision methods of

elemental analysis.The concept was based on: i) assessment of concentrations of heavy metals (HMs) and trace elements in selected industrially developed areas, agricultural and protected areas and their sources, ii) assessment of HM contamination level of the environment and ecological risk over the territories affected by their impact using combined pollution indices, and iii) mapping the pollution in target areas using GIS technology.

The following analytical methods were employed in collaborating institutions from Romania, Moldova, Ukraine, Greece and Russian Federation, and used in complementarity for elemental determination in soils sampled from Romania (about 50 chemical elements of the Periodic Table): X-ray fluorescence analysis with energy dispersion (ED-XRF), including portable technique (p-XRF); instrumental neutron activation analysis (INAA); atomic absorption spectrometry (AAS), including High Resolution Continuum Source (HR CS-AAS) technique, inductively-coupled plasma mass spectrometry (ICP-MS); ion beam techniques Particle-Induced X-ray (PIXE) and Gamma-ray (PIGE) Emission using accelerated proton beams, and scanning electron microscopy with energy-dispersive X-ray analysis (SEM-EDX). The accuracy and precision of the results were evaluated by measuring certified reference samples of similar matrix and organizing several intercomparison exercises between research laboratories.

The elements examined were: Ag, Al, As, Au, B, Ba, Br, Ca, Cd, Ce, Cl, Co, Cr, Cs, Cu, Dy, Eu, F, Fe, Hf, Hg, I, K, La, Lu, Mg, Mn, Mo, Na, Nd, Ni, P, Pb, Rb, S, Sb, Sc, Se, Si, Sm, Sr, Ta, Tb, Ti, Tm,Th, U, V, Yb, Zn. From them, the main toxic elements of interest are: As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, Se, W, Zn, and Zr.

Supplementary measurements of radioactive isotopes from the natural series of U and Th and of ^{40}K, as well as artificial radioisotope ^{137}Cs in several industrial soils in Galati area, Romania, were performed by low background gamma spectrometry.

Merits and drawbacks of each analytical technique employed are discussed, as well as the possibility of the assessment of toxicants, impact upon human health using a risk calculator, developed in the frame of MONITOX partnership.

The results emphasize the fact that the parallel use of different analytical techniques could extend the palette of measured elements, and also provides a quality control for the common elements determined by different techniques. Environmental complex studies proved to be very useful for the identification of a large series of trace elements, some of them being toxic for living organisms and humans and others contributing to the elemental cycling in natural environments. Results could be correlated with those

obtained for a certain region using biological indicators of atmospheric pollution.

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S1.08. Radioactivity Levels in Selected Areas of the Black Sea Basin in Romania, Republic of Moldova and Greece

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This work presents a synthesis of results obtained for nuclear dose rates measuredin indoor spaces and outdoor environmentsusing the DIGILERT and INSPECTOR ALERT dosimeters, during trips in various target areas of the project MIS ETC 1676 and BSB27 MONITOX (Romania, Moldova, Greece), in Galati, Tulcea, Constanta (RO), Cahul, Dubasari (MD), Kavala-Thassos (GR) regions involving project members, students and volunteers. The calculated average for each location was compared with limits stipulated by United NationsScientific Committee on the Effects of Atomic Radiation (UNSCEAR) and national legislation.

The paper also presents some laboratory applications of gamma-ray spectrometry technique using a NaI(Tl) detectors coupled to NUMECINT and PHYWE spectrometric chains such as identification of radionuclides and determination of the activity of natural radioactive isotopes in environmental samples (soils, rocks, industrial wastes). The measurements were carried out at radioactivity- and environmental-related courses designed for the students at undergraduate and master programs at Dunarea de Jos University of Galati, Romania.

The ambient gamma dose rate varied with site, day and hour, due to the temporal fluctuations of natural/cosmogenic radioactivity, meteorological conditions, geological substrate and presence of radiation emitted by building materials. The obtained average value of outdoor gamma radiation dose rate had a minimum of 71 nGy/h at Vama veche beach of Black Sea, Romania, and a maximum of 394 nGy/h in the coastal beach areas of Aegean Sea (Nea Peramos-Amolofi, Greece).

The results were compared with the official reports for external gamma dose and with the respective annual average values in Romania and Moldova, our results being lower than the attention limit of 250 nGy/h. Also, it can be noted that the dose rates were in the most cases in the normal range of variation given by United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) 2008 Report from the total outdoor range gamma dose rate, which is 52–163nGy/h.

The obtained results are an important statistical element for periodic evaluation of radioactivity in the target regions for national reports and will serve as a base in further investigations and preparation of maps of terrestrial gamma dose rates and calculation of the health risk for population.

On-going work is carried out in the frame of Romanian-Moldavian-Greek cross-border cooperation project (code BSB27 MONITOX) for the complex investigation of aquatic ecosystems in the Black Sea basin (Lower Danube, Prut, Dniester and Nestos rivers, Black Sea and Northern Aegean Sea coasts).

Acknowledgements: The work was carried out in the frame of the Projects MIS ETC 1676, JOP Romania-Ukraine-Republic of Moldova 2007-2013, and BSB27-MONITOX, JOP Black Sea Basin 2014-2020.

S1.09. Nutrient Level in Surface Water near Urban Agglomerations. Case Atudy: Confluence Area Siret - Danube -Prut

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The main purpose of this study was to measure of nutrients level from the confluence area of Siret and Prut rivers with the Danube and in a few representative points, situated in upstream and downstream of the cities Braila, Galați and Reni.

Was determined 8 representative indicators, respectively: ammonium nitrogen (N-NH4), nitrite nitrogen ($N\text{-}NO_2$), nitrate nitrogen ($N\text{-}NO_3$), total nitrogen, orthophosphate phosphorus ($P\text{-}PO_4$), total phosphorus and chlorophyll „a", from 5 sampling points located along the Danube, 2 sampling points on the Siret river (1 sampling point upstream river and 1 point in the discharge area of river in Danube) and 1 sampling point situated in the confluence area of the river Prut with the Danube.

The results obtained showed an increase of concentrations with 1.12 mg / L for the total nitrogen, between the monitoring points situated in Brăila upstream and Brăila downstream. The values of phosphorus concentrations from orthophosphates ($P\text{-}PO_4$), showed an increase downstream of Galați city. In discharge area of the Siret river in the Danube, was identified the highest values for total phosphorus and ammonium nitrogen ($N\text{-}NH_4$). However, quality indicators determined, did not present exceedances of the maximum admissible concentrations imposed by the Romanian legislation.

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S1.10. Romanian Heavy Metal Atmospheric Deposition Studies with Biomonitoring and Analytical Techniques Network

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A biomonitoring and analytical techniques network were developed for a nationwide moss survey in 2010/2011 and 2015/2016 to achieve the pollution database with heavy metals in Romania. The temporal trends of heavy metals and toxic elements in moss samples were assessed.The concentrations of heavy metals in mosses collected in Romania were high compared to other (Eastern-) European countries and the temporal trends based on the reported and obtained values for mean concentration of selected metals have revealed a decrease in 2015 for the majority of the elements, with the exception of As, as well as Fe, V and Cr.

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S1.11. Ground-Waters Chemical Characterization by Analytical Techniques and Statistical Approaches

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The main objective of this study was to quantitatively determine the contributions of various ground-water nitrate pollution sources including chemical fertilizers and animal wastes applied to croplands using the statistical approaches of PCA. In this respect, 240 wells water samples were

collected from pre-existing wells, situated mainly in rural agricultural area. Sampling was performed in according with EPA Guide for Ground-Water Sampling. Dissolved cations including Ca, Mg, Na, K, Cr, Fe, and Mn, were analyzed using an iCAP™ Q ICP-MS. Dissolved anions (i.e. SO_4^{2}, NO_3^- and Cl^-) were determined using Dionex ICS-3000 Ion Chromatography system. Alkalinity of groundwater samples was measured by titration method to quantify the carbonate species (mainly HCO_3^-). A statistical analysis of quantitative source apportionment for the chemical investigated elements was performed. The chemical parameters were interpreted with Principal Component Analysis (PCA). Pearson correlation coefficient matrix was used to determine the linear dependence between the analyzed parameters. Schoeller diagram achieved with the RockWare AqQA program is presented for analyzed ions (SO_4^{2-}, HCO_3^-, Cl^-, Ca^{2+}, Mg^{2+}) behaviour interpretation.

Acknowledgments: This work was supported by the Romanian-JINR project 64/2019, Assessment of air and soil quality using biomonitoring, neutron activation analysis and related analytical techniques (Research theme: 03-4-1128-2017/2019).

S1.12. Microbiological Quality and Contamination Level of Danube River Water in Ostrov-Isaccea Sector, South-Eastern Part of Romania

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Microbiological contamination, from many different sources, is a worldwide problem from the global water quality. Nowadays, the aquatic environments are dramatically affected as a result of the anthropic development and also based of the life explosion on all categories (human, animals, vegetables and microorganisms). Extensive human activities (industrialization and agriculture) have led to increased pollution and hydromorphological changes in many river basins. The actions in changing the water flow regime contribute to the modification of the morphology of the rivers and also to the increase of the pollution level. All these factors have led to multiple pressures on freshwater ecosystems, undermining biodiversity and ecological functioning. Microbiological contamination due to faeces pollution by anthropogenic sources is considered to be a crucial problem in the entire Danube river basin. Thus, detailed knowledge of the magnitude and

origin of microbial pollution is essential for managing the water quality in river basins. In this study, the rate of the microbiological contamination of the Danube River water from the BSB27 MONITOX project target sites from SE part of Romania was evaluated by counting the heterotrophic bacteria and the total coliforms. Water samples were collected from Danube River from 15 different sites in the sector Ostrov-Isaccea, which were tested for various microbial populations by incubating diluted water samples on medium specific for the growth of coliform bacteria and mesophilic aerobic bacteria. The total number of coliform bacteria and total mesophilic aerobic bacteria as main bacteriological indicators for the bacteriological quality of water were determined. The determinations of total mesophilic aerobic bacteria were carried out in pour plate using plate count agar followed by incubation at 37°C for 48 h, method provided by the Romanian Standard STAS 3001-91. Coliforms at 37°C were determined through the most probable number (MPN), with three sets of three tubes according to STAS ISO 4831-92.The total number of mesophillic aerobic bacteria ranged from 1.55×10^2 to 6.08×10^3 CFU/mLin the water samples.The coliform bacteria have been identified in all water samples and their numbers varied between 600 and 250 000 CFU/100 mL. According to Romanian legislation, Order no. 161 issued on 16 February 2006 by the Ministry of Environment and Water and published in the Official Gazette no 511 in June 13th, 2006, with the exception of Galati site and the confluence with Prut tributary, the Danube water samples collected from all sampling points were characterized by a high number of coliforms bacteria. The water quality could be classified as moderate to critical contamination, which demonstrates that the human impact on this category of contamination is highly significant.

