THE ANNUAL SCIENTIFIC REPORT

PROJECT code eMS 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"

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INTRODUCTION

0.1. Pollution of Environment in the Project Target Area in Black Sea Basin: Problematics, Types of Pollutants, Types of Investigations

The annual scientific report was jointly elaborated by partners and presents the main methodology used for investigations, historical data collected so far by the project members and preliminary results of the interdisciplinary studies performed in the first year of implementation of BSB27-MONITOX project on a large range of classes of toxic pollutants in the target area in the Black Sea Basin (including NE part of Greece) (Fig. 0.1), as well as the assessment of toxicants' impact upon human health using a risk calculator.

The full-text of the annual scientific report (152 pages) was uploaded in eMS system of Black Sea Programme 2014-2020 and **its content is protected under intellectual property rights** until parts of it are published by the authors of the partner teams.

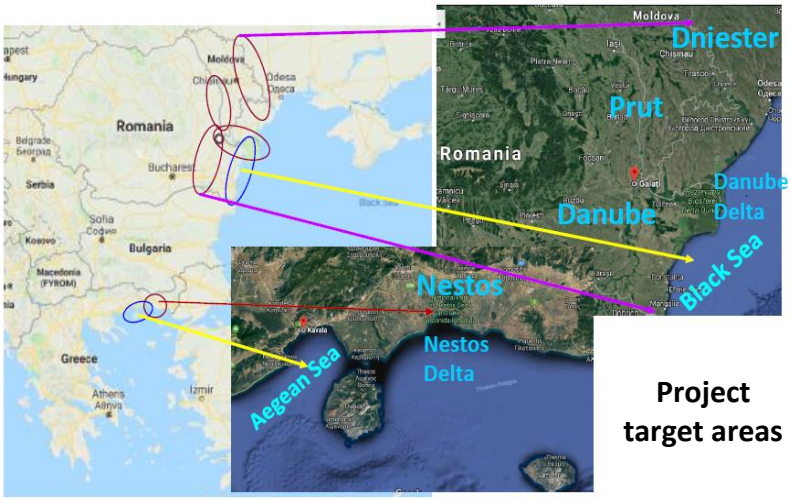

Fig. 0.1 Project target areas, monitoring and sampling sites

The results obtained by the *INPOLDE* international network created in the frame of MIS ETC 1676 Project, Joint Operational Programme Romania-Ukraine-Republic of Moldova 2007-2013, concerning the monitoring of the ecological state of the border areas in Danube River and Danube Delta were the basis of the state of the art for BSB27 project (Ene et al., 2015a). Maps of biodiversity and pollution of water, sediments, soils and biota with heavy metals, trace metals, nutrients and persistent organic pollutants (OCPs, total and individual PCBs and PAHs) were built using ArcGIS software (Ene et al., 2015b).

The **common challenges in the** Black Sea Basin target **region were jointly identified** through analysing:

- ✓ JOP BSB 2014-2020 documents, European legislation and EU Directives for environmental quality assessment;
- ✓ **international conventions** regarding the **toxic chemicals** and **wastes** (*Minamata* Convention on Mercury, Stockholm Convention on Persistent Organic Pollutants, *Basel* Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, *Rotterdam* Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade);
- ✓ Danube and Black Sea Conventions; Convention on the Protection of the Black Sea Against Pollution;
- ✓ Convention Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (*Aarhus*); Convention on Environmental Impact Assessment in a transboundary context (*Espoo*); Convention on Wetlands of international importance (*Ramsar*);
- ✓ Convention on protection and use of transboundary water courses and international lakes (*Helsinki*);
- ✓ WHO and UNSCEAR regulations;
- ✓ recent scientific literature;
- ✓ own (partner) experience gained in the frame of the previous implemented projects.

The main threat is the immense devastation perpetrated by human activities against the natural environment which raises imperative concern for our collective survival.

In May 2019 governments have amended the *Basel Convention* to include *plastic waste* in a legally-binding framework which will make global trade in plastic waste more transparent & better regulated.

Our pledge is: "Through collective action, environmental protection can be achieved"

MONITOX Project context: Pollution has NO borders / does not stop at national borders!

The in-depth study of processes occurring in large, interconnected river basins and evaluation of people exposure to toxics (TOXs) 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 (Ene, 2019; Ene et al., 2019).

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 (Ene et al., 2019).

The target substances, environmental compartments and complex investigations are listed below (Ene et al., 2019)**:**

- **6 classes of TOXs jointly *monitored* and *studied for human health impact* (health/cancer risk calculator)**
  - **1. metals and trace/rare elements,**
  - **2. nutrients** (nitrogen and phosphorus groups) and **ions**,
  - **3. persistent organic pollutants - POPs (**organochlorinated pesticides **OCPs,** polychlorinated biphenyls **PCBs),**
  - **4. polycyclic aromatic hydrocarbons (**16 carcinogenic **PAHs** and their total content **TPAHs),**
  - **5. pharmaceutical products (antibiotics, anti-inflammatory, anticonceptives)** and **endocrine disruptors,**
  - **6. radioisotopes** (natural series, artificial radioisotopes; **radon, thoron),**
- **7 interconnected environmental components (soil, surface water, groundwater, bedrock, sediments, vegetation, fauna)**
- **8 types of complex investigations (geomorphological, geological/mineralogical, hydrogeological, physical, chemical, biological, microbiological, ecotoxicological).**

The BSB27 project 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,
- understanding of complex processes which take place during TOXs migration and accumulation in food chains,

and

- understanding the influence of toxicants and hazardous wastes on ecological state and human health.

Bibliography

Ene A., Elena Zubcov, Oleg Bogdevich, Yuriy Denga (Eds.), 2015a, Abstract Book, International Conference "Environmental Challenges in Lower Danube Euroregion", Galati, June 25-26, 2015.; Ed. Casa Cartii de Stiinta, Cluj-Napoca, Romania.

Ene A., Yuriy Denga, Richard Lisovskyi, Tatiana Gavrilova, Oleg Bogdevich, Elena Zubcov, 2015b, Atlas of Maps (Eds. - Ene, A., Denga Yu., Bogdevich O., Zubcov E.), Ed. Tehnopress, Iasi, 2015, 40 p.

Ene A., 2019, Clase de substanțe toxice investigate în cadrul proiectului MONITOX. Izotopi radioactivi și nivelul dozelor de radiații nucleare în regiunea Dunării de Jos și Bazinului Mării Negre / Classes of toxic substances investigated in the frame of MONITOX project. Radioactive isotopes and level of nuclear radiation doses in Lower Danube region and Black Sea Basin, Regional Workshop „Environmental Pollution of Aquatic Ecosystems of Danube-Black Sea Basin", Chisinau, Institute of Zoology, 16-17 May 2019.

Ene A., Elena Zubcov, Thomas Spanos, Oleg Bogdevich, Liliana Teodorof, 2019, "Interdisciplinary Cooperation for Ecological Monitoring in the Black Sea Basin", Invited Lecture, S1.01, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D,, 2019, ISBN 978-606-8896-00-7, pp.17-18.

CHAPTER 1.
Classes of Toxic Pollutants (TOXs) Monitored in Different Environmental Compartments of the Project Target Regions. State of the Art, Methodology, Results

PART A

1.A.1. Heavy metals and trace elements in surface water – analytical techniques and literature review

Bibliography

Anghel A. M., Diacu E., Ilie M., Petrescu A., Ghita G., Marinescu F., & Deak G., 2016, Statistical analysis of heavy metals concentration in water and sediments in the lower part of the Danube River–Romanian section. Rev Chim (Bucharest), 67(11), 2151.

Baltas H., Kiris E., & Sirin M., 2017, Determination of radioactivity levels and heavy metal concentrations in seawater, sediment and anchovy (Engraulis encrasicolus) from the Black Sea in Rize, Turkey. Marine Pollution Bulletin, 116(1-2), 528-533.

Baltas H., Sirin M., Dalgic G., Bayrak E. Y., & Akdeniz A., 2017, Assessment of metal concentrations (Cu, Zn, and Pb) in seawater, sediment and biota samples in the coastal area of Eastern Black Sea, Turkey. Marine Pollution Bulletin, 122(1-2), 475-482.

Coatu V., Damir N., Oros A., Boicenco L., & Lazar L., 2018, Revised methodology of Black Sea chemical status under water framework directive. Journal of Environmental Protection and Ecology, 19(2), 601-608.

EEA, 2018, European waters - Assessment of status and pressures, EEA Report-No 7/2018, ISSN 1977-8449.

EEA, 2019, National emissions reported to the Convention on Long-range Transboundary Air Pollution (LRTAP Convention).

Ene A., Pantelica A., 2011, Tehnici analitice atomice și nucleare utilizate în monitorizarea mediului, Galati University Press, 100 pp., ISBN 978-606-8348-17-9.

Ene A., Pantelica A., Marius Gugiu, Catalin Ionut Calinescu, Daniela Fluerasu, Elemental contents in Danube River water in Galati region determined by PIXE, 12th International Balkan Workshop on Applied Physics (12 IBWAP), July 06-08, 2011, Constanta, Romania, oral presentation (OP2, S3), Abstract Book p.92.

Ene, A., Zubcov, E., Bogdevich, O., Denga, Yu., Organization and conducting of ecological monitoring of the Lower Danube, International Conference "Environmental Challenges in Lower Danube Euroregion", Galati, 25-26 iunie, 2015a, Invited Lecture IL1, Abstract Book, Ed. Casa Cărții de Știință, Cluj, ISBN 978-606-17-0745-4, p.7.

Ene A.,Yuriy Denga, Oleg Bogdevich, Elena Zubcov, Environmental Sampling and Analysis - Methodological Guide (Editors – Denga Y., Bogdevich O.), Project MIS ETC 1676 – Joint Operational Programme Romania-Ukraine-Republic of Moldova 2007-2013, Odessa, Ukraine, 2015b, 116 pp.

Ene A., O. Bogdevich, G.Bahrim, D.I. Moraru, C. Ungureanu, 2015c, Evaluarea poluarii mediului in Euroregiunea Dunarea de Jos- (Brochure-guide, Ed. Antoaneta Ene), 40 p.

Ene A., Elena Zubcov, Oleg Bogdevich, Yuriy Denga (Eds.), 2015d, Abstract Book, International Conference "Environmental Challenges in Lower Danube Euroregion", Galati, June 25-26, 2015.; Ed. Casa Cartii de Stiinta, Cluj-Napoca, Romania.

Ene A., Yuriy Denga, Richard Lisovskyi, Tatiana Gavrilova, Oleg Bogdevich, Elena Zubcov, 2015e, Atlas of Maps (Eds. - Ene, A., Denga Yu., Bogdevich O., Zubcov E.), Ed. Tehnopress, Iasi, 2015, ISBN 978-606-687-235-5, 40 p.

Ene A., Ana Pantelica, Elena Zubcov, Oleg Bogdevich, Yuriy Denga, Dan Gabriel Ghita, Using Ion beam Analysis as a Complement of XRF, AAS and ICP-OES in Environmental Studies, *Invited Lecture I.L.4.1*, Scientific Conference of Doctoral Schools from University Dunarea de Jos of Galati, Fourth Edition, Galati, 2-3 June 2016, Section IV. Advanced investigation methods in environment and biohealth, Book of Abstracts, pg.24-25.

Ene A., Elena Zubcov, Oleg Bogdevich, Thomas Spanos, Ana Pantelica, Claudia Stihi, Marina V. Frontasyeva, Yuriy Denga, Liliana Teodorof, Adrian Burada, 2017, Advanced Analytical Spectroscopic Techniques for Trace

Elemental Analysis of Environmental and Biological Samples, PP.4.5, Scientific Conference of Doctoral Schools from University Dunarea de Jos of Galati, Fifth Edition, Galati, 8-9 June 2017, Book of Abstracts, pp.130-131.

Ene A., Moraru D.I., Methodological aspects concerning the application of HR-CS-GF-AAS technique for the investigation of trace metals in Danube River water, Galati region, UGAL International Conference Multidisciplinary HUB for the Higher Education Internationalization by Means of Innovative Interaction with the Labour Market and Society, Section 6. Advanced Research in Environmental Science and Engineering, October 26-27, 2018, Galati.

Faciu M. E., Lazar I., Ifrim I., Ureche C., & Lazar G., 2014, Exploratory spatial data analysis of heavy metals concentration in two sampling sites on Siret River. Environmental Engineering and Management Journal, 13(9), 2179-2186.

Gati G., Pop C., Brudașcă F., Gurzău A. E., & Spînu M., 2013, Assessment of the heavy metal contamination in the Danube Delta from the bioaccumulation perspective. Global Journal of Human Social Science, 13, 11-16.; ***, Romanian Normative framework No.161 from 16.02.2006 regarding the rating of the water surfaces for setting the ecological status of water bodies, Monitorul Oficial No. 511/2006.

Gâștescu P., Știucă R., 2008, Delta Dunării Rezervația Biosferei. Edit. CD PRESS, 400 p. ISBN 978-973-1760-98-9.

Gorur K.F., Keser R., Akcay N., Dizman S., (2012), Radioactivity and heavy metal concentrations of some commercial fish species consumed in the Black Sea region of Turkey, Chemosphere, Vol. 87, p. 356-361.

