WATER QUALITY IN IRON GATE / DJERDAP NATURAL PARKS. FIRST FINDINGS OF "AEPS", AN INTERREG – IPA CBC ROMANIA – SERBIA PROJECT.

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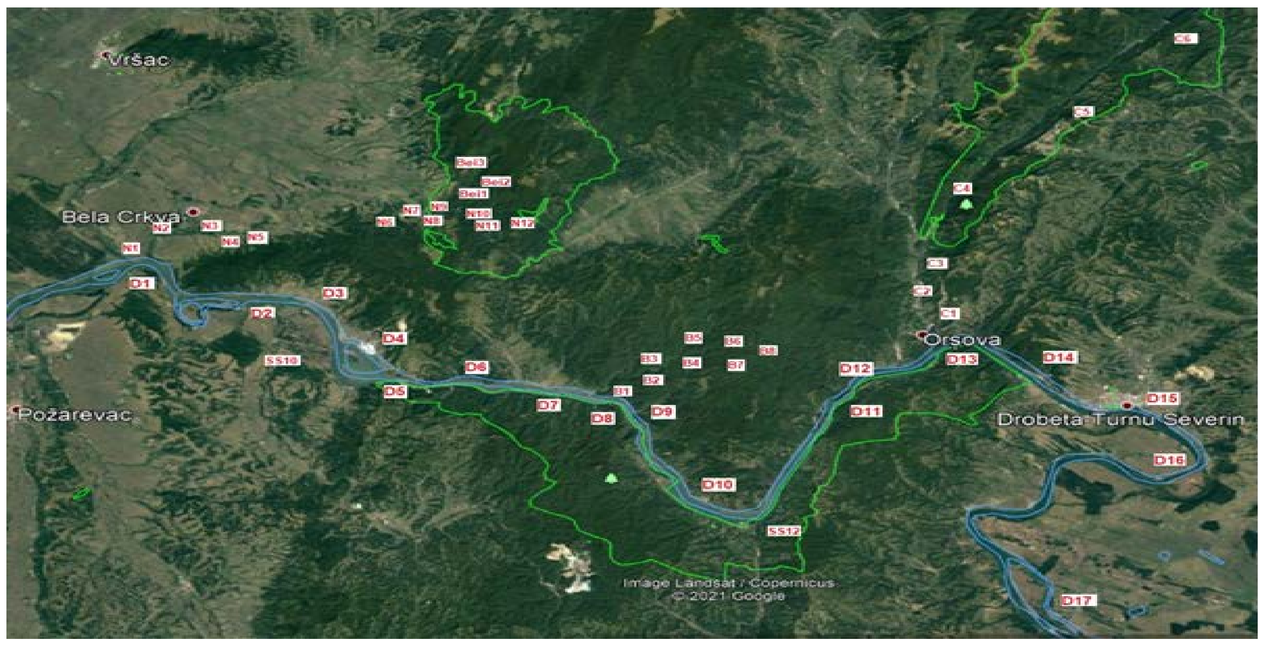
Abstract

The paper presents the objectives and expected results of a new started research project that involves two relevant education and research Balkan institutions, University Politehnica Timisoara (RO) and University of Belgrade, Technical Faculty in Bor (SR) and also two regional relevant NGO's in the field of environmental awareness raising, Pro Mehedinti Association (RO) and Citizen's association "Village – Movement for Rural Development Zlot (SR). Thru the "AEPS" project, specific water quality analysis were performed on Danube and its main tributaries in target area (Nera, Cerna, Berzasca, Porecka and Pek): COD, CBO5, ammonia, nitrates, nitrites, phosphates, conductivity and heavy metals contaminants.

Introduction

As water is essential to life and is an indispensable resource for ecosystems and their services and for nearly all human activities, our project team experts focused project activities to reach 2 main objectives:

- ✓ Evaluation of environmental current situation in cross border "sister" Danube banks nature reservation Djerdap (Serbia) and national parks Iron Gate (Romania)
- ✓ Raising the awareness of young generations on both sides of the border on the immediate need to protect the region remarkable natural heritage.



Surface water samples were collected in 2020, in 48 sampling locations from Danube and its main 5 tributary rivers in the Interreg IPA-CBC Romania-Serbia Programme eligibility area.

A minimum of 4 samples were collected for each sampling location, analysed in situ and preserved for laboratory analysis:

- ✓ Danube: 17 sampling location
- ✓ Nera river: 12 sampling points and 3 sampling points on Bei river
- ✓ Pek river: 1 sampling location
- ✓ Berzasca river: 8 sampling location
- ✓ Porecka river: 1 sampling location
- ✓ Cerna river: 6 sampling location

All project results, studies, activities, outputs, photo gallery and visibility actions can be followed on project webpage: www.aeps.upt.ro

Methodology and results.

Immediate analysis for pH, temp, total hardness and dissolved oxygen were performed on site and all samples were preserved in-situ with acids and analyzed in laboratory with international reference and recognized analytical methods, as seen in table below.

An example of the results obtained is presented in the next table.