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S1.13. Monitoring of Emerging Pollutants from Aquatic Ecosystems – Antibiotics, Endocrine Disruptors and Contraceptives

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Nowadays, there is a pressing need to consolidate the scientific knowledge and to adopt the most suitable approaches to monitor the emerging pollutants in different water sources and wastewater and, at the same time, to assess the environmental risks and their action on the human health, as well as to prevent and control their disposal into the water sources and the environment. The emerging pollutants are represented in a broad sense by any synthetic or naturally-occurring chemical or any microorganism that is not commonly monitored in the environment with potentially known or suspected adverse ecological and human health effects. Among the main emerging pollutants that are incriminated for the adverse reactions are the pharmaceutical compounds and personal care products. Among these pharmaceuticals, antibiotics such as amoxicillin, cefuroxime, ciprofloxacin etc. are recognized as an emerging environmental contaminants class since these compounds have been massively administrated in humans and animals and usually persist in the environment through a complex vicious cycle of transformation and bioaccumulation. Another two classes of emerging pollutants are considered to be the endocrine disruptors and contraceptives which are compounds that may mimic or interfere with the function of hormones in the body. These substances may turn on, shut off, or modify signals that hormones carry, which may affect the normal functions of tissues and organs.

With a focus on pharmaceuticals, a set of programs was initiated in the EU Member States in order to reduce the risks to human health and on the environment, including comprehensive monitoring programs.

The Report of the Joint Danube Survey released in 2015, presented the contamination with pharmaceutical residues in water samples collected in August – September 2013 from 68 sites along the Danube River and the main tributaries. Other recent studies suggested a certain degree of contamination with pharmaceuticals in the Danube river basin, confirming the need for

monitoring programs and future studies. However, according to the Directive 2013/39/EU amending Directive 2000/60/EC concerning the priority substances in thefield of water policy three compounds, diclofenac, 17 alpha ethinylestradiol, and 17 beta-estradiol were nominated in the first watch list (available from September 2014) to be studied within the EU-wide water monitoring framework.

In the light of the new regulations and the concerns regarding the presence of pharmaceuticals in the water environment, the MONITOX project application form (May 31st, 2017) included as project goal the detection of selected compounds, such as antibiotics, anti-inflammatory, endocrine disruptors and contraceptives, in aquatic natural ecosystems located in the region of the Black Sea basin, Danube River and Danube Delta. The experimental design mainly consists in a solid-phase extraction (SPE) for the compound extraction and concentration followed by a high resolution mass spectrometry (HRMS) analysis using the Q-Exactive Orbitrapin both full scan (FS) and targeted ion fragmentation (tMS(2)) modes. The high resolution power of 70,000 (FWHM) of the Orbitrap technology enables the achievement of a high sensitivity and selectivity in the detection of compounds traces. A MS-MS confirmatory analysis for residues according to regulations (Decision 657/2000 and SANCO/12571/2013) is carried out with the same instrument. We expect that the results of the study will be considered for new implementation strategy in order to reduce the contamination due to pharmaceuticals.

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S1.14. Application of Inductively Coupled Plasma Mass Spectrometry (ICP-MS) in the Field of Environmental Protection

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Inductively coupled plasma mass spectrometry (ICP-MS) an important and versatile tool for elemental quantification, has been developed over the years and provides applications in many fields of activities, one of the most popular applications being environmental science. ICP-MS is an analytical technique for the determination of elements using mass spectrometry of ions generated by inductively coupled plasma.

Due to the new legislation requirements of more and more sensitive methods regarding priority hazardous substances or the newly emerging contaminants in the environment, this method evolved and became the most element-specific detection technique. It has been widely used for environmental-oriented applications, as trace elements determination in a variety of samples matrices, with good precision and high sensitivity.

As a technique capable to quantify up to 75 different elements, it is therefore absolutely critical to use calibration standards that have been specifically made for a multielement technique such as ICP-MS.

This paper offers some elements regarding theoretical and practical analytical aspects of this technique capable of detecting trace element at very low level, in diverse matrices.

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S1.15. Spatial Distribution of Phytoplankton in Razim Lake

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Phytoplankton represents the first link in food chain, being responsible for nutrients assimilation and oxigen production through photosynthesis process. The fact that phytoplankton is sensitive to very small variations in ecological parameters, it is necessary that their analysis to be made in the shortest time possible. Taking into consideration the above mentioned, *in situ* measurements are the most recomended alternative to eliminate errors in prelevation, preservation and processing of samples. With an area of 394.30 km^2, Razim lake is the largest lake in Romania. The lake is included in Ramsar convention regarding wetlands from 1991. The maximum depth measured in the date of sampling was 280 cm.

The measurements of the chlorophyll concentrations were made near the bank, in order to find if the nearby land influences the water quality. Taxonomic groups differentiation can be made on the basis of relative fluorescence intensities, following sequential light excitation. In case of aquatic ecosystems, fishing and turism represent the most important anthropic presures and the main causes of ecological degradation. A total of 19 sampling points was set for measurements in Razim Lake, in October 2018. At the same time, the parameters like temperature, depth and transparency were measured.

In Razim lake, phytoplankton recorded variation in concentrations between 3.12 µg/L (very good ecological status) and 60.9 µg/L (moderate ecological status).

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S1.16. Percentage Distribution of Nitrogen Forms in Aquatic Complex Somova-Parches in 2018

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As one of the key nutrients occurring in aquatic ecosystems, nitrogen supports along with phosphorus, carbon and silica the primary production by higher plants and algae.

This paper presents the percentage distribution of both the oxidized and reduced inorganic N species (NO_2^-, NO_3^-, NH_4^+) and organic N fraction from Somova-Parches, an aquatic complex situated in Danube Delta Biosphere Reserve, Romania in the proximity of Tulcea town. The surface water samples were collected in 2018, in spring, summer and autumn seasons, according to European Standards. Analytical determinations of nitrogen forms were performed in the accredited chemistry laboratory of Danube Delta National Institute, using spectroscopic methods.

Our results showed that the concentrations of organic nitrogen frequently exceed in all periods that of inorganic nitrogen, including ammonium, nitrite and nitrate. This observation suggests that organic nitrogen components play an active role in the biological/ ecological processes of this aquatic ecosystem.

The percentage distribution of the nitrogen forms in the studied lakes from Somova-Parches complex ranged between 63% and 74% in the spring season, 89% and 96% in the summer season and between 95% and 97% in the autumn season. Inorganic forms of nitrogen remain relatively constant for ammonium and nitrite; in nitrogen cycle, nitrites appear as intermediates forms that depending on the environmental conditions are easy transformed into nitrates or ammonia. For nitrates a higher variation of the values, between 22% and 32 %, was observed in this aquatic complex.

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S1.17. Forensic Fingerprinting of Biomarkers for Oil Spill Characterization: The Case Study of Kavala, Greece

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After World War II, the increase of the industrial production of synthetic organic compounds, the gradually raised combustion of fossil fuels, and the rapid population growth contributed to the introduction of many permanent contaminants into the environment, such as dioxins, polychlorinated biphenyls (PCBs), phthalates, and polycyclic aromatic hydrocarbons (PAHs). In addition, several severe accidents, like Torrey Canyon (1967), and Santa Barbara Channel (1969) oil spills, led to the formation of environmental protection organizations worldwide such as EPA (1970) in US. However, most oil pollution occurs in marine environment comes from the run-off of oil and fuel from land-based sources rather than from accidental spills which only make up about 5% of oil entering the sea. Crude oil and its refined products could end up in an aqueous system with several ways. Once this is done, forensic fingerprinting of biological markers (biomarkers) plays a dominant role in characterization, correlation, differentiation, and source identification of oil spills.

In the current research, three water samples were gathered from Kavala region in Greece: two marine water samples, one from the Central Port of Kavala (PORT) and the other one from the Filippos B Port (BK) at the Eastern Kavala coast, close to the on-shore premises of the local oil-producing company. Moreover, an additional surface water sample (KO) was collected from a reserve pit inside the oil company premises, known to be contaminated by crude oil. It is worthy of remark that Kavala is the only oil-producing region in Greece. The aforementioned samples were compared with an extracted crude oil sample (CROIL) from oil company and two refined petroleum products, one marine diesel (PPR1) and one auto diesel (PPR2), as potential contaminants. The technique used to identify the oil types of the examined samples in the current study was gas chromatography – mass spectrometry (GC-MS).

There was a clear differentiation between CROIL and PPR1 and PPR2 peak distribution patterns in all three samples. The comparison between CROIL and KO samples revealed identical GC-MS distribution patterns of biomarkers in m/z 191 (terpanes), m/z 217 (steranes) and m/z 231 (triaromatic steranes). On the other hand, the comparison between CROIL and

PORT samples at 57, 191 and 231 m/z showed several important differences. Despite the fact that crude oil is a major suspected pollutant, no correlation can be identified. Nevertheless, small values of Pr/C17 and Ph/C18 ratios is a strong indication of anthropogenic pollution. In Filippos B Port (BK sample), low concentrations of hydrocarbons and PAHs, methyl-phenanthrene and dibenzothiophene, were recorded and neither triterpanes nor hopanes were detected.

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S1.18. Investigating the Quality of Nestos River System

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Sediment heavy metal pollution and water quality were examined at Nestos River and its estuary, a heavily modified ecosystem due to the construction of two hydropower dams (Thissavros and Platanovrisi). The dam operation created three systems with different characteristics: the upstream, the downstream parts and the reservoirs. Surface sediments and water samples were collected from 25 station in total (6 from the main river, 2 from reservoirs and 17 from the estuary) in order to examine the system degradation. The concentrations of five metals (Cu, Cd, Ni, Cr and Pb) were determined with the use of GFAA technique, while the FIAS technique was used for Hg determination in a Perkin-Elmer AAS-800 atomic absorption instrument. Several physicochemical parameters (temperature, conductivity, D.O., pH) were measured in situ and laboratory analysis were undertaken for the determination of six nutrients (NO_3, NO_2, NH_4, NH_3, SiO_2 and PO_4).

The heavy metal pollution assessment was achieved with the use of several indices widely used in the literature (i.e. PLI, CD, Igeo, PERI), whereas water quality was determined using the CCME-WQ index (Canadian Water Quality Guidelines). The results showed that according to CD index moderate metal pollution in sediments were determined in both reservoirs and at the coastal area and considerable ecological risk was found according to PER index

in Platanovrisi reservoir. PLI revealed zero pollution and Igeo showed minimal Pb pollution for all areas. Regarding water quality, the application of CCME-WQ index demonstrated good-excellent water quality at the upstream, downstream and estuary areas, fair quality inside the reservoirs and marginal quality at the bottom of Platanovrisi mainly due to low D.O. and high PO_4 concentrations.

S1.19. The Use of *Daphnia magna* Straus, 1820 as a Test Object in Ecotoxicological Studies

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One of the main aspects of aquatic toxicology is the determination of toxic compounds on organisms that play a significant role in aquatic communities. Cladocerans are suitable as test-objects as they are sensitive for assessing the risk of the presence of pollutants in the aquatic environment. In the methods of biotesting the cladocerans are among the most important groups studied. *D. magna* is a planktonic freshwater crustacean, commonly found in aquatic ecosystems of Moldova. Its fast maturation, reproductive rate, (with maturity reached at 6–12 days), which make them suitable objects for investigations of productivity of aquatic ecosystems, prevention of intensive phytoplankton growth as well as ecotoxicological studies. Arguments in favor of the use of crustacean *D. magna* are: high sensitivity, expressivity, ease of maintenance of laboratory cultures, the adequacy of the response to the action of pollutants. Moreover, they are important components of the natural water bodies and their reaction to the action of pollutants under laboratory conditions reflects the influence of these substances on the entire aquatic biocenosis under natural conditions. An important aspect of daphnia cultivation is the content of optimum environmental factors such as temperature, pH of the environment, oxygen content, light, and food resources.