Ilie M., Marinescu F., Ghita G., Deak G. Y., Tanase G. S., & Raischi M., 2014, Assessment of heavy metal in water and sediments of the Danube River. Journal of Environmental Protection and Ecology, 15(3), 825-833.

ISO 15587-1, Water quality — Digestion for the determination of elements in water — Part 1: Aqua regia digestion.

ISO 15587-2, Water quality — Digestion for the determination of elements in water — Part 2: Nitric acid digestion.

Iticescu C., Lucian Georgescu, Gabriel Murariu, Violeta Pintilie, Antoaneta Ene, Manuela Sidoroff, The assessment of Danube water quality in the Galati area, Romania, through water quality index (WQI), 2018, 8th International Conference on Environment and BioScience (ICEBS 2018), Seoul, South Korea, October 10-12, 2018, Poster S2013, p.43. http://www.icebs.org

Iticescu C., Georgescu L. P., Murariu G., Topa C., Timofti M., Pintilie V., & Arseni M., 2019, Lower Danube Water Quality Quantified through WQI and Multivariate Analysis. Water, 11(6), 1305.

Ivanović J., Janjić J., Baltić M., Milanov R., Bošković M., Marković R. V., & Glamočlija N., 2016, Metal concentrations in water, sediment and three fish species from the Danube River, Serbia: a cause for environmental concern. Environmental Science and Pollution Research, 23(17), 17105-17112.

Liška I., Wagner F., Sengl M., Deutsch K., & Slobodník J. (2015). Joint Danube Survey 3-A Comprehensive Analysis of Danube Water Quality. Final Scientific Report, International Commission for the Protection of the Danube River, Vienna, Austria, 335.

Lopes A.S. and Arruda M.A.Z., 2009, Determination of tin and lead in sediment slurries by graphite furnace atomic absorption spectrometry, Microchim Acta, 164, 445-451.

Milanov Đ. R., Krstić P. M., Marković V. R., Jovanović A. D., Baltić M. B., Ivanović S. J., & Baltić Ž. M., 2016, Analysis of heavy metals concentration in tissues of three different fish species included in human diet from Danube River. Acta veterinaria, 66(1), 89-102.

Oros A., Lazăr L., Coatu V., & Ţigănuş D. (2016). Recent data from pollution monitoring and assessment of the romanian Black Sea ecosystem, within implementation of the european marine strategy framework directive. International Multidisciplinary Scientific GeoConference: SGEM: Surveying Geology & mining Ecology Management, 2, 821-828.

Pantelica A., Ene A., Georgescu I.I., 2012, Instrumental neutron activation analysis of some fish species from Danube River in Romania, Microchemical Journal, 103, 142-147, doi:10.1016/j.microc.2012.02.005.

Pantelica A., Ene A., PIXE Analysis of Elemental Content in River and Underground Water, S3.08, Abstract book MONITOX International Symposium “Deltas and Wetlands”, September 15th-17th, 2019, Tulcea, Romania, p.72.

Radu V. M., Diacu E., Moncea M. A., Dumitru F. D., Panait A. M., & Ionescu P., 2017, Numerical Modelling of Pollutant Dispersion in the Lower Danube River. Revista de Chimie, 68(11), 2477-2481.

Schropp S. J., & Windom H. L., 1988, A guide to the interpretation of metal concentrations in estuarine sediments coastal zone management section. Florida: Florida Department of Environmental Regulation.

Ustun Odabaşı, S., Şentürk İ., Maryam B., Akbal F., Bakan G., & Büyükgüngör H. (2018). Temporal variation of mercury in Turkish Black Sea waters and associated risk assessment, Global NEST Journal, Vol X, No X, pp XX-XX.

Vignati D. A., Secrieru D., Bogatova Y. I., Dominik J., Céréghino R., Berlinsky N. A., & Stanica, A. (2013). Trace element contamination in the arms of the Danube Delta (Romania/Ukraine): Current state of knowledge and future needs. Journal of environmental management, 125, 169-178.

Zubcov E., Zubcov N., Ene A., Biletchi L., 2012, Assessment of copper and zinc levels in fish from freshwater ecosystems of Moldova, Environmental Science and Pollution Research, 19(6), 2238-2247, ISSN: 0944-1344 (Print) 1614-7499 (Online) , doi: 10.1007/s11356-011-0728-5.

1.A.2. Inorganic (heavy metals, trace elements), persistent organic pollutants and emerging pollutants in Lower Danube River and Prut River basin - soils and sediments

1.A.3. Analysis of groundwater and hydrogeological influence

Bibliography

Anghel A.M., Diacu E., Ilie M., Petrescu A., Gheta G., Marinescu F., Deak G., Statistical Analysis of Heavy Metals Concentration in Water and Sediments in the Lower Part of the Danube River - Romanian Section, Rev. Chem., vol. 67, nr.11, (2016), 2151-2155.

Bogdevich O., Ene, A., Chapter 4 – Gas chromatography technique in environmental analyses, in: Instrumental Techniques for Environmental Investigations: Methodological Guide = Tehnici Instrumentale pentru Investigații de Mediu: Ghid Metodologic (Editor - Ene, A.), Ed. Tehnopress, Iasi, 2015, ISBN 978-606-687-233-1, pp. 89-112.

Bogdevich O., Antoaneta Ene, Oleg Cadocinicov, Culighin Elena, 2013, The analysis of PAHs and POPs pollution sources in Low Danube region, 22nd International Symposium „Ecology & Safety", Bulgaria, Sunny Beach, June 7-11, 2013, Journal of International Scientific Publications: Ecology&Safety, Volume 7, Part 2, pp. 233-243. ISSN 1313-2563.

Burada A., Topa C.M., Georgescu P.L., Teodorof L., Nastase C., Seceleanu-Odor D., Iticescu C., Heavy metals environment accumultions in Somova-Parches aquatic complex from the Danube Delta area, Rev. Chem, vol. 66, nr.1, (2015), 48-54.

Chitescu, C.L., Kaklamanos, G., Nicolau, A., Stolker, M., 2015. High sensitive multiresidue analysis of pharmaceuticals and antifungals in surfacewater using U-HPLC-Q-Exactive Orbitrap HRMS. Application to the Danube river basin on the Romanian territory. Science of the Total Environment,532, 501–511. http://dx.doi.org/10.1016/j.scitotenv.2015.06.010.

David I.G., Matache M.L., Tudorache A., Chisamera G., Rozylowicz L., Radu G.L., Food chain biomagnification of heavy metals in samples from the lower Prut floodplain Natural park, Environmental Engineering and Management Journal, (2012), Vol.11, No. 1, p. 69-73.

Despina C., Liliana Teodorof, Adrian Burada, Daniela Seceleanu-Odor, Mihaela Tiganus, Iuliana-Mihaela Tudor, Orhan Ibram, Cosmin Spiridon, Aurel Nastase, George Tiganov, Antoaneta Ene, Danube Delta Biosphere Reserve - ten years of toxic substances monitoring, Annals Dunarea de Jos Univ. Galati, Fasc, II. Mathematics, Physics, Theoretical Mechanics, year IX (XL), No. 1, 2017, p. 55-60.

Ene, A., Bosneaga A., Georgescu L., 2010, Determination of heavy metals in soils using XRF technique, Rom. Journ. Phys., 55 (7-8), 815-820.

Ene A., Bogdevich O., Sion A., Spanos T., 2012a, Determination of polycyclic aromatic hydrocarbons by gas chromatography-mass spectrometry in soils from Southeastern Romania, Microchemical Journal, 100, 36-41, issn 0026-265X , doi:10.1016/j.microc.2011.08.006.

Ene A., Bogdevich O., Sion A., 2012b, Levels of organochlorine pesticides (OCPs) and polycyclic aromatic hydrocarbons (PAHs) in topsoils from SE Romania, Science of the Total Environment, 439, 76–86, ISSN: 0048-9697, DOI: 10.1016/j.scitotenv.2012.09.004.

Ene, A., 2015, Chapter 3- X-ray fluorescence technique, in: Instrumental Techniques for Environmental Investigations: Methodological Guide = Tehnici Instrumentale pentru Investigații de Mediu: Ghid Metodologic (Editor - Ene, A.), Ed. Tehnopress, Iasi, 2015, ISBN 978-606-687-233-1, pp. 61-88.

Ene A., Pantelica A., 2011, Tehnici analitice atomice și nucleare utilizate în monitorizarea mediului, Galati University Press, 100 pp., ISBN 978-606-8348-17-9.

Ene, A., Zubcov, E., Bogdevich, O., Denga, Yu., Organization and conducting of ecological monitoring of the Lower Danube, International Conference "Environmental Challenges in Lower Danube Euroregion", Galati, 25-26 iunie, 2015a, Invited Lecture IL1, Abstract Book, Ed. Casa Cărții de Știință, Cluj, ISBN 978-606-17-0745-4, p.7.

Ene A.,Yuriy Denga, Oleg Bogdevich, Elena Zubcov, Environmental Sampling and Analysis - Methodological Guide (Editors – Denga Y., Bogdevich O.), Project MIS ETC 1676 – Joint Operational Programme Romania-Ukraine-Republic of Moldova 2007-2013, Odessa, Ukraine, 2015b, 116 pp.

Ene A., O. Bogdevich, G.Bahrim, D.I. Moraru, C. Ungureanu, 2015c, Evaluarea poluarii mediului in Euroregiunea Dunarea de Jos (Brochure guide, Editor Antoaneta Ene), Project MIS ETC 1676, 40 p.

Ene A., Elena Zubcov, Oleg Bogdevich, Yuriy Denga (Eds.), 2015d, Abstract Book, International Conference "Environmental Challenges in Lower Danube Euroregion", Galati, June 25-26, 2015.; Ed. Casa Cartii de Stiinta, Cluj-Napoca, Romania.

Ene A., Yuriy Denga, Richard Lisovskyi, Tatiana Gavrilova, Oleg Bogdevich, Elena Zubcov, 2015e, Atlas of Maps (Eds. - Ene, A., Denga Yu., Bogdevich O., Zubcov E.), Ed. Tehnopress, Iasi, 2015, ISBN 978-606-687-235-5, 40 p.

Ene A., Ana Pantelica, Elena Zubcov, Oleg Bogdevich, Yuriy Denga, Dan Gabriel Ghita, Using Ion beam Analysis as a Complement of XRF, AAS and ICP-OES in Environmental Studies, *Invited Lecture I.L.4.1*, Scientific Conference of Doctoral Schools from University Dunarea de Jos of Galati, Fourth Edition, Galati, 2-3 June 2016, Section IV. Advanced investigation methods in environment and biohealth, Book of Abstracts, pg.24-25.

Ene A., Elena Zubcov, Oleg Bogdevich, Thomas Spanos, Ana Pantelica, Claudia Stihi, Marina V. Frontasyeva, Yuriy Denga, Liliana Teodorof, Adrian Burada, 2017, Advanced Analytical Spectroscopic Techniques for Trace Elemental Analysis of Environmental and Biological Samples, PP.4.5, Scientific Conference of Doctoral Schools from University Dunarea de Jos of Galati, Fifth Edition, Galati, 8-9 June 2017, Book of Abstracts, pp.130-131.

Gati G., Pop C., Brudasca F., Gurzau A.E., Spinu M., The ecological risk of heavy metals in sediments from the Danube Delta, Ecotoxicology, vol 25, (2016), 688-696.

Ionescu P., Radu V.M., Diacu E., Sediments as indicators of heavy metals contamination in the Lower Danube River, Rev. Chem., vol. 66, nr. 11, (2015), 1725-1727.

Lozba-Stirbuleac R.S., Giurma-Handley C.R., Giurma I., Water quality characterization of the Prut River, Environmental Engineering and Manangement Journal, vol. 10, nr. 3, (2011), 411-419.

Milenkovic N., Damjanovic M., Ristic M., Study of Heavy Metal Pollution in Sediments from the Iron Gate (Danube River), Serbia and Montenegro, Polish Journal of Environmental Studies, Vol. 14, Nr. 6 (2005), p. 781-787.

Pantelica A., Freitas M.C., Ene, A., Steinnes, E., 2013, Soil pollution with toxic trace elements in selected Romanian sites studied by instrumental neutron activation analysis, Radiochimica Acta, 101, 45-50, DOI: 10.1524/ract.2013.1989.

Pantelica A., Ene A., PIXE Analysis of Elemental Content in River and Underground Water, S3.08, Abstract book MONITOX International Symposium "Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, p.72.

Papadatu C.P., Bordei M., Romanescu G., Sandu I., Researches on heavy metals determination from water and soil in Galati County, Romania, Rev. Chim., 67, 9, (2016), p. 1728-1733.

Pintilie, V., Ene, A., Georgescu, L.P., Moraru, L., Iticescu, C., 2016, Measurements of gross alpha and beta activity in drinking water from Galati region, Romania, Romanian Reports in Physics 68 (3), 1208–1220.

Popa P., Murariu G., Timofti M., Georgescu L., Iticescu C., 2015, Multivariate statistical analyses of water quality of Danube river at Galati, ROMANIA, Environmental engineering and management journal, DOI: 10.30638/eemj.2018.124.

Postolachi L., Rusu V., Maftuleac A., Lupascu T., Mitina T., Assessment Of Heavy Metals Content In Bottom Sediments And Their Interstitial Water Of The River Prut (Moldova), aerapa.conference.ubbcluj.ro/2012/pdf/18 Postolachi.pdf.