Under laboratory conditions *D. magna* has a lifespan of approximately 50–150 days, the main form of reproduction is by parthenogenesis, but it can also alternate with sexual reproduction, which is an important mechanism for maintaining population fitness. The current investigation aimed at observing if *D. magna* collected from natural ecosystems can adapt and reproduce successfully under laboratory conditions, to be used in ecotoxicological investigations. The specimens were collected from end of December 2018

from a fish pond in Falesti. The pond was covered with ice, the fish was not active, that allowed an intense development of *D. magna and* their easy collection for laboratory experiments. The main food source used during laboratory study was *Chlorella* culture. Two times a week the water was changed, at least 1/4 of water being replaced with new water. The investigations indicated that the species can easily adapt to laboratory conditions.

Under normal conditions of light and temperature, *D. magna* was reproducing asexually, increasing rapidly their population. Under increased temperature conditions or when they were placed in the dark, the sexual reproduction occurred and dormant eggs (ephipia) were produced. Aquarium fish fed on live *D. magna* were more active in comparison to the dry food. Also a potential was observed in *D.magna* in preventing of greening of the aquarium due to intense phytoplankton development. Generally, the short term experiments demonstrated that *D.magna* could be growth successfully in the laboratory for performing short term and long term experiments.

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S1.20. Diversity of Phytoplankton and Water Quality in the Danube River during Spring 2019

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Research on phytoplankton was carried out during spring 2019, samples were collected from Danube River Saint George Branch and Sulina Branch. Sampling and analysis of phytoplankton was carried out by conventional hydrobiological methods. During spring 2019 the diversity of quantitative parameters of phytoplankton, as well as the water quality, using algae species as indicators of saprobity were assessed.

In phytoplankton compositions of the Danube River Saint George Branch were identified 15 species and in Sulina Branch-16 species. It was found that in these branches of the river Danube the phytoplankton species of the following groups predominated: *Cyanophyta, Bacillariophyta* and

Chlorophyta. The basis of the floristic diversity of Danube branches consists of species: *Oscillatoria lacustris, Oscillatoria planctonica, Synechocistys aquatilis* from green algae, *Asterionella formosa, Cyclotella kuetzingiana, Gomphonema olivaceum, Gyrosigma acuminatum,Melosira italica,Melosira granulata, Navicula cryptocephala, Nitzschia sigmoidea, Synedra acus* from diatoms algae, *Monoraphidium Komarkovae, Monoraphidium contortum* and *Scenedesmus quadricauda* from green algae.

The number of phytoplankton species in Saint George Branch did not exceed 7.16 mln. cel/l with a biomass 7.56 g/m^3 and in Sulina Branch 3.05 mln. cel/l with biomass 7.37 g/m^3. In both Danube branches was attested the preponderance of *Cyanophyta* in the forming of the number of algae species and *Bacillariophyta* algae in the formation of phytoplankton biomass.

The saprobic index values were established within 1.83 at Saint George Branch and 1.8 at Sulina Branch. The values of saprobic indices were estimated on the basis of species-indicators (19 species) from phytoplankton composition, which were in proportion of 63 % typically β-mezosaprobic. According to these indices, the water quality of Danube River St. George part in the spring time was satisfactory for the development of phytoplankton and was attributed mainly to II-III (good-moderately polluted) quality classes.

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➢ ***Section 2 - Water Quality, Human Health and Biodiversity***

S2.01. Natural Radioactivity of the Black Sea Western Shore

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The paper aim is to get more actual data concerning the natural radioactivity of the Black Sea Western Shore between the city of Sf. Gheorghe (Romania) and Resovo river (Bulgaria). In the case of terrestrial ambient dose rate distribution, measurements between Vama Veche in South and Chituc sandbank in North gave, with some notable exception, values between 34 and 54 nSv/h, lower than 90 nSv/h, which is the average value for Romania.

The experimental determined dose rates increase northward, reaching a maximum in the vicinity the Chituc sandbank, *i.e.* at the Vadu and Corbu beaches, where due to the presence of black sands with monazite and zircon, the ambient dose rate reached up to 200 mSv/h.

A total different situation was evidenced in the case tritium in sea water. In the close vicinity of Danube Delta, the tritium activity concentration in the surface water was around 28 TU, which is almost the same as that of the Danube River waters, but it decreased to about 5 TU in the bottom water. This discrepancy slowly diminished wherein at about 120 km southward, the tritium content in both surface and bottom water reached almost the same constant value of 6.5 ± 2.3 TU. This value, about two and a half times smaller than that reported 17 years ago, remained almost unchanged for the last 240 km of shore up to the Turkish border.

S2.02. Ion Beam Analysis Complementary to Instrumental Neutron Activation Analysis on *Gafrarium Tumidium* Marine Clam (IAEA-461 Reference Material)

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Analytical investigations on *Gafrarium Tumidium* clam tissue using non-destructive thick target Ion Beam Analysis (IBA) techniques at the 3 MV Tandetron™ are presented. PIXE (Particle Induced X-ray Emission), PIGE (Particle Induced Gamma-ray Emission), and RBS (Rutherford Backscattering) techniques were concomitantly applied using a 3 MeV proton beam normal to the target in vacuum. A comparison is made with analytical results previously obtained on this sample by Instrumental Neutron Activation Analysis (INAA) with neutron irradiation at the TRIGA reactor in Pitesti, Romania, as well as thin target PIXE with 3 MeV proton beam at the 9 MV FN Van de Graaff Tandem accelerator of IFIN-HH.

The sample was supplied by IAEA-MEL Laboratory, Monaco, in the frame of an inter-laboratory exercise organized for the determination of trace elements in marine biota IAEA-461, to monitor analytical capabilities of the participating laboratories and to allow them assessing the quality of provided results. Our contribution to this exercise was based on long-lived INAA, the reported elements being Ag, As, Au, Ba, Br, Ca, Cd, Ce, Co, Cr, Cs, Eu, Fe, Hf, Hg, K, La, Lu, Mo, Na, Ni, Rb, Sb, Sc, Se, Sm, Sr, Ta, Tb, Th, U, Yb, Zn (33 elements).

Thin target PIXE was used to determine P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Br, Rb, Sr, and Pb (19 elements). From them, P, S, Cl, Ti, V, Mn, Cu, and Pb are complementary to INAA. Thin targets were prepared from chemically mineralized solutions of the sample and comparator standards, with Y added as internal standard.

With reference to thick target IBA, PIGE technique was able to determine F, Mg and Al, besides Na (also obtained by INAA), Cl and P (also obtained by PIXE). Major light elements C, N, O, as well as Cl, Na, and Ca could be determined by RBS. The knowledge of sample matrix is necessary for PIGE analysis to calculate stopping power values for protons in sample and comparator standards. Thick target pellets were prepared using hydraulic press.

The results obtained by INAA and IBA on *Gafrarium Tumidium* clam (IAEA-461 Reference Material) are in agreement with the certified mass fractions assigned for As, Ca, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, V, and

Zn, as well as information values given for Al, Mg, and Sr. The elements Cu, Mn, Pb, and V could be determined by PIXE, Al and Mg by PIGE, while As, Ca, Cd, Co, Cr, Fe, Hg, Ni, Se, Sr, and Zn by long-lived INAA.

S2.03. The Characteristic of Sediments Quality of Natural Lakes in Lower Prut Region

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The aim of this study was an analysis of the sediment quality of the lake Beleu, natural reserve of Republic of Moldova in Low Prut River region. This area is under intensive anthropogenic impact from petrol mining, agriculture and transport. The sediment samples were taken from the area of petrol mining and from other territory of Beleu lake.

The analysis of POPs, PAHs substances and heavy metals in sediment samples was carried out for the evaluation of the chemical status of this water body. The analysis was made by Gas Chromatography and Atomic Absorption Spectrophotometry methods in accredited laboratory.

The total PAHs concentration in water samples was in the range from detection limit (<0.001) to 0.117 μg/L and Benzo[a]pyrene concentration was below the detection limit of 0.001 μg/L. The total PAHs value in sediment samples was in the interval 0.022 – 1.050 mg/kg.

The total POPs concentration in water samples was in the range from detection limit 0.001 to 0.053 μg/L. The total POPs concentration in sediment samples was in the interval from 0.030 to 1.448 mg/kg. About 20 % of sediment samples had a total POPs value higher than 0.10 mg/kg. The principal POPs were organochlorine pesticides in 70 % of sediment samples and PCBs for 30 % of sediment samples.

The heavy metal concentration in sediment and water samples was at the background level or below of the detection limit.

The conclusion is that the Beleu natural lake is under strong anthropogenic impact from different pollution sources including POPs polluted sites from past pesticide storages. The specific sediment monitoring is required for the more correct assessment of the status of this water body.

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S2.04. Influence of Trace Metals and Biogenic Elements on the Production Processes and Biochemical Oxygen Consumption-CBO5 (in situ and Laboratory Modelling)

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The influence of trace metals and biogenic elements on the production processes and biochemical oxygen consumption in situ (Dniester, Prut, Danube rivers and Dubasari, Costesti-Stinca and Cuciurgan reservoirs) and laboratory modelling was estimated.

For the first time, it was determined the influence of trace elements (Cu, Zn, Mn, Pb, Ni, Cd, Bi, Hg Co, Se, Mo, V) on primary phytoplankton production and destruction of organic matter processes as well as on biochemical oxygen consumption-CBO_5 (inhibition and increases of these processes).

For the first time, analysing was done on the impact of trace elements on primary phytoplankton production and destruction of organic matter processes, CBO^5. This data allowed also to asses the impact of trace elements on growth and development of fish. Supplementary to this, the research allowed to calculate the buffer capacity of aquatic ecosystems and water quality in relation to the studied metals. Therefore, a new method of evaluation of the status of aquatic ecosystems was proposed and proved theoretically. According to this methodology, three classes of water quality was estimated, according to the oligo-elements concentrations:

- optimal or favourable (clean ecosystems, oligotrophic)
- admissible (moderately polluted ecosystems, mesotrophic)
- extreme or dangerous (polluted, eutrophicated - politrophic)

The buffer capacity of the Prut River was higher than that of the Dniester River, that that could be explained by the influence from the functioning of the Dniester Hydropower Complex.

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S2.05. Dependence of Endangered Wetland Fish Species *Umbra krameri* Dniester Population from Hydropower Development

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The European mudminnow *Umbra krameri* Walbaum, 1792, is a species which was numerous three centuries ago, but its specific biology dealing with river-related wetlands became incompatible with changes, produced later by human activities (damming of rivers, irrigation and hydropower development). The species populates the only Danube and Dniester/Nistru river basins, and recent genetic research (Maric et al, 2016) has demonstrated that from 17 evaluated U.krameri populations the Lower Dniester one is most distant and specific. Thus, the contact between the Danubian and the Dniester populations took place long time ago and they are practically isolated.