Radovic T., Lauševic M., Determination of pharmaceuticals and pesticides in river sediments and corresponding surface and ground water in the Danube River and tributaries in Serbia, Environmental Monitoring and Assessment, 187, (2015), p. 4092.

Savio D. , Sinclair L. , Ijaz U. Z. , Parajka J. , Reischer G.H., Stadler P., Blaschke A.P., Blöschl G., Mach R.L., Kirschner A.K.T., Farnleitner A.H., Eiler A., Bacterial diversity along a 2600 km river continuum, Environmental Microbiology (2015) doi:10.1111/1462-2920.12886.

Spanos, Thomas, Antoaneta Ene, Christina Xatzixristou, Agelos Papaioannou, 2015a, Assessment of Groundwater Quality and Hydrogeological Profile of Kavala Area, Northern Greece, Romanian Journal of Physics 60 (7-8), 1139-1150.

Spanos, T., Ene, A., Simeonova, P., 2015b, Chemometric expertise of the quality of groundwater sources for domestic use, Journal of Environmental Science and Health Part A-Toxic/Hazardous Substances & Environmental Engineering, 50(11), 1099 – 1107, DOI:10.1080/10934529.2015.1047646.

Teodosiu C., Cojocariu C., Musteret C.P., Dascalescu I.G., Caraene I., Assessment of human and natural impacts over water quality in the Prut River Basin, Romania, Environmental Integrated Management and Policy Making, vol. 8, nr. 6, (2009), 1439-1450.

Vigiak O., Malagó A., Bouraoui F., Vanmaercke M., Obreja F., Poesen J., Habersack H., Fehér J., Grošelj S., Modelling sediment fluxes in the Danube River Basin with SWAT, Science of The Total Environment, Vol. 599–600, (2017), p. 992-1012.

Winkels H.J., Kroonenberg S.B., Lychagin M., Marin G., Rusakov G.V., Kasimov N.S., Geochronology of priority pollutants in sedimentation zones of the Volga and Danube delta in comparison with the Rhine delta, Applied Geochemistry, Vol. 13, No. 5, (1998), p. 581-591, DOI: 10.1016/S0883-2927(98)00002-X.

1.A.4. Emerging contaminants (pharmaceuticals, personal care products, phenols)

1.A.4.1. General considerations

1.A.4.2. Emerging contaminants (pharmaceuticals, endocrine disruptors). EU regulation and legislation

- ***Antibiotics – State of art***
- ***Antibiotics – Ecotoxicological effects***
- ***Contraceptives – State of art***
- ***Contraceptives – Ecotoxicological effects***
- ***Endocrine disruptors – State of art***
- ***Endocrine disruptors – Ecotoxicological effects***

1.A.4.3. Methodology for the detection and identification of pharmaceutical compounds

- ***Sampling***
- ***Sample clean-up and concentration***
- ***Detection and identification of the targeted pharmaceutical compounds through Ultra High Performance Liquid Chromatography coupled with Mass Spectrometry***
- ***The detection and identification of pharmaceutical compounds in the aquatic environment***

Bibliography

Adeel, M., Song, X., Wang, Y., Francis, D., Yang, Y. 2017. Environmental impact of estrogens on human, animal and plant life: A critical review. Environment International, 99, 107–119. DOI:10.1016/j.envint.2016.12.010.

Albero, B., Sánchez-Brunete, C., García-Valcárcel, A.I., et al., 2015. Ultrasound-assisted extraction of emerging contaminants from environmental samples. TrAC Trends Anal. Chem. 71, 110–118. http://dx.doi.org/10.1016/j.trac.2015.03.015.

Arditsoglou, A., Voutsa, D., 2012. Occurrence and partitioning of endocrine-disrupting compounds in the marine environment of Thermaikos Gulf, Northern Aegean Sea, Greece. Marine Pollution Bulletin, 64, 2443–2452. http://dx.doi.org/10.1016/j.marpolbul.2012.07.048.

Bănăduc, D., Rey, S., Trichkova, T., Lenhardt, M., Curtean-Bănăduc, C., 2016. The Lower Danube River–Danube Delta–North West Black Sea: A pivotal area of major interest for the past, present and future of its fish fauna — A short review. Science of the Total Environment, 545–546, 137–151. http://dx.doi.org/10.1016/j.scitotenv.2015.12.058.

Bellenger, J.P., Cabana, H., 2014. Emerging contaminants: a scientific challenge without borders. Sci. Total Environ. 487, 747. http://dx.doi.org/10.1016/j.scitotenv.2014.05.031.

Bilal, M., Adeel, M., Rasheed, T., Zhaa, Y., Hafiz M.N., Iqbal, H.M.N., 2019. Emerging contaminants of high concern and their enzyme-assisted biodegradation – A review, Environment International 124, 336–353. https://doi.org/10.1016/j.envint.2019.01.011.

Bilal, M., Rasheed, T., Iqbal, H.M., Yan, Y., 2018b. Peroxidases-assisted removal of environmentally-related hazardous pollutants with reference to the reaction mechanisms of industrial dyes. Sci. Total Environ. 644, 1–13, DOI: 10.1016/j.scitotenv.2018.06.274.

Bilal, M., Rasheed, T., Sosa-Hernández, J., Raza, A., Nabeel, F., Iqbal, H., 2018a. Biosorption: an interplay between marine algae and potentially toxic elements—a review. Mar. Drugs 16 (2), 65. DOI:10.3390/md16020065.

Borova, B.V., Maragou, N.C., Gago-Ferrero, P., Pistos, C.,Thomaidis, N.S., 2014. Highly sensitive determination of 68 psychoactive pharmaceuticals, illicit drugs, and related human metabolites in wastewater by liquid chromatography–tandem mass spectrometry. Anal Bioanal Chem, 406, 4273–4285. DOI 10.1007/s00216-014-7819-3.

Carvalho, I.T., Santos, L., 2016. Antibiotics in the aquatic environments: A review of the European scenario. Environment International, 94, 736–757.

Catteau, L., Zhu, L., Van Bambeke, F., Quetin-Leclercq, J., 2018. Natural and hemi-synthetic pentacyclic triterpenes as antimicrobials and resistance modifying agents against *Staphylococcus aureus*: a review. Phytochem. Rev. 1–35. DOI:10.1007/s11101-018-9564-2.

Centers for Epidemiology and Animal Health (U.S.). The Use of Growth-Promoting Implants in U.S. Feedlots; U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, Centers for Epidemiology and Animal Health: Fort Collins, CO, USA, 2013.

Chitescu, C.L., Kaklamanos, G., Nicolau, A., Stolker, M., 2015. High sensitive multiresidue analysis of pharmaceuticals and antifungals in surfacewater using U-HPLC-Q-Exactive Orbitrap HRMS. Application to the Danube river basin on the Romanian territory. Science of the Total Environment ,532, 501–511. http://dx.doi.org/10.1016/j.scitotenv.2015.06.010.

Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy. O.J. L 226/1. DOI: 10.1016/j.envint.2013.12.007.

Ebert, I., Bachmann, J., Kühnen, U., et al., 2011. Toxicity of the fluoroquinolone antibiotics enrofloxacin and ciprofloxacin to photoautotrophic aquatic organisms. Environ. Toxicol. Chem. 30, 2786–2792. http://dx.doi.org/10.1002/etc.678.

EC, 2000. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. Off J. Eur. Parliam. L 327, 1–82.

EC, 2001. Decision No 2455/2001/EC of the European Parliament and of the Council of 20 November 2001 establishing the list of priority substances in the field of water policy and amending Directive 2000/60/EC. Off J. Eur. Commun. L 331, 1–5.

EC, 2003a. Regulation (EC) No. 1831/2003 of the European Parliament and of the Council of 22 September 2003 on additives for use in animal nutrition. Off. J. Eur. Union L268, 29–42.

EC, 2003b. Council and parliament prohibit antibiotics as growth promoters: Commissioner Byrne welcomes adoption of Regulation on feed additives. (http://europa.eu/rapid/press-release_IP-03-1058_en.htm?locale=en. Accessed on 16 March 2019).

EC, 2006. Directive 2006/118/EC of the European parliament and of the council on the protection of groundwater against pollution and deterioration. Off J. Eur. Union L 372, 19–31.

EC, 2008. Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC. Off J. Eur. Union L 348, 84–97.

EC, 2011. Communication from the Commission to the European Parliament and the Council: Action plan against the rising threats from Antimicrobial Resistance (Brussels).

EC, 2013. Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy. Off J. Eur. Union L 226, 1–17.

EC, 2014. Commission Adopts Proposals To Improve Animal And Human Health. IP/14/987 (http://europa.eu/rapid/press-release_IP-14-987_en.htm. Accessed 16 November 2018).

EC, 2015a. Decision (EU) 2015/495 of 20 March 2015 establishing a watch list of substances for Union-wide monitoring in the field of water policy pursuant to Directive 2008/105/EC of the European Parliament and of the Council. Off J. Eur. Parliam. L 78, 40–42.

EC, 2015b. Action plan against antimicrobial resistance. http://ec.europa.eu/health/antimicrobial_resistance/policy/index_en.htm (Accessed 7 Sep 2018).

EC, 2015c. Antimicrobial resistance projects. http://ec.europa.eu/health/antimicrobial/resistance/projects/index_en.htm (Accessed 7 Sep 2018).

ECDC, 2015a. Antimicrobial resistance. http://ecdc.europa.eu/en/activities/surveillance/ESAC-Net/Pages/index.aspx (Accessed 20 March 2019).

EFSA, 2015. Antimicrobial Resistance. http://www.efsa.europa.eu/en/topics/topic/amr (Accessed 12 January 2019).

EMA, 2015b. Sales of Veterinary Antimicrobial Agents in 25 EU/EEA Countries in 2013: Fifth ESVAC Report (London).

European Environment Agency, 2010. Pharmaceuticals in the environment. Technical Report No 1/2010p. 4 (available at: www.eea.europa.eu/publications/pharmaceuticalsin-the-environment-result-of-an-eea-workshop/at_download/file - accessed 3 February 2019).

European Environmental Bureau - Europe's largest network of environmental citizens' organization, BIO Intelligence Service, Executive Agency for Health and Consumers, Study on the environmental risks of medicinal products, final report, January 2018, https://eeb.org/wp-admin/admin-ajax.php?juwpfisadmin=false&action=wpfd&task=file.download&wpfd_category_id=31&wpfd_file_id=92673&token=6569152a1133517433eb9fd762565318&preview=1 Accessed on 24 January 2019 .

Evgenidou, E.N., Konstantinou, I.K., Lambropoulou, D.A., 2015. Occurrence and removal of transformation products of PPCPs and illicit drugs in wastewaters: a review. Sci. Total Environ. 505, 905–926. http://dx.doi.org/10.1016/j.scitotenv.2014.10.021.

Farré, M., Kantiani, L., Petrovic, M., et al., 2012. Achievements and future trends in the analysis of emerging organic contaminants in environmental samples by mass spectrometry and bioanalytical techniques. Journal of Chromatography A 1259, 86–99, http://dx.doi.org/10.1016/j.chroma.2012.07.024.

Gall, H.E., Sassman, S.A., Jenkinson, B., Lee, L.S., Jafvert, C.T., 2014. Hormone loads exported by a tile-drained agroecosystem receiving animal wastes. Hydrol. Process., 28, 1318–1328. DOI:10.1002/hyp.9664.

Grinten, E.V., Pikkemaat, M.G., Brandhof, E.J.V., et al., 2010. Comparing the sensitivity of algal, cyanobacterial and bacterial bioassays to different groups of antibiotics. Chemosphere 80, 1–6. http://dx.doi.org/10.1016/j.chemosphere.2010.04.011.

Gros, M., Petrovic, M., Barceló, D., 2006. Data set on the occurrence of pharmaceutical compounds in the samples from the Danube river basin. AquaTerra report. Project no. 505428 (GOCE).

Hernandez-Vargas, G., Sosa-Hernández, J., Saldarriaga-Hernandez, S., Villalba-Rodríguez, A., Parra-Saldivar, R., Iqbal, H., 2018. Electrochemical biosensors: a solution to pollution detection with reference to environmental contaminants. Biosensors 8 (2), 29, DOI: 10.3390/bios8020029.