Being typical to marsh lands, oxbows and swamp regions, its biology is closely linked with the specific hydrological regime of the natural rivers, which have a spring floods, covering their shallow habitats. The eggs and larvae are producing in early spring time, when water is enough cold and the great majority of fish species still not spawn, and sharing with high waters to other habitats. Because mudminnow possesses the ability to breathe with the help of a swim bladder and survive for a long time in winter time with almost no oxygen dissolved in water, it could survive in shallow frozen reservoirs along with Misgurnus fossilis and Carassius gibelio, while other species of fish die under ice. Dead fish remnants form the basis for plankton development as the Umbra larvae fodder. The need condition for such cyclic reproduction of the Umbra is the every year spring floods. The European RDB treats U.krameri as Vulnerable A2c (2010), but the Dniester population looks the most endangered.

From 1954, the hydro construction has started on the Dniester by the erection of the Dubasari HPP. Later, in 1980th, another big facility was constructed in Ukraine (Dnestrovsk Hydro Energetic Complex - DHEC), which significantly deteriorated the natural hydrologic regime by minimizing the

spring floods. The European mudminnow almost disappeared from the Dniester and some ichthyologists stated that this population is lost at all (Movchan, 1995), so U.krameri remained only in Danube River basin.

But in 2000, the small population was rediscovered near the Turunciuc branch as well as in channels in Dniester lower stream near Palanca and Maiaki villages (Trombitsky et.al., 2001). The current Umbra habitats are not numerous and fish survival fully dependent from the efficiency of the artificial spring discharges organized by the authorities, but frequently having not enough water to produce real flood. The effectiveness is more dependent from the precipitations, rather then water management decisions.

We see the way to improve the effectiveness of spring water discharges by the raising the useful volume of DHEC reservoir for water collection, which will permit to accumulate more winter and spring waters. Because the 1987 DHEC management rules were created in time, when the long-term weather forecasts were not so accurate, the current ones could compensate the shorted preparation for floods period provoking by heavy rains. In general, the existence and status of U.krameri populations could be an indicator of HPP impact, but insurance of the population survival – the duty of both riparian states.

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S2.06. Experience of Transboundary Cooperation of Sanitary Epidemiological Services of Moldova and Ukraine on Water and Health Issues of Dniester River

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In the last years a serious attention was given to the implementation of the UNECE Protocol on Water and Health, including the development of a model for the participation of the region's sanitary services in transboundary water monitoring and management. The objective of this component was to create a platform for the effective cooperation of the sanitary services of the

basin in accordance with art. 13 of the Protocol: "Where any Parties border the same transboundary waters, …, they shall cooperate and, as appropriate, assist each other to prevent, control and reduce transboundary effects of water-related disease.".

To create a good platform for effective participation, we had to combine the efforts of the sanitary and epidemiological services of the river basin to control the quality of transboundary waters and prevent waterborne diseases. This idea had a success: the model was launched, it was initiated the activity of the joint Moldovan-Ukrainian working group on sanitary-hygienic monitoring of transboundary waters. As a result, within the framework of the project, the working group developed a draft "Regulations for cooperation on sanitary and hygienic monitoring of water quality in the transboundary Moldovan-Ukrainian sections of the Dniester River basin", designed to become the official mechanism of interaction between the sanitary services of the basin. The implementation of the provisions of such Regulations in the future can provide a good opportunity to work together to improve monitoring, as well as to prevent the negative impact of water quality on human health.

A representative of a public environmental organization became the coordinator of such a working group by mutual consent of the countries. It speaks about the democratic principles of the approach to solving the set tasks.Sanitary doctors from different areas of the basin: Chisinau, Odessa region, Vinnitsa, Cernauți, and Transdniestria (Tiraspol) were involved in the work of the working group, which indicates compliance with the principles of an integrated approach to the development of common and effective documents and models of collaboration. Such a model of effective participation of sanitary-epidemiological services passed a good practice of cooperation and implementation. The draft Regulation was based on Art. 6 of the 1994 Inter-government Agreement on Use of Boundary Waters between Moldova and Ukraine. The purpose of the Regulation was to determine the main criteria for the sanitary-hygienic assessment of the quality of transboundary waters in the Dniester River Basin in order to obtain comparable measurement data on water quality indicators, the basis of which it is possible to jointly assess the quality of transboundary waters.

The elaborated cooperation model permitted to demonstrate the effectiveness of such cooperation, especially to prevent the waterborne human diseases and to determine the sources of infections.

It is important for now to include these activities in everyday inter-state water cooperation of Moldova and Ukraine in frames of the Dniester River Commission working groups and governmental agencies responsible for human health and environment.

S2.07. Comparative Aspects of Ichtyofauna of Dniester and Prut

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Following multiannual studies conducted on Dniester and Prut Rivers on ichtyofauna (within the territorial limits of the Republic of Moldova), it became possible to elucidate the comparative aspects between these two large aquatic macroecosystems. Although the basin of the Danube (of which Prut River belongs) and Dniester River are separated by the geographical barrier, their ichtyofauna has many common points. The great similarity is due to the shallow continental platform between the mouths of the Danube and the Dniester valley, which shows that, during the glacial periods, the Dniester was a tributary of the lower Paleo-Danube. Despite this, the hydrobiotopic characteristics and the special anthropogenic threats have revealed some distinctive ichtyofaunistic particularities:

• According to the diversity and the proportion of fish species with various rarity status, Dniester River has more significant values han the Prut River (Vimba vimba, Ballerus sapa, Pelecus cultratus, Leuciscus Leuciscus idus, Alburnoides bipunctatus, Barbus petenyi, Sabanejewia aurata, Sabanejewia bulgarica, Lota lota, Zingel zingel, Zingel streber, etc.), which indicates a higher anthropic pressure on these river ecosystem.

• Representatives of genus Romanogobio, Gobio, Sabanejewia, Gymnocephalus, are more common in catches in the Prut River (except the Gymnocephalus acerina missing in the river), and representatives of Cobitis sp. which hold a higher constancy in Dniester River.

• Migratory Clupeidae (Alosa immaculata, Alosa tanaica, Clupeonella cultriventris) are better represented in Dniester River (except Alosa tanaica, which migrates massively on the route: Black Sea → Danube → Lower Prut → Beleu Lake).

• Among semi-migratory species of fish, it is noted that the Pelecus cultratus is endangered in the Dniester River, while in the Prut River this species shows a positive dynamics of the herds. Rutilus frisii, in Dniester River, has formed two growing populations, while in Prut River the species is missing.

• The quantitative values of the intervenient fish species (such as Gobiidae species, Syngnathus abaster, Gasterosteus aculeatus, Pungitius

platygaster, Clupeonella cultriventris, Atherina boyeri, etc.,) in Dniester River are much higher than in the Prut River.

• The greater abundance of the oxyphilous Gymnocephalus cernua from the Stinca-Costești reservoir, including some reophilous fish species like the Barbus barbus, Vimba vimba, Squalius cephalus, Ballerus sapa, Gobio and Romanogobio species, etc., implies a more favorable ecological status compared to the Dubăsari accumulation.

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S2.08. On the Parasites Diversity of *Umbra krameri* (Esociformes) from the Lower Dniester

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The material was the data on the endemic fish *U.krameri* parasites sampled in the Lower Dniester wetlands neighboring drainages and the Danube Delta in 2000-2018. A total of 137 fish specimens (89 and 48, respectively) were fully parasitologically dissected.

In the surveyed U.krameri individuals nearly 120 species taxa of the parasites belonging to different systematic groups were revealed: 45 Ciliophora, 21 Plathelminthes, 16 Euglenozoa, 8 Sporozoea & Nemathelminthes, 7 Cnidaria, 3 Arthropoda, 2 Acanthocephales, Annelida & Mollusca, 1 Metamonada, Amoebozoa, Microsporidia, Oomycota & Chytridiomycota. Obtained data demonstrated that diversity of parasites of the Lower Dniester *U.krameri* populations is much richer and is distinguished by originality, compared with those of the Danube basin: although the *U.krameri* populations from the Dniester have a rich community of parasites, some „Dniester species" are absent or very rare; almost all identified species present a novelty for this fish-host and 12 of them were described as previously unknown; the parasite fauna of the examined *U.krameri* includes 18 host-specific species, one species common with *U.limi* and 12 species common with relative Esox lucius.

The total extensity of invasion of fishes was 100%; however, the extensity of invasion with certain species of parasites was insignificant. The maximum number of parasites species for one fish reached 18, and usually 4-8. Males are slightly more infested than females. By prevalence, species diversity and by numerical abundance in almost all the biotopes species/combinations of protists (ectobiont ciliates, blood flagellates, sporozoans) and worms (trematodes, nematodes) were dominant. Among the body parts of the sampled fishes, the gills, skin and gut had the highest parasitic load. The parasitological situation of *U. krameria* populations inhabiting the Lower Dniester is unfavorable and tense. More than a third of the founded parasites species may be considered pathogenic for the ichthyocenosis. The prevalence rate of *U. krameri* parasites is alarming, it is difficult to assume that such high values of infestation did not cause severe damage and even mortalities among fish. The carriage of many pathogenic parasites by this fish, under certain circumstances, may pose a potential threat to the survival of its unique populations of the Dniester.

The composition of the parasites community of the *U.krameri* in the lower Dniester biotopes was similar in most cases in its structure, but extensity/intensity of invasion was variable and depended on the peculiarities of the biotopes. Meanwhile, it should be noted that lower species diversity of the parasites and lower intensities of invasion of U.krameri populations in restored and newly created hydrobiotopes of the Dniester delta were discovered, comparatively with long-standing biotopes. The structural rearrangement in the parasitic fauna of the *U.krameri* from new biotopes is manifested in a decrease in the species richness due to the disappearance of typical parasites for hypertrophic biotopes. The peculiarities of the diversity and abundance of parasites in the *U.krameri* adequately reflect the ecological state of the biotopes, their hydrobiocenosis, as well as the impact of the waterthe hydrologic regime, i.d. the intensity of hydropower plants water discharges.

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S2.09. Fish Fauna from Freshwater in Danube Delta

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In Danube Delta Biosphere Reserve there were identified 137 fish species inside of *Animal Kingdom, Phyllum Chordata, Subphyllum Vertebrata*, belonging of 3 Classes (Actinopterygii bony-fish which are mostly, Petromyzontida-lampreys species accidentally in the area and Chondrichthyes-sharks species) and 20 Orders, 45 Families, representing about 75 % romanian fish fauna, clasified in:

- 128 native fish species:
    - 51 freshwater fish (including *Carassius gibelio* and *Cyprinus carpio* considered to be native to Danube delta after long debates)
    - 21 euryhalin species divided into: 12 euryhalin half-migratory or expansion species like gobiids, aterina and 9 migratory fish species: anadromous like shads, sturgeons and catadromous like eel)
    - 56 exclusively marine fish species (probably much more in number considering other 69 species are around in Black Sea basin waiting to enter in Danube Delta Biosphere Reserve limits). Some of them enter in freshwater gulfs for feeding like young mullets.
- 9 exotic non-native fish species: 8 freshwater fish species and 1 marine fish species (*Mugil soiuy*).