Hines, C.J., Jackson, M.V., Christianson, A.L., Clark, J.C., Arnold, J.E., Pretty, J.R., Deddens, J.A., 2017. Air, hand wipe, and surface wipe sampling for bisphenol a (BPA) among workers in industries that manufacture and use BPA in the United States, J. Occup. Environ. Hyg., 14, 882–897, DOI: 10.1080/15459624.2017.1339164.

http://www.pharmamicroresources.com/2017/12/efforts-to-combat-antibiotic-resistant.html - Accessed on 28 September 2019

https://en.wikipedia.org/wiki/Danube_Delta - Accessed on 28 September 2019

https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcRVbCD5woCZ1qAIWVsXmA7AYbbLm28i_eCWDcxVH9JPtXXf98SC - Accessed on 28 September 2019

https://farm6.staticflickr.com/5613/31550717933_a0e6bac019_o.jpg - Accessed on 20 September August 2019

https://foodpharmacy.blog/2019/06/pcos-oral-contraceptives-and-inflammation-part-2/ - Accessed on 10 September 2019

https://i2.wp.com/www.compoundchem.com/wp-content/uploads/2014/09/A-Guide-to-Different-Classes-of-Antibiotics-Aug-15.png?fit=1323%2C935&ssl=1 - Accessed on 05 September 2019

https://upload.wikimedia.org/wikipedia/commons/thumb/7/70/Liquid_Chromatography_Mass_Spectrometer.png/550px-Liquid_Chromatography_Mass_Spectrometer.png - Accessed on 05 September 2019

https://www.bag.admin.ch/bag/en/home/krankheiten/infektionskrankheiten-bekaempfen/antibiotikaresistenzen/wie-entstehen-antibiotikaresistenzen---/_jcr_content/par/image/image.imagespooler.png/1511168109495/evolution-of-antibiotic-resistancy-en.png - Accessed on 28 August 2019

https://www.cdc.gov/narms/index.html - Accessed on 28 September 2019

https://www.chem-academy.com/sites/chem-academy/files/bilder/gr/END4764_Graphic_Recording_thumb.png - Accessed on 10 September 2019

https://www.compoundchem.com/2015/02/03/oral-contraceptives/ - Accessed on 10 September 2019

https://www.hidenanalytical.com/real-time-process-monitoring-pharmaceuticals/ - Accessed on 10 September 2019

https://www.phenomenex.com/Info/Page/spedoa?utm_campaign=2018%20strata%20x%20drug%20b%20plus&utm_source=print&utm_medium=redirect&utm_content=strataxdrug - Accessed on 28 August 2019

https://www.researchgate.net/publication/315717521_Water_Quality_Assessment_for_Dukan_Lake_Using_LANDSAT_8_OLI_Satellite_Images/figures?lo=1&utm_source=google&utm_medium=organic - Accessed on 28 September 2019

https://www.sproutsanfrancisco.com/get-educated/endocrine-system-endocrine-disruptors-harms/ - Accessed on 28 August 2019

Jarošová, B., Javu˚rek, J., Adamovský, O., Hilscherová, K., 2015. Phytoestrogens and mycoestrogens in surface waters–Their sources, occurrence, and potential contribution to estrogenic activity. Environ. Int., 81, 26–44. DOI:10.1016/j.envint.2015.03.019.

Joint Danube Survey (JDS) 3-2013, 2015. A Comprehensive Analysis of Danube Water Quality. Final Report. International Commission for the Protection of the Danube River, Vienna.

Krzeminski, P., Tomei, M.C., Karaolia, P., Langenhoff, A., Almeida, C.M.R., Felis, E., Rizzo, L., 2018. Performance of secondary wastewater treatment methods for the removal of contaminants of emerging concern implicated in crop uptake and antibiotic resistance spread: a review. Sci. Total Environ. 648, 1052–1081. DOI:10.1016/j.scitotenv.2018.08.130

Kumar M., Jaiswal S., Sodhi K.K., Shree P., Singh D.K., Agrawal P.K., Shukla P., 2019, Antibiotics bioremediation: Perspectives on its ecotoxicity and resistance, Environment International, 124, 448-461, https://doi.org/10.1016/j.envint.2018.12.065.

Lecomte, S., Habauzit, D., Charlier, T.D., Pakdel, F., 2017. Emerging Estrogenic Pollutants in the Aquatic Environment and Breast Cancer. Genes, 2017, 8, 229. DOI:10.3390/genes8090229.

Li Sun, L., Yong, W., Chu, X., Lin, J.-M., 2009. Simultaneous determination of 15 steroidal oral contraceptives in water using solid-phase disk extraction followed by high performance liquid chromatography–tandem mass spectrometry. Journal of Chromatography A, 1216, 5416–5423. DOI:10.1016/j.chroma.2009.05.041

Li, M., Wei, D., Du, Y., 2014. Acute toxicity evaluation for quinolone antibiotics and their chlorination disinfection processes. J. Environ. Sci. 26, 1837–1842. http://dx.doi.org/10.1016/j.jes.2014.06.023.

Madureira, T., Barreiro, J., Rocha, M., Cass, Q., Tiritan, M., 2010. Spatio-temporal distribution of pharmaceuticals in the Douro River estuary (Portugal). Sci. Total Environ. 408 (22), 5513–5520. DOI: 10.1016/j.scitotenv.2010.07.069.

Mansell, D.S., Bryson, R.J., Harter, T., Webster, J.P., Kolodziej, E.P., Sedlak, D.L., 2011. Fate of endogenous steroid hormones in steer feedlots under simulated rainfall-induced runoff. Environ. Sci. Technol., 45, 8811–8818. DOI:10.1021/es202072f.

Moldovan, Z., Marincas, O., Povar, I., Lupascu, T., Longree, P., Rota, J. S., Alder, A. C., 2018. Environmental exposure of anthropogenic micropollutants in the Prut River at the Romanian-Moldavian border: a snapshot in the lower Danube river basin. Environmental Science and Pollution Research. doi:10.1007/s11356-018-3025-8.

Murphy, E.A., Post, G.B., Buckley, B.T., et al., 2012. Future challenges to protecting public health from drinking water contaminants. Annu. Rev. Public Health 33, 209–224. http://dx.doi.org/10.1146/annurev-publhealth-031811-124506.

Ohore, O.E., Zhang, S., 2019. Endocrine disrupting effects of bisphenol A exposure and recent advances on its removal by water treatment systems. A review. Scientific African, 5, e00135. https://doi.org/10.1016/j.sciaf.2019.e00135

Pal, A., He, Y., Jekel,M., et al., 2014. Emerging contaminants of public health significance as water quality indicator compounds in the urban water cycle. Environ. Int. 71, 46–62. http://dx.doi.org/10.1016/j.envint.2014.05.025.

Papageorgiou, M., Kosma, C., Dimitra Lambropoulou, D., 2016. Seasonal occurrence, removal, mass loading and environmental risk assessment of 55 pharmaceuticals and personal care products in a municipal wastewater treatment plant in Central Greece. Science of the Total Environment, 543, 547–569. http://dx.doi.org/10.1016/j.scitotenv.2015.11.047.

Pleiter, M.G., Gonzalo, S., Palomares, I.R., et al., 2013. Toxicity of five antibiotics and their mixtures towards photosynthetic aquatic organisms: Implications for environmental risk assessment. Water Res. 47, 2050–2064. http://dx.doi.org/10.1016/j.watres.2013.

Plotan, M., Elliott, C.T., Frizzell, C., Connolly, L., 2014. Estrogenic endocrine disruptors present in sports supplements. A risk assessment for human health. Food Chem., 159, 157–165. DOI:10.1016/j.foodchem.2014.02.153.

Rasheed, T., Bilal, M., Nabeel, F., Adeel, M., Iqbal, H.M., 2019. Environmentally-related contaminants of high concern: potential sources and analytical modalities for detection, quantification, and treatment. Environ. Int. https://doi.org/10.1016/j.envint.2018.11.038 in press.

Rezg, R., El-Fazaa, S., Gharbi, N., Mornagui, B., 2014. Bisphenol a and human chronic diseases: Current evidences, possible mechanisms, and future perspectives, Environ. Int., 64, 83–90,

Rico, A., Dimitrov, M.R., Wijngaarden, R.P.A.V., et al., 2014. Effects of the antibiotic enrofloxacin on the ecology of tropical eutrophic freshwater microcosms. Aquat. Toxicol. 147, 92–104. http://dx.doi.org/10.1016/j.aquatox.2013.12.008.

Sabanayagam, C., Teppala, S., Shankar, A., 2013. Relationship between urinary bisphenol a levels and prediabetes among subjects free of diabetes. Acta Diabetol., 50, 625–631, DOI: 10.10 07/s0 0592- 013- 0472- z.

Samuel Fekadu, S., Alemayehu, E., Dewil, R., Van der Bruggen, B., 2019. Pharmaceuticals in freshwater aquatic environments: A comparison of the African and European challenge. Science of the Total Environment, 654, 324–337. https://doi.org/10.1016/j.scitotenv.2018.11.072.

Sauvé, S., Desrosiers, M., 2014. A review of what is an emerging contaminant. Chemistry Central Journal 8, 1–8, http://dx.doi.org/10.1186/1752-153X-8-15.

Szymańska U., Wiergowski M., Sołtyszewski I., Kuzemko J., Wiergowska G., Woźniak M.K., 2019 Presence of antibiotics in the aquatic environment in Europe and their analytical monitoring: Recent trends and perspectives, Microchemical Journal, 147, 729–740, https://doi.org/10.1016/j.microc.2019.04.003.

Toner, F., Allan, G., Dimond, S.S., Waechter, J.M., Beyer, D. 2018. In vitro percutaneous absorption and metabolism of bisphenol a (BPA) through fresh human skin, Toxicol. Vitr. 47, 147–155, DOI: 10.1016/j.tiv.2017.11.002.

Toolaram, A.P., Haddad, T., Leder, C., Kümmerer, K., 2016. Initial hazard screening for genotoxicity of photo-transformation products of ciprofloxacin by applying a combination of experimental and in-silico testing. Environ. Pollut. 211, 148–156. http://dx.doi.org/10.1016/j.envpol.2015.12.040.

Ullah, S., Zuberi, A., Alagawany, M., Farag, M.R., Dadar, M., Karthik, K., Iqbal, H.M., 2018. Cypermethrin induced toxicities in fish and adverse health outcomes: its prevention and control measure adaptation. J. Environ. Manag. 206, 863–871. DOI: 10.1016/j.jenvman.2017.11.076.

Zwiener, C., Frimmel, F.H., 2004. LC-MS analysis in the aquatic environment and in water treatment technology - A critical review. Part II: Applications for emerging contaminants and related pollutants, microorganisms and humic acids. Analytical and Bioanalytical Chemistry, 378, 862–874, http://dx.doi.org/10.1007/s00216-003-2412-1.

PART B

1.B.1. Heavy metals, trace elements in surface waters in Republic of Moldova

1.B.2. Heavy metals and trace elements in sediments of Nestos River

1.B.3. Heavy metals in water of Nestos River

1.B.4. Heavy metals and trace elements in Danube River and Danube Delta

1.B.5. Nutrients and ions in Prut and Dniester Rivers

1.B.6. Nutrients and ions in Nestos River

1.B.7. Nutrients and ions in Danube River

1.B.8. Priority organic pollutants (POPs) (organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) in rivers of Moldova

1.B.9. Priority organic pollutants (POPs), organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) in Greece

1.B.10. Polycyclic aromatic hydrocarbons (PAHs) and petroleum hydrocarbons in Greece

Bibliography

Albanakis K., Psilovikos Aris, Margoni Sofia and Styllas Michael (2001). Some recent observations on the Nestos river sediment outflow and dispersion in the deltaic region. Conference: INTERREG II Meeting titled: North Aegean System Functioning and Inter-Regional Pollution, At Kavala, Greece, Volume: Abstracts, p. 18.

Andayesh S., Hadiani M.R., Mousavi Z., Shoeibi S., 2015, Lead, cadmium, arsenic and mercury in canned tuna fish marketed in Tehran, Iran, Food Additives and Contaminants, Part B, 8, 93-98. DOI: 10.1080/19393210.2014.993430.

APHA, AWWA (American Public Health Association, American Water Works Association), Standard Methods for the Examination of Water and Wastewater, 20th Edition, Washington, DC; 1998.

APHA, AWWA (American Public Health Association, American Water Works Association),Standard Methods for the Examination of Water and Wastewater, 20th Edition, Washington, DC; 1998.

Argiropoulos D., Ganoulis J. and Papachristou E., 1996, Water quality assessment of the Greek part of Nestos (Mesta) River, In Transboundary Water Resources Management: Institutional and Engineering Approaches (J.Ganoulis et al. eds), NATO ASI SERIES, Partnership Sub-Series 2. Environment, Vol.7, pp.427–438, Springer-Verlag, Heidelberg, Germany.

Argiropoulos D., Papachristou E. and Ganoulis J.,1994, Statistical assessment of water pollution in the Aegean Rivers: The case of Nestos, Sixth Meeting of the Regional Agency for the Environment, Provence – Alpes – Cote D'Azur, France.

Boskidis I., Gikas G., Sylaios G., Tsihrintzis V., 2011, Water quantity and quality assessment of lower Nestos River, Greece, Journal of Environmental Science and Health Part A 46, 1–18, DOI: 10.1080/10934529.2011.590381.

Burada A., Despina C., Secelenau-Odor D., Tiganus M., Teodorof L., Ene A., Tudor M., Adrian Burada, Nutrient Level in Surface Water near Urban Agglomerations. Case Atudy: Confluence Area Siret - Danube -Prut,S1.09, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp. 28

Canadian Council of Ministers of the Environment (CCME), 2016, Guidance manual for developing Nutrient Guidelines for Rivers and Streams, Chapter 1.4 Nutrient Dynamics of Rivers and Streams, pp. 4-8.

Christoforidis A., Stamatis N., 2009, Heavy metal contamination in street dust and roadside soil along the major national road in Kavala's region, Greece. Geoderma, 151, 257-263. DOI 10.1016/j.geoderma.2009.04.016.

Ciornea, V.; Ivanova, A.; Zubcov, E.; Ene, A. Determination of some organochlorine pesticides in the waters of the Prut River. In: Annals of the University Dunarea de Jos of Galati, Fascicle II - Mathematics, Physics, Theoretical Mechanics, 2016, vol. VIII (XXXIX) No. 1, p.81-86. ISSN 2067-2071.

Cociașu A., Popa L., 2005, Buga L., 1998, Long term evolution of the nutrient concentrations on the north-western shelf of the Black sea, Cercetari marine, IRCM Constanta, 31, 13-29.

Cociașu A., Popa L., 2005, Significant changes in Danube nutrient loads and their impact on the Romanian Black Sea coastal waters, Cercetări marine, INCDM, 35, 25-37.

Council-Directive-1998/83/EC.b On the quality of water in tented for human consumption. Adopted by the Council, on 3 November 1998.

Council-Directive-2000/60, Establishing a framework for Community action in the field of water policy. Adopted by the Council at 23 October 2000.

Darakas E., 2002, The transboundary river Nestos and its water quality assessment: cross-border cooperation between Greece and Bulgaria, The Environmentalist, 22, 367–75.

Despina C., Teodorof L., Burada A., Seceleanu Odor D., Spiridon C., Tudor I.M., Tudor M., Ene A., Application of Inductively Coupled Plasma Mass Spectrometry (ICP-MS) in the Field of Environmental Protection, S1.14, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.34

EFSA (European Food Safety Authority), 2011, Statement on tolerable weekly intake for cadmium. EFSA Journal, *9* (2), 1975.

European agricultural fund for rural development (EAFRD), Project "monitoring of chemical quality of irrigation waters (surface and groundwater) of the river basins of Macedonia-Thrace and Thessaly", 2007-2013.

Gâștescu P., Știucă (R.), 2006, Delta Dunării Rezervația Biosferei. Ed. Dobrogea, 498 pg.

Gikas G., Sylaios G., Tsihrintzis V., 2011, Water quantity and quality assessment of lower Nestos River, Greece, Journal of Environmental Science and Health Part A 46, 1–18, DOI: 10.1080/10934529.2011.590381.

Hatzianestis, I. and Sklivagou E. (2000). Contamination from hydrocarbons and chlorinated compounds in sediments from the Nestos estuary. p. 503-510. In: V International Conference on Protection and Restoration of the environment, Thassos, Greece, 3-6 July 2000, proccedings, Vol. I.

Hatzianestis, I. and Sklivagou E. (2002). Dissolved and Suspended Polycyclic Aromatic Hydrocarbons (PAH) in the North Aegean Sea. Mediterranean Marine Science, Vol. 3/1, 89-98

Hatzianestis, I., Sklivagou, E. and Georgakopoulou, E., (2001). Hydrocarbons, pesticides and PCBs in sediments from the Thermaikos gulf. Fresenius Environmental Bulletin, 10: 63-68

Hatzianestis, Ioannis (2013). The role of rivers in transporting organic contaminants in the marine environment of Greece. 11873-. "The role of rivers in transporting organic contaminants in the marine environment of Greece"

Ioannis Boskidis, Georgios D. Gikas , Georgios Sylaios & Vassilios A. Tsihrintzis (2011) Water quantity and quality assessment of lower Nestos river, Greece, Journal of Environmental Science and Health, Part A, 46:10, 1050-1067, DOI: 10.1080/10934529.2011.590381BOSKIDIS I.,

Ivanova, A. Organochlorinated compounds in the Prut River sediments. Annals of "Dunarea de jos" University of Galati: Mathematics, Physics, Theoretical mechanics. Fascicle II, year VIII (XXXIX) 2018, No. 1, pp.40-47

Ivanova, A. Organochlorinated compounds in the Prut River sediments. Annals of "Dunarea de jos" University of Galati: Mathematics, Physics, Theoretical mechanics. Fascicle II, year VIII (XXXIX) 2018, No. 1, pp.40-47

Konstantinou IK, Hela DG, Albanis TA (2006). The status of pesticide pollution in surface waters (rivers and lakes) of Greece. Part I. Review on occurrence and levels. Environ Intern 141(3):555-570.

Mihailov G., Arsov R., Nikolaeva R., Tzachev T., Stanchev A., 1994, Current status of the anthropogenic impact on the Bulgarian part of the Mesta (Nestos) river, INTERREG I programme, Final report (Bulgarian part), Sofia.

Nikolaos Stamatis,[1,*] Nikolaos Kamidis,[1] Pelagia Pigada,[1] Georgios Sylaios,[2] and Emmanouil Koutrakis[1] Quality Indicators and Possible Ecological Risks of Heavy Metals in the Sediments of three Semi-closed East Mediterranean Gulfs, Toxics. 2019 Jun; 7(2): 30. Published online 2019 May 29. DOI: 10.3390/toxics7020030

Ostberg W., Buijse A. D., Coops H., Ibelings B. W., Menting G. A. M., StaraS̨ M., Bogdan L., Constantinescu A., Hanganu J., Nă̈vodaru I., Tö̈rö̈k L., 2000, Ecological gradients in the Danube Delta lakes. - Present state and man-induced changes. RIZA rapport 2000.015, The Netherland: 3-168.

Papachristou E., Ganoulis J., Bellou A., Darakas E., and Ioannidou D., 2000, The Nestos/Mesta River: A transboundary water quality assessment. (J.Ganoulis et al. eds), Transboundary Water Resources in the Balkans, 33-40, Kluwer Academic Publishers, Printed in the Netherlands.

Papachristou E., Ganoulis J., Darakas E., Bellou A., Ioannidou D., Vafiadis, M., Mylopoulos J., and Argiropoulos D., 1994, Study of pollution of transborder river Nestos (Greece–Bulgaria) and impact on the receiver, INTERREG I programme, Final report (Greek part), Thessaloniki.

Papadakis, E., Tsaboula, A., Vryzas, Z., Kotopoulou, A., Kintzikoglou, K. and Papadopoulou-Mourkidou, E. (2018). Pesticides in the rivers and streams of two river basins in northern Greece, Science of The Total Environment, Volume 624, Pages 732-743, ISSN 0048-9697.

Postolache C., 2006, The chemistry of the Danube Delta. IN Danube Delta. Genesis and Biodiversity (eds. Tudorancea C, Tudorancea M.M.), 65-93. Backhuys Publisher, The Netherlands.

Seceleanu-Odor D., Despina C., Burada A., Teodorof L., Spiridon C., Tiganus M., Ene A., Tudor M., Percentage Distribution of Nitrogen Forms in Aquatic Complex Somova-Parches in 2018,S1.16, Abstract book MONITOX International Symposium "Deltas and Wetlands"pp36.

Sklivagou, E., Hatzianestis, I. and Papadopoulos, V. (2001). Polycyclic aromatic hydrocarbons in sediments of the Strymonikos gulf and the marine area around the Nestos. p. 444-448. In: 6Ô Hellenic Symposium on Oceanography and Fisheries, Chios, 23-26 May 2000, proceedings, Vol. I.

Spiridon C., Burada A., Teodorof L., Despina C., Seceleanu Odor D., Tudor M., Ene A., Georgescu L.P., Spatial Distribution of Phytoplankton in Razim Lake, S1.15, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.35

Stamatis N., Ioannidou D., Christoforidis A., Koutrakis E., 2002, Sediment pollution by heavy metals in the Strymonikos and Ierissos Gulfs, North Aegean Sea, Greece,Environmental Monitoring and assessment, *80*, 33-49, DOI 10.1023/A:1020382011145.

Stamatis N., Kamidis N., Sylaios G., 2006, Sediment and Suspended Matter Lead Contamination in the Gulf of Kavala-Greece. Environmental Monitoring and assessment, 1*15*, 433-449, DOI 10.1007/s10661-006-7238-9.

Teodorof L., Burada A., Despina C., Seceleanu –Odor D., Tiganus M., Spiridon C., Tudor M., Ene A., 2019, Mercury Concentrations in Surface Waters and Sediments from Target Areas of MONITOX Network, S1.05, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7p.22

Török L., Teodorof L., Năstase C., 2007, The assessment of the nutrient pollution in Danube Delta Biosphere Reserve surface water and proposal for risk evaluation of failing the environmental quality objective, Scientific Annals of IDD,Tulcea-Romania, 14, 101-106

Torres P., Rodrigues A., Soares L., Garcia P., 2016, Metal concentrations in two commercial tuna species from an active volcanic region in the mid-Atlantic Ocean, Archives of Environmental Contaminants and Toxicology, 70, 341-347. DOI: 10.1007/s00244-015-0249-1.

Trans Adriatic Pipeline (TAP) – Integrated ESIA Greece Annex 6.6.2 - Groundwater Baseline Study, 2012.

Valavanidis, Athanasios and Vlachogianni, Thomais. (2015). Environmental Pollution of Rivers, Lakes and Wetlands in Greece. Environmental Research and Reports on the State of Greek Freshwater Resources. Web site, Dpt of Chemistry, University of Athens, www.chem.uoa.gr. 1. 1-33.

Zubcov, E.; Biletchi, L.; Bagrin, N.; Zubcov, N.; Borodin, N.; Jurminskaia, O.; Bogonin, Z. Investigation of hydrochemical characteristics of the Prut River. *Buletinul Academiei de Ştiinţe a Moldovei. Seria "Ştiinţele vieţii"*. 2014, 3(324), p. 127-136. ISSN 1857-064X http://bsl.asm.md/articles/edition/1534?page=2

**** Order 161/2006 of Ministry of Environment and Water Management, regarding the classification of surface water quality to determine the ecological status of water bodies, Table no. 6, Elements and biological quality standards, chemical and physico-chemical for setting ecological status of surface waters, Annex C, Elements and chemical, physico-chemical quality standards in water. (Published in 13 June 2006), Bucharest. [In Romanian].

**** SR EN 26667/ISO 6777/2002 Determination of nitrite. Molecular absorption spectrometric method.

**** SR ISO 7890-3:2000 – Water quality. Determination of nitrate. Part 3. Spectrometric method using sulfosalicylic acid.

****SR EN 6878/2005. Water quality. Determination of phosphorus. Ammonium molybdate spectrometric method

****SR ISO 7150-1/ 2001 Water quality. Determination of ammonium. Part 1. Manual spectrometric method.

CHAPTER 2.
Complex Investigations of Toxic Pollutants (TOXs) in Black Sea Basin. Optimized techniques and project preliminary results

2.1. Microbiological quality and contamination level of Danube River Water

- *Introduction*
- *Materials and methods*
- *Results and discussion*
- *Conclusions*

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2.4. Assessment of water and sediment quality in Moldova. Preliminary results

2.5. Water Quality Index. Preliminary results for Lower Danube River sector, Romania

2.6. Mapping the monitored chemical parameters in Lower Danube River sector, Romania

Bibliography

Albinger, O., 1988, Bakteriologische Wasser- und Sedimentuntersuchungen der Donau von Str.-km 16 bis Str.-km 1868 im März 1988. Ergebnisse der Int. Donauexpedition 1988. Hrsg.: IAD der SIL, 249-256.

Arbanas (Moraru) S.S., Ene A., Gosav S., Moraru D.I., 2019a Intensive Agricultural Practices and Industrial Activities Influence on Soil Fertility of Agroecosystems from Prut and Siret Lowlands, SE Romania, S3.16, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp.80-81.

Arbanas (Moraru) S.S., Ene A., Gosav S., 2019b, Mineralogical Composition Assessment of Soils from Covurlui and Braila Plains by ATR-FTIR Technique, Proceedings, 29, 80; doi:10.3390/proceedings2019029080. (will be presented at the 15th International Symposium "Priorities of Chemistry for a Sustainable Development" PRIOCHEM, Bucharest, Romania, 30th October–1st November 2019).

Bahrim G., 2019, Poluanți emergenți persistenți în ecosisteme acvatice – compuși farmaceutici / Emerging persistent pollutants in aquatic ecosystems – pharmaceutical compounds, Regional Workshop „Environmental Pollution of Aquatic Ecosystems of Danube-Black Sea Basin", Chisinau, 16-17 May 2019.

Bogdevich O., Ene A., Igor Nicoara, Oleg Cadocinicov, Elena Culighin, Elena Nicolau, 2019a, The Characteristic of Sediments Quality of Natural Lakes in Lower Prut Region, S2.03., Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp.44-45.

Bogdevich O., Ene A., Teodorof L., Cadocinicov O., Culighin E., Nicolau E., Grigoras M., 2019b, The study of toxic substances in Low Danube region of Republic of Moldova, Oral presentation O19, Book of Abstracts International Conference "Achievements and Perspectives of Modern Chemistry", October 9-11, 2019, Chisinau, Republic of Moldova, p.46.

Bogdevich O., Spanos T., Ene A., Cadocinicov O., Culighin E., Nicolau E., Grigoras M., 2019c, The analysis of groundwater quality in monitoring network of Republic of Moldova, Oral presentation O22, Book of Abstracts International Conference "Achievements and Perspectives of Modern Chemistry", October 9-11, 2019, Chisinau, Republic of Moldova, p.49.

Chowdhury R.M., Muntasir S.Y., Hossain M.M.) 2012, Water quality index of water bodies along Faridpur-Barisal road in Bangladesh, Glob. Eng. Tech. Rev. 2(3), 1-8.

Duliu O., Romul Margineanu, Carmen Varlam, Constantin Costea, Natural Radioactivity of the Black Sea Western Shore, S2.01, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, p.43.