In the Lower Danube River (from Black Sea river mouths until to Iron Gates) are cited 77 fish species, but in Danube delta arms and connected running waters was caught 66 species. Totally freshwaters of Danube Delta Biosphere Reserve present 82 fish species including freshwater and euryhaline species (anadromous, catadromous migratory or half-migratory fish species) and sometimes in freshwaters gulfs or paramarine lakes enter some marine species. Ofcourse, some freshwater fish species can penetrate Black Sea brackishwater.

S2.10. The Gobiidae Family in Aquatic Ecosystems of the Republic of Moldova

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The investigations carried out in various aquatic ecosystems of the Republic of Moldova, during the years 2004–2019, led to the establishment of the diversity of *Gobiidae*, which lists 10 species: *Benthophilus nudus* Berg, 1898; *Knipowitschia longecaudata* (Kessler, 1877); *Mesogobius batrachocephalus* (Pallas, 1814); *Ponticola eurycephalus* (Kessler, 1874); *Neogobius fluviatilis* (Pallas, 1814); *Neogobius gymnotrachelus* (Kessler, 1857); *Neogobius kessleri* (Guenther, 1861); *Neogobius melanostomus* (Pallas, 1814); *Proterorhinus semilunaris* (Heckel, 1837) and *Gobius niger Linnaeus*, 1758. Such species as: *Caspiosoma caspium* (Kessler, 1877), *Knipowitschia cameliae* Nalbant et Otel, 1996, *Neogobius ratan* (Nordmann, 1840), *Neogobius syrman* (Nordmann, 1840), *Benthophiloides brauneri* Beling et Iljin, 1927 have not been identified by us, but are mentioned in other scientific sources (Ganea et al., 1981; Cozari et al., 2003; Romanescu, 2012; Moșu et al., 2013).

Comparative analysis of the gobiidae ichthyofauna from Dniester River and Prut River revealed a greater diversity and abundance of Gobiidae in the Dnister River than in the Prut river, 10 species versus 6 species. The relative abundances of *Gobiidae* species in the Lower Dniester sector for the year 2018 captured with juvenile catching trap are: *N. fluviatilis* (Pallas, 1814) – 4.13%, *N. kessleri* (Gunther, 1895) – 3.96%, *N. melanostomus* (Pallas, 1814) – 2.24%, *P. semilunaris* (Heckel, 1837) – 1.03%, N. gymnotrachelus (Kessler, 1857) – 0.86% and *B.nudus* Berg, 1898 – 0.17%. In the lower Prut River, in the area of outbreak in the Danube River, for the year 2018, the maximum share in catches was held by *N. kessleri* (Gunther, 1861) – 4.99% and *B. nudus* Berg, 1898 – 4.30%, which indicates the active process of expansion of these species upstream on the Prut river. Other species of gobiidae are shown in catches with the following values of dominance: *N. gymnotrachelus* (Kessler, 1857) – 3.79%, *N. fluviatilis* (Pallas, 1814) – 3.10% and *P. semilunaris* (Heckel, 1837) – 1.20%.

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S2.11. Assessment of Water Quality in Flowing Ecosystems from Danube Delta Biosphere Reserve Based on Zooplankton Community

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The aim of this study was to assess the zooplankton community in Danube branches to determine the water quality from this point of view. For this was studied 12 sampling sites: Cotul Pisicii, downstream Reni, Ceatal Chilia, downstream Izmail, Periprava, upstream Bastroe channel, downstream Bastroe channel, Ceatal Saint George, upstream Sulina, downstream Sulina, upstream Saint George, downstream Saint George for the sampling period -21 March - 2 April, 2019.

The preliminary results of the analysis of the biotic community of zooplankton determined from all 12 locations demonstrated the following aspects:

The zooplankton of the RBDD flowing ecosystems is characterized by reduced diversity, small numerical abundances and low biomasses.

During the study period various species of Rotifers, Copepods, Cladocerans were recorded, in all samples total 30 species of zooplankton were identified, 3 species of Cladocerans, 5 species of Copepods and 22 species of Rotifers.

The zooplankton community was dominated by Copepoda, which contributed about 50% to the total zooplankton density.

Overall, oligo-mesosaprobic - Keratella quadrata, Notholca squamula to beta-mesosaprobic rotifers - Polyarthra vulgaris, Pompholyx sulcata, Brachionus angularis bidens have been prevailing indicating that the water was slightly or moderate polluted.

A higher number of species and numerical abundances was recorded in downstream comparatively to upstream sector, this may be attributed to the gradual decrease of the flow rate of the water.

The researches will be continued in order to assess the seasonal variations and to estimate the role of zooplankton community as indicator of changes in water quality along DDBR, flowing ecosystems.

S2.12. Evaluation of Fish Community Important Species from ROSCI0105 Lower Prut Floodplain

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In the lower part of the Prut River, from the confluence with its tributary, the Elan river from the right side, to the confluence with the Danube river, on both sides of the Prut river, in the mirror, there are protected areas at national, european and world level. Thus, on the Romanian side was established in 2005, at the national level, the Natural Park of the Lower Prut Floodplain, with an area of 8247 ha, and at the European level it was designated in 2008 year, ROSCI 0105 Lower Prut Floodplain with an area of 5,852 and ROSPA0070 Prut-Vlădești-Frumușița Floodplain with an area of 14600 ha.These two sites overlap mostly with the Natural Park of the Lower Prut Floodplain.

On the moldavian side, from July 2018, Biosphere Reserve Prutul de Jos has been set up, with an area of almost 15,000 hectares, of which two thirds are occupied by Lake Beleu.On the basis of the expeditions on the Romanian side, carried out between August and November 2018, the presence, frequency, abundance of the 9 fish community importance species, present in the ROSCI0105 was evaluated by the structure survey method among commercial and amateur fishermen. These species are: *Aspius aspius, Misgurnus fossilis, Cobitis taenia, Pelecus cultratus, Rhodeus sericeus amarus, Zingel streber, Zingel zingel, Gobio kessleri, Gymnocephalus schraetzer.*

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S2.13. The Commercial Fishing in the Prut River

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Following the Danube, the Prut River is the only internal river where commercial fishing is approved, this activity being carried out in two distinct areas, in the accumulation lake Stânca-Costesti, between 544 km and 742 km, and in the Lower Prut River, from the confluence with the Danube and up to the confluence with the river Elan, between km 0 and km 115. Due to the two very different biotopes, there are significant differences between fishing activity and catches in the accumulation lake Stânca-Costesti and in the Lower Prut River.The fishing activity in the Stânca Costești reservoir was registered in the year 2018 by a number of 46 commercial fishermen and in the fishing activity in the lower Prut river were registered in the year 2018 a number of 63 commercial fishermen.The catches recorded in the accumulation lake Stânca-Costesti in 2018 amounted to 22,516 tons, and the ones made in the commercial fishing activity in the lower Prut river in 2018 were 15,325 tons. In the period 2012-2018, the catches recorded in the accumulation lake Stânca-Costesti range from a minimum of 16,595 tons to a maximum of 34,166 tons and in the lower Prut River from a minimum of 11.49 tons to a maximum of 18.42 tons. The structure of catches is also different because the asian ciprinids were captured in considerable quantities in the accumulation lake Stanca-Costesti.

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S2.14. Analysis of Physical-Chemical and Radiological Parameters of Surface and Groundwater from Lower Danube Region, Galati County

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Pollution of soil and air, industrial and domestic waste disposal, application of fertilizers and pesticides in agriculture influence the quality of surface waters and groundwater receivers. Together with accelerated extraction of groundwater, the significance of groundwater chemical quality also increases relative to its economic value and usefulness. The pollution of surface and groundwater could have a negative impact upon the ecosystems and population health and an attentive monitoring is imposed, especially in urban communities and industrial zones. In this paper we present a review of results of the analysis of some surface water samples from the Lower Danube-Prut rivers basin (Galati county, SE part of Romania), groundwater and wastewater, using various analytical methods. The spectrometric, electrochemical and optical determinations were carried out at INPOLDE research center of "Dunarea de Jos" University of Galati for: turbidity, nutrients, oxygen regime (dissolved oxygen, CCO-Mn, CCO-Cr, CBO_5), mineralization grade (pH, conductivity), volumetric determinations (alkalinity, chlorides) and toxicological analyses (phenols, heavy metals, beta radioactivity).

The obtained results for the concentrations of heavy metals and physical-chemical parameters in water samples were generally found within the Romanian admissible values for surface and drinking water. On-going measurements are performed regarding the quality of tap and underground water from Galati town and some localities of Galati County and the assessment of the health risk for the population in the target region due to ingestion of water.

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S2.15. The Use of DO-BOD Ccorrelation to Assess the Biochemical Potential of Water Ecosystems

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In recent centuries, people with an increasing rate create more and more of new artificial compounds (chemicals, biocides, pharmacological preparations, etc.), most of which, entering the environment, and then into water bodies, become toxicants for hydrobionts, and ultimately – through food chains – and humans. Throughout the evolution of life on Earth, micro-organisms are the main barrier to toxicants in aquatic habitats. In order for bacterioplankton to effectively perform the function of biodegradation of pollutants and toxicants, the temperature of water and oxygen regime must be favorable for the development of aquatic microflora. The main hydrochemical parameters that characterize the oxygen regime are "Dissolved oxygen" (DO) and "Biochemical oxygen demand" (BOD). The specificity of the BOD parameter is that its value is determined by the composition of aquatic microbial communities and the conditions of their habitat. In a normally functioning aquatic ecosystem, the correlation between these parameters is negative - with increasing oxygen concentration, the BOD value decreases. An empirical model of the mutual change of these parameters (DO-BOD inter-action) in the flowing water bodies was proposed by Streeter H.W. and Phelps E.B. (1925) and then modified by other researchers (Schnoor J., 1996; Lung W., 2001; Gotovtsev A., 2010).

The depth and speed of flow in this model are considered as the main factors influencing overcoming oxygen deficiency and reducing BOD.

In this study, an attempt was made to detect a trend in the correlation of DO-BOD parameters for various types of aquatic ecosystems. The values of the oxygen regime parameters are the result of the mutual influence of many factors: time of day, hydrological season, presence or absence of current, climatic conditions, ecological state, etc. To evaluate this multifactor process, a statistical analysis of the long-term data of the Laboratory of Hydrobiology and Ecotoxicology of the Institute of Zoology was carried out. For the Lower Prut, the data from Cahul, Cislita-Prut and Giurgiulesti stations (2013 – 2019) were used. For the Danube Delta, they were taken from Galati, Reni, Isaccea, Ismail, Chilia and Vilcovo stations (2013 – 2014).

The regression lines obtained for the ecosystems of the Lower Prut and the Danube Delta are distinguished by their tendency. For the Danube Delta, the correlation of DO-BOD parameters is close to the natural one – negative, but for the Lower Prut it is positive.Similar regression lines were obtained for the Cahul and Cislita-Prut stations.

Conclusion: functioning of the Lower Prut ecosystem is significantly different from natural conditions. Further data processing will determine the boundary from which the Prut River becomes a highly modified water body (HMWB).