Ene A., 2019, Clase de substanțe toxice investigate în cadrul proiectului MONITOX. Izotopi radioactivi și nivelul dozelor de radiații nucleare în regiunea Dunării de Jos și Bazinului Mării Negre / Classes of toxic substances investigated in the frame of MONITOX project. Radioactive isotopes and level of nuclear radiation doses in Lower Danube region and Black Sea Basin, Regional Workshop „Environmental Pollution of Aquatic Ecosystems of Danube-Black Sea Basin", Chisinau, 16-17 May 2019.

Ene A., 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, 2019a, "Nuclear and Atomic Techniques Used for the Quantification and Mapping of Heavy Metals and Trace Elements in Soils", S1.07, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, pp.24-26.

Ene A., Elena Zubcov, Thomas Spanos, Oleg Bogdevich, Liliana Teodorof, 2019b, "Interdisciplinary Cooperation for Ecological Monitoring in the Black Sea Basin", S1.01, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D,, 2019, ISBN 978-606-8896-00-7, pp.17-18.

Ene A., Ana Pantelică, Sorina-Simona Arbanaș (Moraru), Violeta Pintilie, Florin Sloată, Florina Cristiana Căpriță, Mihai Straticiuc, Claudia Stihi, Marina Frontasyeva, Oleg Bogdevich, Elena Culighin, 2019c, Development of analysis methodology using Proton Induced X-ray Emission (PIXE) as a complementary technique to determine trace elements in environmental matrices, Scientific Conference of the Doctoral Schools – Perspectives and challenges in doctoral research, 7th edition (SCDS-UDJG), Galați, 13-14 June 2019.

Ene A., 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", S1.08, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, pp.26-27.

Ene A., Pintilie V., Radon and Thoron Activity Concentrations in Selected Indoor Environments in Lower Danube and Danube Delta Region, Romania, S3.07, Abstract book MONITOX International Symposium "Deltas and Wetlands" , September 15th-17th, 2019, Tulcea, Romania, pp.70-71.

Ene A., Violeta Pintilie, Ana Pantelica, Assessment of radon, thoron and their descendants in selected indoor environments in Romania, International Symposium on Natural Radiation Sources – Challenges, Approaches and Opportunities, 21-24 May 2019, Bucharest, Romania

Ene A., Gosav S., Capabilities of FT-IR Spectroscopy for the Investigation of Microplastics in Environmental Samples and Personal Care and Cosmetic Products, S3.13, Abstract book MONITOX International Symposium "Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, pp.77-78.

Ene A., 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, S2.14, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, p.57.

Enachi E., Carmen Chițescu, Gabriela Bahrim, Antoaneta Ene, Monitoring of Emerging Pollutants from Aquatic Ecosystems – Antibiotics, Endocrine Disruptors and Contraceptives, S1.13, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp. 32-33.

Farnleitner A.H., Hocke L. Beiwl, C., Kavka G.G., Zechmeister T., Kirschner A.K.T., Mach R.L., 2001, Rapid enzymatic detection of Escherichia coli contamination in polluted river water, Letters in Applied Microbiology, 33, 246-250.

Kavka G.G., Poetsch E., 2002, Microbiology. - In: Technical Report of the International Commission for the Protection of the Danube River. Eds. Péter Literáthy, Veronika Koller Kreimel, Igor Liska. Eigenverlag ICPDR. 138-150.

Kohl W., 1975, Über die Bedeutung bakteriologischer Untersuchungen für die Beurteilung von Fließgewässern, dargestellt am Beispiel der österreichischen Donau, Arch, Hydrobiol. Suppl.44, 4, 392-461.

Lumb A., SharmaT. C., Bibeault J.F. 2011, A Review of Genesis and Evolution of Water Quality Index (WQI) and Some Future Directions, Water Quality, Exposure and Health 3(1), 11-24.

Negru M.; Şuberneţkii I. Dinamica şi distribuţia bacteriilor, participante în circuitul azotului în r. Prut în anul 2016. В: Материалы международной конференции, 26-27 октября 2017 года, Тирасполь: Eco-TIRAS (Tipogr. "Elan Poligraf"), p.277-281. ISBN 978-9975-66-591-9

Pantelica A., Ene A., PIXE Analysis of Elemental Content in River and Underground Water, S3.08, Abstract book MONITOX International Symposium "Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, p.72.

Pall E., Niculae M., Kiss T., Sandru C.D., Spinu M., 2013, Human impact on the microbiological water quality of the rivers, Journal of Medical Microbiology 62, 1635-1640.

Sloata F., Antoaneta Ene, ED-XRF analysis of trace elements in soils located in the vicinity of a former chemical plant, TIM 19 Physics Conference, Timisoara, Romania, 29 – 31 mai 2019.

Spanos T., Nikolaos Mittas, Antoaneta Ene, Christina Chatzichristou, Konstantinos Dermentzis, Oleg Bogdevich,"Evaluation of Groundwater Quality through Environmetrics. The case of Kavala Region", S3.01, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, p.62.

Trifanov C., Burada A., Teodorof L., Visualizing the Chemical Parameters in surface Water of the Danube River. Case Study: Danube River Km 175 – Km 67, S3.11, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.75

Tyagi, S., Sharma, B., Singh, P., Dobhal R. 2013, Water Quality Assessment in Terms of Water Quality Index, American Journal of Water Resources 1(3): 34-38.

Ungureanu C., Ifrim G., Turturica M., Bahrim G., Ene A., 2014, Chemical and microbiological analysis of water quality from Lower Danube Region, Annals of Dunarea de Jos University of Galati – Fascicle II, Year VI (XXXVII), 51-57.

Vasile A., Ene A., Bahrim G., 2019, Microbiological Quality and Contamination Level of Danube River Water in Ostrov-Isaccea Sector, South-Eastern Part of Romania, S1.12, Abstract book MONITOX International Symposium "Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, pp.30-31.

CHAPTER 3.
Risk Assessment of Toxic Pollutants in Black Sea Basin.

3.1. QGIS maps

3.2. Health Risk Calculator of Toxic Pollutants in Black Sea Basin

3.2.1. Review no.1. of literature health risk indices

- ***Pollution index for soils, bioaccumulation factors, chronic daily intake and carcinogenic risk for carcinogenic chemicals***
- ***Cancer risk after polycyclic aromatic hydrocarbons (PAHs) exposure from aquatic organisms (calculated through BaPeq)***
- ***Soil contamination with PAHs. Toxic equivalent factor of the given species relative to BaP carcinogenic potency***
- ***Other indices potential to be used in the health risk assessment: tolerabile daily intake of heavy metals from food consumption, eco-impact quantifying the accumulative ecological risks of metals, bioconcentration, human risk assessment by estimating daily intake, non-carcinogenic risk***
- ***Water radionuclides: the annual equivalent effective dose due to water ingestion***
- ***Soil and sediment radionuclides: absorbed gamma dose rate, external hazard index***

P4. 3.1. Environmental Risk Assessment (ERA)

Bibliography

Alidadi H., Sany S. B. T., Oftadeh B. Z. G., Mohamad T., Shamszade H., and Fakhari M., 2019, Health risk assessments of arsenic and toxic heavy metal exposure in drinking water in northeast Iran, Environmental Health and Preventive Medicine, vol. 24, Article number: 59.

Bogdevich O., Igor Nicoara, Oleg Cadocinicov, Elena Culighin, Evgenii Isicico, Victor Jeleapov, 2019, The Application of GIS Technology for Environmental Risk Assessment from Toxic Substances, S3.09., Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, p.73.

Brito, M.G., Costa, C., Vendas, D., and Serranheira, F., 2015, Soil contamination and human health risk assessment at a former industrial site in a densely populated urban area, MIST 2015 (Modelling Innovation, Sustainabilityand Technology), Conference proceedings.

Ene A., 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, 2019a, "Radioactivity Levels in Selected Areas of the Black Sea Basin in Romania, Republic of Moldova and Greece", S1.08, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, p.26.

Ene A., Pintilie V., Pantelica A., 2019b, Assessment of radon, thoron and their descendants in selected indoor environments in Romania, International Symposium on Natural Radiation Sources – Challenges, Approaches and Opportunities, 21-24 May 2019, Bucharest, Romania

Ene A., 2019, Clase de substanțe toxice investigate în cadrul proiectului MONITOX. Izotopi radioactivi și nivelul dozelor de radiații nucleare în regiunea Dunării de Jos și Bazinului Mării Negre / Classes of toxic substances investigated in the frame of MONITOX project. Radioactive isotopes and level of nuclear radiation doses in Lower Danube region and Black Sea Basin, Regional Workshop „Environmental Pollution of Aquatic Ecosystems of Danube-Black Sea Basin" , Chisinau, 16-17 May 2019.

Hu B., Jia X., Hu J., Xu D., Xia F., and Li Y., 2017, Assessment of Heavy Metal Pollution and Health Risks in the Soil-Plant-Human System in the Yangtze River Delta, China, International Journal of Environmental Research and Public Health, 14(9), 1042; https://doi.org/10.3390/ijerph14091042.

Huang S., Shao G., Wang L., Wang L., and Tang L., 2019, Distribution and Health Risk Assessment of Trace Metals in Soils in the Golden Triangle of Southern Fujian Province, China, International Journal of Environmental Research and Public Health, *16*(1), 97; https://doi.org/10.3390/ijerph16010097.

Jiang X., Lu W.X., Zhao H. Q., Yang Q. C., and Yang Z. P., 2014, Potential ecological risk assessment and prediction of soil heavy-metal pollution around coal gangue dump, Natural Hazards and Earth Syste, Sciences, 14, 1599–1610, doi: 10.5194/nhess-14-1599-2014.

Koki I.B., Bayero A. S., Umar A., and Yusuf S., 2015, Health risk assessment of heavy metals in water, air, soil and fish, African Journal of Pure and Applied Chemistry, vol. 9(11), pp. 204-210, doi: 10.5897/AJPAC2015.0654.

Lewis M. A., 1990, Chronic toxicities of surfactants and detergent builders to algae: A review and risk assessment, Ecotoxicology and Environmental Safety vol. 20, issue 2, 123-140, https://doi.org/10.1016/0147-6513(90)90052-7.

Łozowicka B., Kaczyński P., Rutkowska E., Jankowska M., and Hrynko I., 2013, Evaluation of pesticide residues in fruit from Poland and health risk assessment, Agricultural Sciences, vol.4, no.5B, 106-111, doi:10.4236/as.2013.45B020.

Majlesi M., Pashangeh S., Salehi S. O., and Berizi E., 2018, Human Health Risks from Heavy Metals in Fish of a Fresh Water River in Iran, International Journal of Nutrition Sciences, vol. 3(3), 157-163.

Masih A., Taneja A., 2006, Polycyclic aromatic hydrocarbons (PAHs) concentrations and related carcinogenic potencies in soil at a semi-arid region of India, Chemosphere, vol. 65, 449–456

Mohammadi A. A., Zarei A., Majidi S., Ghaderpoury A., Hashempour Y., Saghi M. H., Alinejad A., Yousefi M., Hosseingholizadeh N., and Ghaderpoori M., 2019, Carcinogenic and non-carcinogenic health risk assessment of heavy metals in drinking water of Khorramabad, Iran, MethodsX, Vol. 6, 1642-1651, doi: 10.1016/j.mex.2019.07.017.

Pintilie, V., Ene, A., Georgescu, L.P., Moraru, L., Iticescu, C., 2016, Measurements of gross alpha and beta activity in drinking water from Galati region, Romania, Romanian Reports in Physics 68 (3), 1208–1220.

Thiombane M., Albanese S., Di Bonito M., Lima A., Zuzolo D., Rolandi R., Qi S., De Vivo B., Source patterns and contamination level of polycyclic aromatic hydrocarbons (PAHs) in urban and rural areas of Southern Italian soils, 2019, Environ Geochem Health, 41(2), 507-528

Wilson M. J., Frickel S., Nguyen D., Bui T., Echsner S., Simon B. R., Howard J. L., Miller K., and Wickliffe J. K., 2015, A Targeted Health Risk Assessment Following the Deepwater Horizon Oil Spill: Polycyclic Aromatic Hydrocarbon Exposure in Vietnamese-American Shrimp Consumers, Environmental Health Perspectives, vol. 123, no. 2, http://dx.doi.org/10.1289/ehp.1408684.

Yi Y., Tang C., Yi T., Yang Z., Zhang S., 2017, Health risk assessment of heavy metals in fish and accumulation patterns in food web in the upper Yangtze River, China, Ecotoxicology and Environmental Safety, vol. 145, p. 295-302.

https://qgis.org/en/site/

https://www.naturalearthdata.com/

https://www.qgistutorials.com

Conclusions

The impact of anthropogenic and/or natural heavy metal pollution on Kavala Gulf and Nestos Delta in the North Aegean Sea, Greece, was evaluated using concentration data per sampling site for Cu, Pb, Zn, Cr and Ni in 25 surface sediment samples. KAV 13 sediment from the Kavala Gulf showed the maximum contents, which means that the above sampling sites were the highest polluted locations by the metals Cu, Pb, Zn, Cr, and Ni in the studied area. In the central and deeper parts of Kavala Gulf (directly affected from urban and oil offshore production) showed increased concentrations of the above metals. The pollution level of heavy metals (mg kg^{-1})in the surface layer of sediments in the Kavala Gulf decreased in the order of Zn> Cr > Pb> Cu ~Ni.

The elements measured in samples from the Nestos River were Cd, Cu, Fe Mn, Pb, Ni, Zn with the unit of measurement in ppb (µg/L). The conclusion of all these analyses and the results of the average concentration of all sampling sites the Cd Cu, Fe, Mn elements it is that they were significantly lower than the limits of drinking water. However, some maximum values exceeded the EU limit, but all values were below the WHO standards as Pb, Ni, Zn.

Nutrient concentrations were found within acceptable limits, while bicarbonates were the dominant ions coming from the dilution of limestone and marble of the mountainous part of the river basin. They claimed that Nestos River presents no significant pollution problems. The water quality of the river was in good condition with concentrations of pollutants below the limits set for drinking water. No significant seasonal and spatial variations were observed, suggesting little impact from human activities on the part of river basin under investigation

Several pesticides were detected in the Nestos River basin. Chlorpyrifos was the most frequentlydetected pesticide.In some samples, violations of the Annual Average of Environmental Quality Standards (AA-EQS) as well as Maximum Allowable Concentration (MAC) of EQS were identified for alphamethrin and chlorpyrifos. Nevertheless, most of the examined pesticides were at relatively low concentrations.

State of the art fingerprinting and data interpretation techniqueswere used for the analysis of three oil samples. Hydrocarbon distribution patterns of unknown oils were recognized. Multiple suites of analytes were quantified and compared. A variety of diagnostic ratios of ‘‘source-specific marker’’ compounds for interpreting chemical data were further determined and analyzed. Despite the fact that crude oil is a major suspected pollutant, no correlation can be identified.

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.

In target areas of MONITOX network in Romanian sector, there were analysed surface waters and sediments in order to establish the quality, according with Romanian legislation and EU Water Framework Directive. The indicators selected are representative for the toxicants class assumed in our project.

Mercury concentrations determined in surface waters and sediments had values that do not exceed the standard limits and had a general trend of increasing from Ostrov (bac pass) to Sf. Gheorghe (branch mouth).

Form nutrients point of view, ammonia, nitrate, expressed in nitrogen, dissolved phosphorus and total phosphorus, the surface waters had a very good and good ecological status.

Nitrite concentrations had values corresponding to second quality class. In the Black Sea coastal are, the values are corresponding to first quality class, except Gura Portitei (third quality class).

Comparing with historical data (1996-2002), the general trends of nutrients concentrations is of decreasing. Also, the evolutions in nutrients concentrations are similar.

Water Quality Index, a useful tool for surface water management developed for stakeholders in order to have a general view of water quality, has values in general corresponding to very good and moderate ecological status.

The chemical results represented in GIS system, by maps, are also an efficient tool for authorities and stakeholders, population, in order to understand the scientific terms and language through a visualizing environment.

Environmental Risk Assessment (ERA) methodologies on regional (ranking system) and local level (conceptual model) will be performed for individual sites. Three principal factors should be taken into consideration: level and pollution spectrum, risk receptors and distribution potential. The pollution spectrum is complex and consists of six groups of toxic substances. 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.

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 through 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.

Because the contamination of environmental compartments (water, soil, biota) with heavy metals, radionuclides, hydrocarbons, detergents or pharmaceuticals or release of radioactive gases (radon, thoron) can cause health problems, we considered that it was necessary to create a computer application for the detection of health risks. This platform will take into account each pollutant group, the location in water, soil, flora or fauna and the age group of persons (children, adults or seniors). In order to create the application (Fig. C.1), we used a series of indices existing in the literature and measured or historical data, described in the *Deliverable D.T1.6.4. New ICT tools - health risk calculator version 1.0*.

Fig. C.1. Health risk calculator version 1.0

The health risk calculator scheme was developed, based on reviewed risk coefficients for various toxic pollutants.

Annex 1. Water quality - European Directives -transposition and implementation in Romanian legislation

Annex of Annual Scientific Report - List of elaborated scientific papers in the frame of BSB 27-MONITOX project

List of LP1 published papers on BSB 27 MONITOX project

1. Ene A., Elena Zubcov, Thomas Spanos, Oleg Bogdevich, Liliana Teodorof, "Interdisciplinary Cooperation for Ecological Monitoring in the Black Sea Basin", S1.01, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D,, 2019, ISBN 978-606-8896-00-7, pp.17-18.
2. Ene A., 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", S1.07, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, pp.24-26.
3. Ene A., 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", S1.08, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, pp.26-27.
4. Ene A., Pintilie V., Radon and Thoron Activity Concentrations in Selected Indoor Environments in Lower Danube and Danube Delta Region, Romania, S3.07, Abstract book MONITOX International Symposium "Deltas and Wetlands" , September 15th-17th, 2019, Tulcea, Romania, pp.70-71.
5. Pantelica A., Ene A., PIXE Analysis of Elemental Content in River and Underground Water, S3.08, Abstract book MONITOX International Symposium "Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, p.72.
6. Ene A., Gosav S., Capabilities of FT-IR Spectroscopy for the Investigation of Microplastics in Environmental Samples and Personal Care and Cosmetic Products, S3.13, Abstract book MONITOX International Symposium "Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, pp.77-78.
7. Vasile A., Ene A., Bahrim G., 2019, Microbiological Quality and Contamination Level of Danube River Water in Ostrov-Isaccea Sector, South-Eastern Part of Romania, S1.12, Abstract book MONITOX International Symposium "Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, pp.30-31.
8. Ene A., 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, S2.14, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, p.57.
9. Enachi E., Carmen Chițescu, Gabriela Bahrim, Antoaneta Ene, Monitoring of Emerging Pollutants from Aquatic Ecosystems – Antibiotics, Endocrine Disruptors and Contraceptives, S1.13, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp. 32-33.
10. Arbanas (Moraru) S.S., Ene A., Gosav S., Moraru D.I., Intensive Agricultural Practices and Industrial Activities Influence on Soil Fertility of Agroecosystems from Prut and Siret Lowlands, SE Romania, S3.16, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp.80-81.
11. Zubcov E., Ion Toderas, Ungureanu Laurentia, 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", S1.04, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, p.20-21.

12. Bogdevich O., Ene A., Igor Nicoara, Oleg Cadocinicov, Elena Culighin, Elena Nicolau, The Characteristic of Sediments Quality of Natural Lakes in Lower Prut Region, S2.03., Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp.44-45.
13. Spanos T., Nikolaos Mittas, Antoaneta Ene, Christina Chatzichristou, Konstantinos Dermentzis, Oleg Bogdevich,"Evaluation of Groundwater Quality through Environmetrics. The case of Kavala Region",S3.01, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, p.62.
14. Teodorof L., 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, S1.05, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, p.22.
15. Jurminskaia, O.; Zubcov, E.; Bagrin, N.; Biletchi, L.; Ene, A.; Teodorof, L. The Use of DO-BOD Correlation to Assess the Biochemical Potential of Water Ecosystem, S2.15, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp.58-59.
16. Tumanova, D.; Ungureanu, L.; Andreev, N.; Ene, A.; Teodorof, L. Diversity of phytoplankton and water quality in the Danube, S1.20, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp.40-41.
17. Bulat, Dm.; Bulat, Dn.; Toderas, I.; Usatîi, M.; Ungureanu, L.; Ene, A.; Zubcov, E. Comparative aspects of ichthyofauna of Dniester and Prut Rivers, S2.07, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp.49-50.
18. Burada A., Despina C., Secelenau-Odor D., Tiganus M., Teodorof L., Ene A., Tudor M., Adrian Burada, Nutrient Level in Surface Water near Urban Agglomerations. Case Atudy: Confluence Area Siret - Danube -Prut,S1.09, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp. 28
19. Despina C., Teodorof L., Burada A., Seceleanu Odor D., Spiridon C., Tudor I.M., Tudor M., Ene A., Application of Inductively Coupled Plasma Mass Spectrometry (ICP-MS) in the Field of Environmental Protection, S1.14, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.34
20. Spiridon C., Burada A., Teodorof L., Despina C., Seceleanu Odor D., Tudor M., Ene A., Georgescu L.P., Spatial Distribution of Phytoplankton in Razim Lake, S1.15, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.35
21. Seceleanu-Odor D., Despina C., Burada A., Teodorof L., Spiridon C., Tiganus M., Ene A., Tudor M., Percentage Distribution of Nitrogen Forms in Aquatic Complex Somova-Parches in 2018,S1.16, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.36.
22. Arbanas (Moraru) S.S., Ene A., Gosav S., 2019, Mineralogical Composition Assessment of Soils from Covurlui and Braila Plains by ATR-FTIR Technique, Proceedings, 29, 80; doi:10.3390/proceedings2019029080. (will be presented at the 15th International Symposium "Priorities of Chemistry for a Sustainable Development" PRIOCHEM, Bucharest, Romania, 30th October–1st November 2019)
23. Bogdevich O., Ene A., Teodorof L., Cadocinicov O., Culighin E., Nicolau E., Grigoras M., The study of toxic substances in Low Danube region of Republic of Moldova, Oral presentation O19, Book of Abstracts International Conference "Achievements and Perspectives of Modern Chemistry", October 9-11, 2019, Chisinau, Republic of Moldova, p.46.
24. Bogdevich O., Spanos T., Ene A., Cadocinicov O., Culighin E., Nicolau E., Grigoras M., The analysis of groundwater quality in monitoring network of Republic of Moldova, Oral presentation O22, Book of Abstracts International Conference "Achievements and Perspectives of Modern Chemistry", October 9-11, 2019, Chisinau, Republic of Moldova, p.49.
25. Ene A., Clase de substanțe toxice investigate în cadrul proiectului MONITOX. Izotopi radioactivi și nivelul dozelor de radiații nucleare în regiunea Dunării de Jos și Bazinului Mării Negre / Classes of

toxic substances investigated in the frame of MONITOX project. Radioactive isotopes and level of nuclear radiation doses in Lower Danube region and Black Sea Basin, Regional Workshop „Environmental Pollution of Aquatic Ecosystems of Danube-Black Sea Basin", Chisinau, 16-17 May 2019.

26. Bahrim G., Poluanți emergenți persistenți în ecosisteme acvatice – compuși farmaceutici / Emerging persistent pollutants in aquatic ecosystems – pharmaceutical compounds, Regional Workshop „Environmental Pollution of Aquatic Ecosystems of Danube-Black Sea Basin" , Chisinau, 16-17 May 2019.
27. Ene A., Elena Zubcov, Oleg Bogdevich, Yuriy Denga, Thomas Spanos, International cooperation for ecological monitoring in the border areas of the Lower Danube Euroregion, UGAL International Conference Multidisciplinary HUB for the Higher Education Internationalization by Means of Innovative Interaction with the Labour Market and Society, Section 6. Advanced Research in Environmental Science and Engineering, October 26-27, 2018, Galati.
28. Sloată F., Antoaneta Ene, Determination of PCB content in industrial waste water, UGAL International Conference Multidisciplinary HUB for the Higher Education Internationalization by Means of Innovative Interaction with the Labour Market and Society, Section 6. Advanced Research in Environmental Science and Engineering, October 26-27, 2018, Galati.
29. Ene A., Ana Pantelică, Sorina-Simona Arbanaș (Moraru), Violeta Pintilie, Florin Sloată, Florina Cristiana Căpriță, Mihai Straticiuc ,Claudia Stihi, Marina Frontasyeva, Oleg Bogdevich, Elena Culighin, Development of analysis methodology using Proton Induced X-ray Emission (PIXE) as a complementary technique to determine trace elements in environmental matrices, Scientific Conference of the Doctoral Schools – Perspectives and challenges in doctoral research, 7th edition (SCDS-UDJG), Galați, 13-14 June 2019.
30. Sloata F., Antoaneta Ene, ED-XRF analysis of trace elements in soils located in the vicinity of a former chemical plant, TIM 19 Physics Conference, Timisoara, Romania, 29 – 31 mai 2019.
31. Ene A., Violeta Pintilie, Ana Pantelica, Assessment of radon, thoron and their descendants in selected indoor environments in Romania, International Symposium on Natural Radiation Sources – Challenges, Approaches and Opportunities, 21-24 May 2019, Bucharest, Romania
32. Ene A., Contribuții ale Catedrei de Fizică a Universității Dunărea de Jos din Galați la proiecte internaționale din domeniul mediului și al sănătății, Conferința științifică cu participarea elevilor:"Fizica medicală: simbioză între Fizică, Medicină și Mediu", Galati, 28 februarie 2019.
33. Sion A., Ene A., Metode fizico-chimice folosite pentru determinarea metalelor grele din sol, Conferința științifică cu participarea elevilor:"Fizica medicală: simbioză între Fizică, Medicină și Mediu", Galati, 28 februarie 2019.
34. Sion A., Ene A., Efectele poluării solului asupra sănătății umane, Conferința științifică cu participarea elevilor, "Fizica medicală: simbioză între Fizică, Medicină și Mediu", Galati, 28 februarie 2019.