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S2.16. Change in Climate of the Prut River Basin

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There are growing evidences that climate warming results in a drying trend. The higher temperatures and more variable precipitations significantly alter the ecologically important attributes of wetlands hydrologic regime and exacerbate impacts on their ecosystems.Very likely, the increased seasonal variability of precipitation will increase the duration of low-flow and dry-spell periods in semiarid and arid regions, leading to reduced water quantity and quality. As to climate change impacts, the latest comprehensive integrated assessments have identified wetlands as ecosystems that are most vulnerable to climate variability and extremes; accordingly, the study of observed trends in regional climate as well as projections of its future behavior is considered as a mandatory dimension in any wetland related research.

The present study aims to compare statistically the temperature-humidity conditions in the Moldavian part of the Prut River basin in two climatic periods (1991-2018 vs. 1961-1990) and to present some climatic projections for the future. For each period, the average annual and seasonal values of air temperature and precipitation, as well as their linear trends were considered. As initial information, the observations at four weather stations of Moldova, located in the Prut basin below the Costești-Stânca hydropower plant, were used.

It was shown that in 1991-2018 the annual mean (Tmean), maximal (Tmax) and minimal (Tmin) temperatures increased by 1.1, 1.2 and 1.0 °C, respectively, compared with 1961-1990. Tmean highest increase (1.7 °C) was observed in summer, the smallest – in autumn (0.5°C). Tmax also increased mostly in summer (by 1.9°C), and to a lesser extent – in autumn (by 0.3°C). The same picture was observed for Tmin: the greatest increase in summer (1.6°C), the smallest – in autumn (0.6°C). The precipitation change was extremely small: only 1 mm decrease per year: 15 mm in winter and 10 mm – in summer against 25 mm increase in autumn. The linear trends confirmed the results of the comparative analysis. Almost complete absence of a trend in annual Tmean in 1961-1990 was replaced by its sharp increase in subsequent years (~ 0.8 °C/decade).The positive trend of Tmin (~0.05 °C/decade), outlined in 1961-1990, has increased practically to 0.6 °C/decade later. Trends evolution is most pronounced for Tmax: from about 0.07 °C/decade negative to above 0.9 °C – positive. The slight negative trend of precipitation (~2 mm/year) has weakened to ~0.6 mm/year. An increase of air temperature, which was not compensated by equivalent precipitation increase, resulted in the inevitable strengthening of the climate aridity, already characteristic for the region. The process of drying is most pronounced in the April-August period.

The likely projections of future climate were based on the latest high resolution (12.5 km) data set from a multi-model ensemble of regional climate simulations, provided by the EUROCORDEX initiative for Europe. These simulations used the so-called Representative Concentration Pathways (RCPs) of greenhouse gaze emissions that assume different radiative forcings on climate system: weak (RCP2.6), moderate (RCP4.5) and strong (RCP8.5) for two time horizons (2021-2050 and 2071-2100). The results of future climate simulations showed that in the first modeling period mean annual air temperature in this part of the Prut basin can increase, depending on the level of radiating forcing, from 0.1 ºC to 1.6 ºC in comparison with 1970-2000, taken as a baseline climate in this modeling experiment. Increase of temperature in the second period will be more significant: from 0.2 ºC to 4.4 ºC. At the same time, change in precipitation will be minor and, most importantly, with a great uncertainty in the results.

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S2.17. The Potable Water Quality of Kavala, Northern Greece

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The potable water of Kavala city has been extensively studied in relation to the quality through systematic chemical-physical analysis in recent years by the Kavala Municipal Service for Water Supply and Sewage (DEYAK). Initially, a historical review was made concerning the city and how the construction of the water supply system began. Next, records were collected from previous years to the present day, for the quality of the potable water of Kavala and the surrounding villages from the website of DEYAK.

By comparing the results of analyses to the EC legislation of potable water it can be concluded that Kavala city drinking water completely satisfies the regulations.

Acknowledgement: The documentation study was performed within the project BSB 27-MONITOX.

- ***Section 3 - Environmental Technologies, Restoration and Management of Aquatic Ecosystems***

S3.01. Evaluation of Groundwater Quality through Environmetrics. The Case of Kavala Region

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In the present study two geographical areas were selected, from which potable groundwater samples were systematically collected from central water supplies in the region of Kavala, Northern Greece. The selected areas are close to the Nestos and Strymon Rivers.

During the year 2012 groundwater samples were collected and analyzed three times every four months for the following parameters: pH, electric conductivity, nitrate, chloride, sodium, potassium, total hardness, total alkalinity, bicarbonate and calcium.

The main objective of the current case study was to study the effects of the area and time period on the above parameters within the limits given by the 98/83/EC Directive.

The findings of the Linear Mixed Effects modeling revealed statistically significant main effects of both factors on the examined parameters.

Acknowledgement: The statistical approach was developed in the frame of the project BSB 27-MONITOX.

S3.02. Spatial Interaction between Marine Fisheries and Aquaculture with Other Maritime Activities and Uses

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The EU the Maritime Spatial Planning Directive (2014/89/UE) aims to reduce conflicts and increase synergies among human activities, including the reduction of pressures on marine ecosystems. Involving the political choices, having in mind the best overall welfare for society, are also a priorities. Taking these into account, the spatial and temporal relations among human uses occurred in the Romanian Black Sea case study, were done, by analyzing their distribution, investigating possible interactions among them, adding the main pressures identification, exerted on the marine ecosystem, focused on marine fisheries and aquaculture. There were evaluated possible scenarios taking into account the results produced by using new methods, DISPLACE, GRID, Cumulative impact, as well as the stakeholder consultation.

The resulted maps of spatial interactions between activities and the matrices of possible conflicts are presented. GIS data layers, based on derived information from various sources were created. A pairwise geographic-area-of-overlap matrix was realised and each activity was characterized by a set of factors. The computation of the conflict score was made based on a grid with corresponding cell size value equal to 1km. The distribution of spatial interactions among human uses was computed as the sum of scores for each 1x1 cell of a grid covering all study area.Through this analysis potential "hot-spots" between conflicting spatial uses have been identified after including representative groups of datasets in the analysis. The marine uses evaluated, demonstrate the spatial and temporal heterogeneity and the varying use intensity of activities. Key outcomes referring to potential pairwise conflicts are discussed and could be developed, taking into account the temporal ad spatial analyses of marine aquaculture and fisheries in Romania. The results obtained will support the national authorities and decisions factors for the management of marine fisheries improvement and strengthening. Also, the National Maritime Spatial Plan, in developing according to the MSP Directive terms of implementation will include the database and sectoral plans elaborated under this study.

S3.03. The Dniester River Basin Treaty as A Modern Approach to Transboundary Waters Management in post-Soviet Area

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The inter-governmental treaty between the Republic of Moldova and Ukraine "On Cooperation on Conservation and Sustainable Development of the Dniester River Basin" is a result of long-time lobbying of NGO community of two countries and of the international organizations efforts supported by the Helsinki Water Convention. More then 20 years was necessary that it will enter to force. The Eco-TIRAS as the registered river basin non-governmental association of more then 50 NGOs from Moldova and Ukraine initiated the Dniester River basin treaty and were fully involved in drafting and promotion of this bilateral agreement signed in Rome in 2012 and entered into the force in 2017. Due to large involvement of stakeholders the treaty creates unprecedented options for involvement of them to its implementation both using the River Commission and from outside as observers etc. In contrary with many similar inter-state documents the Treaty covers all main spheres of the activities and priorities like joint transboundary monitoring of the river, conservation of biodiversity, fish and other biologic resources, impact evaluation, etc. It has the following tasks: development of sustainable water use based on the principles of reasonable use and protection of water and other natural resources and ecosystems of the Dniester River basin; considerable decrease in the pollution levels of the Dniester River basin and the Black Sea, accordingly;prevention of deterioration and rehabilitation of ecosystems, and also conservation of the biodiversity in the Dniester River basin;prevention and mitigation of adverse water impacts, generated by natural and anthropogenic factors. Prevention of floods and scarcity is another target of the Treaty. The Art. 26 of the Treaty permits direct possibility to be involved as a Commission members for NGOs, academic community and the regions.

Because of hydropower overdevelopment in the plain part of the Dniester River basin, the interests of two riparian states seriously differs: when official Ukraine prefers to further develop its HPPs and construct new ones, Moldova is interesting to preserve and improve the current river environmental status, clearly understanding its role in provision of ecosystem services (water self-purification, recreation, tourism, fish resources, irrigation and potable water supply).

The created in frames of the Commission working groups realize its mission in different areas, like day-to-day monitoring, elaboration of river basin management plan, establishing of spring ecological flow releases for needs of ecosystems, prevention of floods etc.

The hydropower currently represents the main challenge for the Dniester River, producing disputes and protests on civic and academic levels. In this respect the establishing of jointly agreed indicators of hydropower impact on river ecosystems (the target of the BSB-165 "HydroEcoNex" project) represents a way to get more balanced evaluation of HPP impact.

Until present the Commission activities have been supported by the Dniester GEF Middle Size project, managing by OSCE, but its further sustainability is under the question, taking into consideration both the financial situation of two states and the weak priority of environmental issues for them. The Commission needs the secreatiat at least from two persons, which have no other tasks to be fully involved in this main activity.

Acknowledgement: Current work was realized in the frame of the Joint Operational Black Sea Programme 2014-2020, Project BSB165 „HydroEcoNex", with the financial assistance of the European Union.

S3.04. WaSec – Innovative Educational Tools for the Sustainable Management of Semi-Aquatic Ecosystems to Promote Water Security in the Eastern Mediterranean

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Water is the most valuable and rare resource in the Middle East. The potential climate change impacts in the region require a new generation of water managers to learn and utilize new and innovative methods and techniques to achieve water sustainability. A key to provide adequate water supplies in the region is the sustainable management of semi-aquatic ecosystems such as wetlands, riparian areas and deltas.

These ecosystems provide many services to humans, particularly in semi-arid and arid regions. Some of the services are directly connected to water supply and water quality. Through the WaSec project the awareness of the importance of these ecosystems for water security in the Eastern Mediterranean will be promoted. In addition, it will develop material that will train science-based water management graduates with the necessary tools on the proper management of these ecosystems.

This will be accomplished by three main activities: a) a Neighborhood Network, b) Educational Courses and c) Dissemination activities. Overall, the WaSec project is very collaborative, interdisciplinary and international since 13 partners, comprised of universities, public organizations and private companies, are involved that originate from 6 countries (Cyprus, Greece, Jordan, Netherlands, Palestine and Spain).

A Network with water professionals (universities, public organizations, companies and enterprises) will be established for the Middle East. This network will provide feedback on the new state of the art courses that will be developed and taught in Jordan and Palestine to enhance the knowledge, tools and skills of the graduates and increase their attractiveness to enterprises.

The courses developed will incorporate the latest and newest technologies on water management. Some of these courses will focus on the sustainable management of wetlands, riparian areas and deltas. The courses will utilize new pedagogical approaches with interactive exercises, use of videos, social networks, flexible learning path, blended courses etc. to enhance learning capacities. An active involvement of enterprises in the courses is a priority by having students to solve real-life water case studies provided by them, through seminars taught by water professionals and practical placement to promote entrepreneurship.

Finally, many dissemination activities will take place, such as training and tester workshops, awareness events and a conference to promote awareness of the importance and sustainable management of wetlands, riparian areas and deltas for sustainable water management.

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S3.05. Environmental Platform as an Approach to Solve the Transboundary Dniester River Management Issues and Promote Sustainable Decisions

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Efficient implementation of environmental policies is impossible without their understanding and support by local public authorities and communities. But the frozen conflict, which is created on Dniester River in the beginning of 1990th, creates obstacles for any cooperation in public benefit spheres. In such conditions the confidence building is becoming the

single way to solve jointly the common challenges appearing in humanitarian spheres (health, environment, education, science etc.).

Understanding the importance of stakeholders' involvement in promotion of interests of the transboundary Dniester River, the group of Moldavian and Ukrainian NGOs in 1999 established the transboundary association with headquarters in Chisinau, Moldova – Eco-Tiras. Initially this registered in Moldova umbrella united eleven eco-NGOs from Moldova and Ukraine, but for now – 50+. From the beginning it became clear that without representation in association of Transdniester region (TR) the main umbrella task – the integrated river basin management could not be applied. But there was no any eco-NGO in this region in that time. The Eco-Tiras started to promote the civil society values in this specific region. In 2001 the first five eco-NGOs were registered, and later – the other 15. In 2003-2015 the everyday work on strengthening of eco-NGO sector in TR was supported by the American National Endowment for Democracy. In the result the eco-NGO community in TR became well prepared for the local problems solution.

In 2016-2018, Eco-TIRAS supported by the UNDP Moldova, established the multilateral Environmental Platform of cooperation between local actors from Moldova and TR to identify and start the solution of environmental challenges along the Dniester. The joint community of mayors, NGOs, teachers, youth leaders, businesses, universities (about 100 in total) was created during two years. The community jointly determined the priorities for the cooperation:

- Land use and sustainable agriculture. Restoration of pastures and meadows, coastal belts - the transfer of the experience of Moldova to similar structures of TR
- Sustainability in agricultural production - continuing the convergence of agricultural innovations, production and technology (research institutes, universities, farmers)
- Eco-Network and Natural protected areas of Moldova and TR
- Environmental protection - small rivers, forestation.
- Water resources, Dniester management and land use efficiency in the Dniester river basin
- Establishing and management of Lower Dniester National Park on two banks
- Drinking water quality, sanitary conditions improvement. Sewage
- Energy efficiency, alternative energy sources, legislation in this area
- Utilization of pesticides, toxic chemicals in order to prevent contamination of soil and groundwater. Trainings on the collection and disposal of garbage in villages, explanatory work, best practices from the villages of the two banks.

Involvement of the Platform to activities of MD-TR working group on environment and the Dniester River Commission and its working groups activities.

S3.06. Assessing and Restoring Urban Riparian Areas to Improve the Quality of Life of Urban Dwellers

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Riparian areas are unique disturbance-driven ecosystems that have played an essential role for human welfare and development for thousands of years. They can provide many ecosystem services, especially for urban dwellers, such as decreased water pollution, recreation and relaxation areas and opportunities to escape from their daily routine. The impending climate change impacts to the hydrologic cycle that will include more intense precipitation events that will lead to more and higher magnitude floods and longer drought periods will further exacerbate the pressures that these ecosystems face, especially in urban settings. Through this project the current conditions of the riparian areas of Drama were assessed. This was done through visual assessment protocols, specifically the Stream Visual Assessment Protocol (SVAP) and the Riparian Forest Quality (QBR). Through the field measurements of the protocols, for the reaches along three streams that run through the city of Drama, the vegetation and stream channel conditions were assessed. Overall, the urban riparian areas that were visually assesed, have strong alterations and have poor quality. Additionally, stream water quality (water samples for different pollutants) and quantity (discharge) measurements on the three streams were taken to provide more insight on the stream channel and riparian conditions. Preliminary results indicate that the urban riparian areas are fragmented, face urban

encroachment with many human infrastructures that have modified the stream channel and degraded the riparian vegetation and the presence of garbage is very frequent found. More effective management with nature-based restoration practices are required in order to maintain and/or improve the quality of riparian areas to be able to provide their ecosystem services to its urban dwellers. Additionally, the awareness of the importance and best use of riparian areas for citizens needs to be reinforced and promoted. Overall similar assessments, plans and practices should be adopted in other Greek cities for the enhancement and protection of urban riparian areas.

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S3.07. Radon and Thoron Activity Concentrations in Selected Indoor Environments in Lower Danube and Danube Delta Region, Romania

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The paper presents a review of results obtained in the period 2014-2019 during complex studies performed in the frame of international projects by team of Dunarea de Jos University of Galati, regarding the investigation of indoor radon (222-Rn) and thoron (220-Th) concentrations and their temporal variations in selected dwellings and public spaces in Lower Danube and Danube Delta region (Galati and Tulcea counties – Galati, Sendreni, Sulina localities), SE Romania.

For the measurements, RTM1688-2 and Thoron Scout calibrated instruments of SARAD type have been used. The data were processed with the aid of SARAD Radon Vision 6.3.4 software. A disscussion is made on the factors influencing the variability of radon/thoron levels, such as: type of building, construction material, location, geological features, ventilation of the space, existence of basement, floor level, measuring time, etc. For some locations,

the ambient gamma-ray dose rate and immediate beta radioactivity of aerosols was also recorded.

The obtained values are compared with the world average value reported by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and other results published for Romania and other countries.

The data collection was based on strong collaboration of research team with volunteers (inhabitants and students from master and doctoral programs), which participated at various training programs and courses, improving their knowledge, awareness and attitudes towards the ionizing radiation exposure and the radioactivity and indoor radon impact on human health.

It is known the fact that the exposure of human beings to ionizing radiation from external and internal natural sources, is 2.4 mSv y^{-1} and from this 1.2 mSv y^{-1} is due to indoor radon.

The obtained results show that the radon concentration in several houses, built from slag bricks or adobe, exceeds the legislated limit for the average annual reference level (300 Bq m^{-3} set by Romanian legislation, Law no. 63/2018).

Utilization of the active detectors is very advantageous by offering a graphic with the hourly variations of radon/thoron concentration in air over a long period, based on which there could be identified the intervals in which the supplementary aeration of spaces would be necessary**.** Further research is focused on radon and thoron levels in soils and water from targeted areas of BSB27 MONITOX project.

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S3.08. PIXE Analysis of Elemental Content in River and Underground Water

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Proton-Induced X-ray Emission (PIXE) technique has been employed to determine elemental concentrations in surface water samples collected from some rivers and streams in zones affected by human activities, as well as underground water samples (well and tap water) from different localities in Romania. The sampling points were located both in areas with various industrial and agricultural activities and in control zones.

PIXE analyses have been carried out using a 3 MeV proton beam, generated by the 9 MV FN Van de Graaff Tandem accelerator at Horia Hulubei National Institute of Physics and Nuclear Engineering in Magurele (near Bucharest). The target was placed in vacuum in the center of the irradiation chamber at 45^0 angle with respect to the incident beam and X-ray detector (Si(Li) Ortec, FWHM of 180 eV at 5.9 keV). The proton beam current on the target was ~0.5 nA. As targets, volumes of 200-250 µL were pipetted on Mylar foil (2.5 µ thickness), dried at room temperature, then fixed on special aluminum frames (2x3 cm^2). Yttrium (Y) internal standard was used as proton beam flux monitor. GUPIX (Guelph PIXE) program was employed for spectra processing (thin targets). Certified Reference Materials (CRMs), prepared in a similar way with the investigated samples, were considered for quantitative analysis: CRM-TMDW (drinking water); CRM-OT (oyster tissue); IAEA-V10 (hay); IAEA-393 (algae); IAEA MA-B-3/TM (fish homogenate).

PIXE technique allowed the determination of the concentrations of elements Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, As, Br, Rb, Sr, Hg and Pb in water samples. The obtained results were compared with literature data, Romanian admissible levels of chemical elements in surface water, and WHO concentration limits for potable water.

For some water samples, the results obtained by PIXE were compared with those obtained by complementary analytical techniques, such as neutron activation analysis or atomic absorption spectrometry.

S3.09. The Application of GIS Technology for Environmental Risk Assessment from Toxic Substances

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POPs polluted site at pesticide storages is an important issue for Republic of Moldova. The aim of this study is a review of Environmental Risk Assessment (ERA) methodologies on regional (ranking system) and local level (conceptual model) for individual sites. Three principal factors were taken into consideration: level and pollution spectrum, risk receptors,and distribution potential. The pollution spectrum was complex and consists of five groups of POPs and other toxic substances (trifluraline, triazines, PAHs, heavy metals). Risk receptors include two factors: distance of risk receptors to polluted site; importance and vulnerability of every receptor. Risk index for distribution potential included particularities of site for the distribution of toxic substances to the environment and several ways of dispersing pollution in the environment: wind dispersion; infiltration to groundwater; surface runoff; and anthropogenic factor. The calculation of risk value on the regional level included balance between all factors using GIS approach. Several sites with different conditions were investigated for ERA procedure in Lower Danube Area. ERA on local level included a formulation of "conceptual model" of the pollution fate to risk receptors.

This procedure has following key steps: 1 – hazard identification; 2 – consequences identification in the case when the hazard occurred; 3 - estimating the magnitude of the consequences (spatial and temporary); 4 - estimation of the consequence probability or the exposure assessment; 5 – the evaluation of risk importance (risk characteristic or assessment). The risk management is proposed for the realization by several modes: the reduction or modification of pollution sources; managing or elimination of migration pathways; receptor modification. The polluted site remediation project should to be developed individually to take into consideration a polluted area, volume of contaminated soil, geological conditions, and pollution spectrum.

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S3.10. Fragmentation and Flow Regulation of the Prut River Systems

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The aim of this work was to present the results of fragmentation the Prut River's ecosystems within Moldova as the first step in valuation of the ecological impacts of Costești-Stânca dam and hydropower plant (HPP) operation. The environmental consequences of dams are numerous and varied, including the direct and indirect impacts on biological, chemical and physical properties of riverine and riparian ("stream-side") ecosystems. In our case, the riparian ecosystem are understood as a stream channel between the low- and high-water marks plus the terrestrial landscape above the high-water mark where vegetation may be influenced by elevated water tables or extreme flooding as well as by soil water capacity. Riparian areas are particularly sensitive to variation in the hydrological cycle and thus serve as a good indicator of any change in the environment caused by dam and hydropower plant operation. Moreover, riparian processes have a central ecological role in most landscapes, while the riparian ecosystems offer habitats for many species, serve as filters between land and water, and pathways for the dispersing and migrating organisms; they also provide with many economic and recreational values.

The degree of HPPs and dams influence on the ecosystems depends mainly on three stimuli:

- Change in the hydrological regime and the state of inundated riverbed complexes downstream the dams;
- Transformation of aquatic ecosystems above dams;
- Fragmentation of a river basin due to blocking by dam the flow of energy, matter, nutrients and biological objects species and populations.