List of PP2 published papers on BSB 27 MONITOX project

1. Bulat, Dm.; Bulat, Dn.; Toderas, I.; Usatîi, M.; Ungureanu, L.; Ene, A.; Zubcov, E. Comparative aspects of ichthyofauna of Dniester and Prut Rivers. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, pp.49-50. ISBN 978-606-8896-00-7
2. Bulat, Dn.; Bulat, Dm.; Zubcov, E.; Usatîi, M.; Biletchi, L.; Andreev, N. The Gobiidae family in aquatic ecosystems of the Republic of Moldova. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, p.53. ISBN 978-606-8896-00-7
3. Ene, A.; Bogdevich, O.; Zubcov, E.; Denga, Y.; Spanos, T.; Pantelică, A.; Frontasyeva, M.; Stihi, C.; Teodorof, L.; Burada, A.; Despina, C.; Moraru, D. I.; Culighin, E.; Sion, A.; Bașliu, V.; Ceoromila, A.; Moraru, S. S.; Sloată, F. Nuclear and atomic techniques used for the quantification and mapping of heavy metals and trace elements in soils. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, pp.24-26. ISBN 978-606-8896-00-7
4. Ene, A.; Cîrciumaru, A.; Bîrsan, I. G.; Zubcov, E.; Bogdevich, O.; Spanos, T.; Cartaș, V.; Pascu, E.; Pintilie, V.; Sloată, F.; Patrascu, N.D.; Vodarici, L.; Stăvărache, M. Radioactivity Levels in Selected Areas of the Black Sea Basin in Romania, Republic of Moldova and Greece. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, pp.26-27. ISBN 978-606-8896-00-7
5. Ene, A.; Zubcov, E.; Spanos, T.; Bogdevich, O.; Teodorof, L. Interdisciplinary cooperation for ecological monitoring in the Black Sea Basin. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, pp.17-18. ISBN 978-606-8896-00-7
6. JURMINSKAIA, O.; ZUBCOV, E.; BAGRIN, N.; BILETCHI, L.; ENE, A.; TEODOROF, L. The Use of DO-BOD Correlation to Assess the Biochemical Potential of Water Ecosystem. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, pp.58-59. ISBN 978-606-8896-00-7
7. LEBEDENCO, L.; ZUBCOV, E.; UNGUREANU, L.; ANDREEV, N. The use of Daphnia magna Straus, 1820 as a test object in ecotoxicological studies. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, pp.39-40. ISBN 978-606-8896-00-7
8. TUMANOVA, D.; UNGUREANU, L.; ANDREEV, N.; ENE, A.; TEODOROF, L. Diversity of phytoplankton and water quality in the Danube. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, pp.40-41. ISBN 978-606-8896-00-7
9. ZUBCOV, E.; TODERAS, I.; UNGUREANU, L.; ENE, A.; SPANOS, T.; TEODOROF, L.; BOGDEVICI, O.; BAGRIN, N.; ZUBCOV, N.; BILETCHI, L.; ANDREEV, N.; CIORNEA, V.; GROSU, N.; CIORBA, P. Ecotoxicological investigations on water ecosystems. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, pp.20-21. ISBN 978-606-8896-00-7
10. ZUBCOV, E.; ZUBCOV, N. Monitoring of trace metals in the ontogenesis of freshwater fish. In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, p.23. ISBN 978-606-8896-00-7
11. ZUBCOV, E.; ZUBCOV, N.; UNGUREANU, L.; BAGRIN, N.; JURMINSKAIA, O.; BILETCHI, L.; ANDREEV, N.; TUMANOVA, D. Influence of trace metals and biogenic elements on the production processes and biochemical oxygen consumption-CBO_5 (in situ and laboratory modelling). In: MONITOX International Symposium ,,Deltas and Wetlands", September 15th-17th, 2019, Tulcea, Romania, Abstract book, Tulcea: C.I.T.D.D, 2019, pp.45-46. ISBN 978-606-8896-00-7

List of PP3 published papers on BSB 27 MONITOX project

1. Thomas Spanos, Nikolaos Mittas, Antoaneta Ene,Christina Chatzichristou, Konstantinos Dermentzis,Oleg Bogdevich,"Evaluation of Groundwater Quality through Environmetrics. The case of Kavala Region". Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p62, S3.01
1. Sophia Mitkidou, Nikolaos Kokkinos, Konstantinos Trompakas,"Forensic Fingerprinting of Biomarkers for Oil Spill Characterization: The Case Study of Kavala, Greece". Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p37, S1.17
2. George N. Zaimes, Valasia Iakovoglou, Dimitrios Emmanouloudis and Olga Papantsiou,"WaSec – Innovative Educational Tools for the Sustainable Management of Semi-Aquatic Ecosystems to Promote Water Security in the Eastern Mediterranean".Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p66, S3.04
3. Christina Chatzichristou, Ioannis Kalavrouziotis, Thomas Spanos"Reuse of Treated Municipal Wastewater Effluents for Irrigation in Protected Areas: The Case of Nestos Delta Region".Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p78, S3.14
4. Vilson Topi, Thomas Spanos, Christina Chatzichristou, "Quantitative and Semi-quantitative analysis using Inductively Coupled Plasma- Mass Spectrometry (ICP-MS)".Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p79, S3.15
5. Nikolaos Kamidis, Georgios Sylaios, Argyris Sapounidis, Manos Koutrakis,"Investigating the Quality of Nestos River System". Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p38, S1.18
6. 7.Mitska Aikaterini, Deligianni Aspasia, Kostopoulou Chrysanthi, Thomas Spanos, "The Potable Water Quality of Kavala, Northern Greece". Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p61, S2.17
7. 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".
8. Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p69, S3.06
9. Paschalis Koutalakis, Ourania Tzoraki, George N. Zaimes, "Detecting Riverbank Changes with Remote Sensing Tools. Case study: Aggitis River in Greece". Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p76, S3.12
10. Achilleas Ntaoutis, Georgia Soukou, Emmanouela Apostolidou, Thomas Spanos, "A Bibliographic Survey of The Existence of Radon in The Greek Territory".Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p81, S3.17
11. Antoaneta Ene, Elena Zubcov, Thomas Spanos, Oleg Bogdevich, Liliana Teodorof, "Interdisciplinary Cooperation for Ecological Monitoring in the Black Sea Basin". Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p17, S1.01
12. Elena Zubcov, Ion Toderas, Ungureanu Laurentia, 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".Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p20, S1.04
13. 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"Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p24, S1.07
14. 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" Abstract book MONITOX International Symposium "Deltas and Wetlands" Sept 15th-17th 2019, Tulcea, Romania, p26, S1.08

List of PP4 published papers on BSB 27 MONITOX project

1. Bogdevich O., Ene A., Igor Nicoara, Oleg Cadocinicov, Elena Culighin, Elena Nicolau, The Characteristic of Sediments Quality of Natural Lakes in Lower Prut Region, S2.03., Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, pp.44-45.
2. Bogdevich O., Igor Nicoara, Oleg Cadocinicov, Elena Culighin, Evgenii Isicico, Victor Jeleapov, 2019, The Application of GIS Technology for Environmental Risk Assessment from Toxic Substances, S3.09., Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, p.73.
3. Bogdevich O., Ene A., Teodorof L., Cadocinicov O., Culighin E., Nicolau E., Grigoras M., The study of toxic substances in Low Danube region of Republic of Moldova, Oral presentation O19, Book of Abstracts International Conference "Achievements and Perspectives of Modern Chemistry", October 9-11, 2019, Chisinau, Republic of Moldova, p.46.
4. Bogdevich O., Spanos T., Ene A., Cadocinicov O., Culighin E., Nicolau E., Grigoras M., The analysis of groundwater quality in monitoring network of Republic of Moldova, Oral presentation O22, Book of Abstracts International Conference "Achievements and Perspectives of Modern Chemistry", October 9-11, 2019, Chisinau, Republic of Moldova, p.49.
5. Ene A., Elena Zubcov, Thomas Spanos, Oleg Bogdevich, Liliana Teodorof, "Interdisciplinary Cooperation for Ecological Monitoring in the Black Sea Basin", S1.01, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, C.I.T.D.D,, 2019, ISBN 978-606-8896-00-7, pp.17-18.
6. Ene A., 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", S1.07, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, pp.24-26.
7. Ene A., 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", S1.08, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, pp.26-27.
8. Ene A., Elena Zubcov, Oleg Bogdevich, Yuriy Denga, Thomas Spanos, International cooperation for ecological monitoring in the border areas of the Lower Danube Euroregion, UGAL International Conference Multidisciplinary HUB for the Higher Education Internationalization by Means of Innovative Interaction with the Labour Market and Society, Section 6. Advanced Research in Environmental Science and Engineering, October 26-27, 2018, Galati.
9. Ene A., Ana Pantelică, Sorina-Simona Arbanaș (Moraru), Violeta Pintilie, Florin Sloată, Florina Cristiana Căpriță, Mihai Straticiuc, Claudia Stihi, Marina Frontasyeva, Oleg Bogdevich, Elena Culighin, Development of analysis methodology using Proton Induced X-ray Emission (PIXE) as a complementary technique to determine trace elements in environmental matrices, Scientific Conference of the Doctoral Schools – Perspectives and challenges in doctoral research, 7th edition (SCDS-UDJG), Galați, 13-14 June 2019.
10. Spanos T., Nikolaos Mittas, Antoaneta Ene, Christina Chatzichristou, Konstantinos Dermentzis, Oleg Bogdevich,"Evaluation of Groundwater Quality through Environmetrics. The case of Kavala Region",S3.01, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17, 2019, Tulcea, Romania, p.62.
11. Zubcov E., Ion Toderas, Ungureanu Laurentia, 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", S1.04, Abstract book MONITOX International Symposium "Deltas and Wetlands" September 15-17 2019, Tulcea, Romania, p.20-21.

List of PP5 published papers on BSB 27 MONITOX project

1. Ene A., Zubcov E., Spanos T., BogdevichO., Teodorof L., 2019, Interdisciplinary Cooperation for Ecological Monitoring in the Black Sea Basin, S1.01, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.17-18.
2. Zubcov E. Toderas I., Ungureanu L., Ene A., Spanos T., Teodorof L., Bogdevici O., Bagrin N., Zubcov N., Biletchi L., Andreev N., Ciornea V., Grosu N., Ciorba P., “Ecotoxicological Investigations on Water Ecosystems”, S1.04, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7p.20-21.
3. Teodorof L., Burada A., Despina C., Seceleanu –Odor D., Tiganus M., Spiridon C., Tudor M., Ene A., 2019, Mercury Concentrations in Surface Waters and Sediments from Target Areas of MONITOX Network, S1.05, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7p.22
4. Ene A., Bogdevich O., Zubcov E., Denga Y., Spanos T., Pantelică A., Frontasyeva M., Stihi C., Teodorof L., Burada A., Despina C., Moraru D.I., Culighin E., Sion A., Bașliu V., Ceoromila A., Moraru S.S., Sloată F., Nuclear and Atomic Techniques Used for the Quantification and Mapping of Heavy Metals and Trace Elements in Soils, S1.07, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.24-26
5. Burada A., Despina C., Secelenau-Odor D., Tiganus M., Teodorof L., Ene A., Tudor M., Adrian Burada, Nutrient Level in Surface Water near Urban Agglomerations. Case Atudy: Confluence Area Siret - Danube -Prut,S1.09, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp. 28
6. Despina C., Teodorof L., Burada A., Seceleanu Odor D., Spiridon C., Tudor I.M., Tudor M., Ene A., Application of Inductively Coupled Plasma Mass Spectrometry (ICP-MS) in the Field of Environmental Protection, S1.14, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.34
7. Spiridon C., Burada A., Teodorof L., Despina C., Seceleanu Odor D., Tudor M., Ene A., Georgescu L.P., Spatial Distribution of Phytoplankton in Razim Lake, S1.15, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.35
8. Seceleanu-Odor D., Despina C., Burada A., Teodorof L., Spiridon C., Tiganus M., Ene A., Tudor M., Percentage Distribution of Nitrogen Forms in Aquatic Complex Somova-Parches in 2018,S1.16, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.36.
9. Tumanova, D.; Ungureanu, L.; Andreev, N.; Ene, A.; Teodorof, L. Diversity of phytoplankton and water quality in the Danube,S1.20, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.40-41.
10. NăstaseA., Fish Fauna from Freshwater Danube Delta, S2.09, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp. 52
11. Suliman I., Tudor I.M., Tofan L., Assessment of Water Quality in Flowing Ecosystems from Danube Delta Biosphere Reserve Based on Zooplankton Community, S2.11, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.54
12. Jurminskaia, O.; Zubcov, E.; Bagrin, N.; Biletchi, L.; Ene, A.; Teodorof, L. The Use of DO-BOD Correlation to Assess the Biochemical Potential of Water Ecosystem,S2.15, Abstract book

MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, pp.58-59.

13. Trifanov C., Burada A., Teodorof L., Visualizing the Chemical Parameters in surface Water of the Danube River. Case Study: Danube River Km 175 – Km 67, S3.11, Abstract book MONITOX International Symposium “Deltas and Wetlands” September 15-17, 2019, Tulcea, Romania, C.I.T.D.D, 2019, ISBN 978-606-8896-00-7, pp.75
14. Bogdevich O., Ene A., Teodorof L., Cadocinicov O., Culighin E., Nicolau E., Grigoras M., The study of toxic substances in Low Danube region of Republic of Moldova, Oral presentation O19, Book of Abstracts International Conference “Achievements and Perspectives of Modern Chemistry”, October 9-11, 2019, Chisinau, Republic of Moldova, p.46.