Identification of areas, which provide water-related ecosystem services in the Prut River basin, proceeded from the principles of the European Water Framework Directive. In accordance with this document, Moldova is located within two ecoregions: Pontic Province (12) and Eastern Plains (16). The Prut's riparian ecosystems are located at altitudes below 200 m. The Prut basin dominant geology is siliceous; in the northern part the calcareous rocks predominate. On the whole, in the Prut floodplain six elements were

identified, which include both individual reaches and other water bodies. From these elements, the four are located below the Costești-Stânca dam.

The territory under study includes the following ecosystems (more than 730 plots): water (12.8%), forest (17.6%), grassland (50.9%), wetlands (11.6%), perennial plantations (0.5%), and built-up areas (6.6%).Within this territory there is Ramsar site "Lower Prut Lakes". A large part of this site is included in the Lower Prut biosphere reserve. The presence of natural floodplain lakes with area of up to 850 hectares is a principal characteristic of the Lower Prut basin.

For the selected elements (sub-basins), the fragmentation coefficients were calculated as a ratio of their areas to their perimeter. The fragmentation results reflected a high mosaic structure and degree of ecosystem diversity.

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S3.11. Visualizing the Chemical Parameters in Surface Water of the Danube River. Case Study: Danube River Km 175 – Km 67

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The aim of this study is to illustrate the parameters determined at certain stages according to the project milestones by using GIS procedures in order to visualize the monitored chemical parameters of the Danube River between the Black Sea coast and Km 175 on the Danube River. This study will only focus on a small segment of the Danube River which is Km 175 in the upstream of Braila city and nautical mile 67 downstream from Reni city for the following chemical parameters: chlorophyll, total phosphorus, orthophosphate phosphorus (P -PO4), ammonium nitrogen (N-NH4), nitrite nitrogen (N-NO2), nitrate nitrogen (N-NO3), organic nitrogen and total nitrogen. By choosing the right color shader in order to be easily understood, the visual representation of the water quality can improve the population, authorities and stakeholder's perception. GIS nowadays is a very efficient tool in supporting the decision-making process. The authorities often rely on this tool and on the experts that develop map products of any kind in order to understand the scientific terms and language through a visualizing environment.

Acknowledgement: The study was performed in the frame of the project BSB 27-MONITOX.

S3.12. Detecting Riverbank Changes with Remote Sensing Tools. Case study: Aggitis River in Greece

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Fluvio geomorphologic processes such as bank erosion and deposition affect and change the shape and condition of river and stream channels. Erosion and deposition rates are dependent on many natural (e.g. climate, geology, vegetation, topography) and anthropogenic (e.g. dams, bridges, gabions, straightening, wildfires etc.) factors. Alterations to these factors disrupt the river/stream dynamic equilibrium and they respond by altering their shape, formation or even location. These changes might be slow or rapid but can cause serious problems to infrastructures and loss of human lives.

For the more effective and sustainable management of rivers or streamσ and in general watersheds, new innovative methods are needed to monitor and understand these fluviogeomorphologic processes. Remote sensing tools can be utilized to monitor, predict and measure such changes in rivers and streams. Free satellite images and ortho-maps generated by airplanes have been used worldwide to map geomorphologic changes through time. Ortho-images captured by drone flights are more effective because they provide more details because of the higher spatial resolution they provide compared to satellite or airplane images. The use of drone images can be low cost, thus provide an effective way to map riverbank changes in targeted reaches that face erosional or depositional problems.

This study used remote sensing tools to identify river banks changes by combining free satellite, aerial and low flight drone images. The study areas were reaches along Aggitis River in northern Greece. Firstly, free satellite and Google Earth images were utilized to map the entire watershed and find at a large scale the potential changes at riverbanks. Secondly, drone flights were

executed to acquire high resolution images at the specific locations. Through these images, it was determined more accurately if accelerated bank erosion or deposition were occurring. Overall, these remote sensing tools proved to be a quick and low-cost methodology that allows identifying and measuring stream bank changes over many years but also over short periods of time (e.g. after a flood event). In addition, the methodology enables us to locate the areas with the greatest potential of erosion and deposition where nature-based solution should be implemented to stabilize stream banks, reduce erosion or deposition rates and mitigate nonpoint source pollutants.

S3.13. Capabilities of FT-IR Spectroscopy for the Investigation of Microplastics in Environmental Samples and Personal Care and Cosmetic Products

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In recent decades, microplastics (MPs) have been recognised as an emerging issue in river and ocean systems. They are particles smaller than 5 millimeters in diameter, made of conventional plastics e.g. polyethylene (PE), polypropylene (PP), polyester (PS), polyamide (PA), polyvinylchloride (PVC) or polyethylene terephthalate (PET).

Plastics have been produced on large scale since the 1960s and are now ubiquitous in numerous consumer and industry sectors. They are even present in common food and beverages because of the huge amounts of plastic products used in modern life. Due to their small size and irregular shapes, MPs can enter organisms throughout the food web, including humans, via ingestion, thus posing a potential threat to human health.

Microplastics can be classified as primary and secondary microplastics. Primary microplastics are polymeric particles manufactured for particular applications, such as personal care and cosmetic products, industrial pellets, clothes fibres, air blasting and medical vectors. Secondary microplastics result from the breakdown of larger plastics, for example the breakdown of *in situ* litter.

Studies have highlighted evidence of accumulation of toxic chemicals such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDTs), organo-halogenated pesticides and nonylphenols on microplastics. Moreover, most MPs are not

retained by wastewater treatment processes, ending up in the receiving waters.

In this paper Fourier Transform Infrared (FTIR) spectroscopy has been evaluated for its suitability for microplastics analysis in selected environmental (water, sediment) and experimental samples prepared from common used products (synthetic textiles, cosmetics, personal care products – toothpastes, facial cleansers, shower gels, sun screens, etc.).

Attenuated Total Reflectance - Fourier transform infrared (ATR-FTIR) spectroscopytechnique was employed for the identification and classification of different polymers (PE, PP, PS, PA, PVC, PET) at INPOLDE interdisciplinary research network, Dunarea de Jos University of Galati, Romania, using a Bruker Tensor 27 FTIR spectrometer coupled with a diamond ATR device.

The technique has the advantage of being non-invasive and applicable directly on the filter holding the extracted particles. We evaluated several materials for compatibility with microplastic suspensions containing different polymers widely found in microplastic surveys worldwide.

The experiment promises the monitoring of drinking waters and surface waters for microplastics. Further studies will be carried out by coupling FTIR spectroscopy with Raman spectroscopy.

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S3.14. Reuse of Treated Municipal Wastewater Effluents for Irrigation in Protected Areas: The Case of Nestos Delta Region

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The Nestos Delta is one of the most important wetland in Greece as well as in Europe due to its extent and diverse habitats. It is included in the Wetlands List of International Importance under the Ramsar Convention, belongs to the Natura 2000 Network as well as to the Special Protection Areas of the Birds of the European Union. It is also part of the Eastern Macedonia and Thrace National Park. Intensive agriculture is one of the greatest threats for this important ecosystem.

The municipal wastewater reuse for crop irrigation grown in the protected area, appears to be an environmentally acceptable solution for alleviating the natural water shortage, since it could save significant amounts of irrigation water as well as it could reduce the adverse effects of the treated effluents discharge into the aquatic ecosystem.

This study describes the plan of reusing the treated wastewater effluent, produced by Waste water Processing Plant of Chrysoupolis Municipality in this ecologically sensitive area, on the basis of climatic factors, and crop irrigation water requirements, grown in the area. Thus, the mean daily and monthly rate of reference evapotranspiration was calculated employing the Penman–Monteith equation according to FAO-56., and the net water requirements for each crop were assessed for the whole irrigation period.

The volume of the effluents produced by the wastewater treatment plant of Chrysoupolis could cover 5.0% of the irrigation water requirements.

S3.15. Quantitative and Semi-quantitative Analysis using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

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Inductively coupled plasma mass spectrometry (ICP-MS) is an optical technique currently used in elemental analysis in many diverse research fields such as life, environmental, earth, forensic sciences and in food, chemical, material and nuclear industries. The technique has many advantages over other techniques such as the Flame-AAS, GF-AAS, and ICP-AES. The main advantages compared to the other techniques are higher analytical speed, higher sensitivity, lower limits, multi-element, trace analysis and analysis of rare-earth elements. The different types of analysis are quantitative, semi-quantitative, isotope ratio and isotope dilution. Quantitative analysis (Full Quant Analysis) gives the exact quantitative results of the element under investigation with all the necessary statistical data to ensure the quality and accuracy of the analysis. Semi-quantitative analysis gives the concentration of all the elements of the periodic table that a sample contains with

approximate concentrations of each element ±30% in just a few minutes. It provides a fingerprint of the elements present in a sample.

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S3.16. Intensive Agricultural Practices and Industrial Activities Influence on Soil Fertility of Agroecosystems from Prut and Siret Lowlands, SE Romania

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When we talk about soil fertility we refer to its ability to sustain a crop by making available to the plants the nutrient reserves acquired during pedogenesis and due to the application of natural and organic fertilizers. Preserving and increasing soil fertility as well, in the context of a worldwide high demand for food, raise problems for agronomists and researchers, who have the responsibility of obtaining good quality agricultural products, and keeping in balance the functional parameters of the pedosphere. Among the agricultural soils, those formed on the alluvial deposits show a great quality variability generated by the vertical variation of the pedophreatic level, the degree of mineralization of the waters, the mineralogical and chemical composition of the materials they were formed. By association, their fertility varies, being related to the pedological and environmental factors in a certain area, including the geographical position towards an industrial enterprise, and also to the specific agricultural methods applied at a given time.

This study assesses the level of agricultural soils fertility in Prut River (Tulucesti commune, Galati County) and Siret river (Vadeni commune, Braila County) meadow area. The main physical-chemical parameters investigated are the following: macroelements (N, P, K, Ca), microelements (Zn, Co, Cd, Cr, Ni), the organic matter content, soil reaction state. Mineralogical composition and soil granulometry were also determined. To assess the fertility status, samples were taken from the first 30 cm layer of the soil.

High-Resolution Continuum Source Atomic Absorption Spectrometry (HR-CS AAS) technique and Attenuated Total Reflectance - Fourier Transform Infrared Spectroscopy (ATR-FTIR) method were performed at INPOLDE research center, "Dunarea de Jos" University of Galati to determine the concentration of microelements and soil mineralogy.

The other determinations were made within The County Office for Soil Survey of Galati by physical-chemical methods approved by national and international organizations. The results show a slightly-moderately alkaline reaction, higher than the optimum of the main agricultural crops. At the same time, there is an imbalance in the supply of macro- and micro-elements, which could have a negative impact on agricultural production. All investigated samples have a coarse texture, and the mineralogical analysis indicates the presence of clay minerals (montmorillonite, kaolinite) and non-clay minerals (calcite, quartz). In these conditions, soil fertility of the studied areas is satisfactory, which requires a better management of the soil.

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S3.17. A Bibliographic Survey of the Existence of Radon in the Greek Territory

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We inhabit a planet which receives a variety of radiation. Recent research shows the interest of the human being to know the levels of radiation emitted due to radon, a chemical inert gas. The purpose of this assignment is to become more familiar with the origins of radon and how its negative influence on the environment could be reduced. This paper will present validated studies conducted by various scientific groups on the levels of findings of radon in different parts of Greece.

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