Parameters	Sample preservation		Measurement methods
	Hold time	Addition acids to pH<2	
pH	In situ	None	Electrode - electric potential difference
Conductivity			Electrolytic probe
Dissolved oxygen (DO)			Galvanic probe
Chemical oxygen demand (COD – CCO-Cr)	28 days	H_2SO_4	Velp Eco6 thermo-reactor
Biochemical oxygen demand (BOD – CBO5)	48 hours	None	Analytik Jena Specord 250Plus, UV-VIS photometric method
Ammonia (NH_4^+)	28 days	H_2SO_4	
Nitrates (NO_3^-)	48 hours	None	
Nitrites (NO_2^-)	48 hours	None	HANNA HI 83200, UV-VIS photometric method
Orto phosphate $P\text{-}PO_4^{3-}$	48 hours	None	
Sulphates (SO_4^{2-})	28 days	None	
Chloride (Cl^-)	28 days	None	
Total Nitrogen (TN)	28 days	H_3PO_4	Analytik Jena Multi N/C 3100. Corrosion-free Focus-Radiation NDIR detection and furnace technology of combustion.
Sodium (Na+)	6 months	HNO_3	Analytik Jena ZEEnit 700 P Compact Tandem Spectrometer. Atomic Absorption Spectrometry – equipped with flame, hydride and graphite furnace, with Zeeman magnetic field control and Deuterium and Zeeman background correction. ICP-OES Perkin Elmer Optima 8300 Inductively Coupled Plasma Optical Emission spectroscopy equipped with Segmented-array Charge-coupled Device.
Calcium (Ca2+)			
Iron (Fe – total)			
Arsenic (As_3^+)			
Lead (Pb)			
Zinc (Zn_2^+)			
Cadmium (Cd)			
Manganese (Mn - total)			
Mercury (Hg)	28 days	HNO_3	

Results obtained for parameter analysis in samples of Danube, between 14 august 2020 and 19 October 2020. ***D1*** *– Bazias,* ***D2*** *– Divic,* ***D3*** *– Pojejena,* ***D4*** *– Moldova-Noua,* ***D5*** *– Coronini,* ***D6*** *– Liborajdea,* ***D7*** *– Liubcova,* ***D8*** *– Berzasca,* ***D9*** *– Cozla,* ***D10*** *– Svinita,* ***D11*** *– Dubova,* ***D12*** *– Esalnita,* ***D13*** *– Orsova,* ***D14*** *– Iron Gate I,* ***D15*** *– Drobeta Tr. Severin,* ***D16*** *– Ostrovul Corbului,* ***D17*** *– Iron Gate II*

Parameter	Unit	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	Eco state
		24 - 27.09.2020						14 - 15.08.2020						18 - 19.10.2020					
pH	-	6.9	7.1	7.5	6.5	7.1	7.2	7.3	7.5	7.5	7.4	7.2	7.3	7.1	7.5	7.0	6.7	6.7	-
Conductivity	µS/cm	399	402	408	411	411	405	408	409	405	402	403	405	399	389	394	388	404	-
Oxygen concentration																			
Dissolved oxygen (DO)	mgO_2/l	7.5	7.2	7.2	7.1	7.2	7.2	7.5	7.5	7.3	7.2	6.9	7.4	7.2	7.4	7.0	6.5	6.4	II[nd]
Biochemical oxygen demand (BOD – CBO5)	mgO_2/l	3.6	3.3	3.5	3.7	3.5	3.2	3.2	3.4	3.5	3.5	3.5	3.6	3.4	3.4	3.3	3.3	3.2	II[nd]
Chemical oxygen demand (COD – CCO-Cr)	mgO_2/l	26	22	20	24	25	22	20	22	24	26	27	25	24	20	20	18	18	II[nd]
Nutrients and general ions concentrations																			
Sodium (Na+)	mg/l	2.1	3.4	4.1	1.9	2.5	3.4	2.9	3.3	3.4	2.8	2.2	2.7	3.5	3.3	4.1	3.8	2.9	I[st]
Calcium (Ca_3+)	mg/l	4.5	5.8	6.5	5.1	6.5	6.8	7.2	7.1	6.1	5.8	4.7	5.6	5.3	4.9	5.8	5.1	3.9	I[st]
Ammonia (NH_4^-)	mg/l	0.11	0.21	0.22	0.16	0.18	0.28	0.31	0.24	0.18	0.16	0.14	0.21	0.16	0.18	0.28	0.31	0.33	I[st]
Nitrates (NO_3^-)	mg/l	0.77	0.84	0.85	0.81	0.99	0.92	0.88	0.78	0.81	0.79	0.72	0.80	0.84	0.72	0.72	0.68	0.66	I[st]
Nitrites (NO_2^-)	mg/l	0.022	0.029	0.021	0.025	0.018	0.022	0.027	0.021	0.021	0.024	0.028	0.021	0.020	0.020	0.019	0.017	0.016	II[nd]
Orthophosphate ($P\text{-}PO_4^{3-}$)	mg/l	0.31	0.28	0.29	0.35	0.31	0.18	0.24	0.25	0.30	0.27	0.32	0.30	0.27	0.22	0.25	0.21	0.22	III[rd]
Sulphates (SO_4^{2-})	mg/l	8.3	9.7	10.4	7.5	12.1	8.7	11.2	14.5	12.1	10.2	8.1	7.8	9.8	10.2	8.1	7.2	7.1	I[st]
Chloride (Cl^-)	mg/l	3.5	8.1	6.2	3.2	5.7	8.1	7.4	8.2	5.2	5.1	3.6	3.6	4.5	5.2	7.6	18.5	11.1	I[st]
Total Nitrogen (TN)	mg/l	1.21	1.32	1.18	1.11	1.12	1.18	1.20	1.18	1.19	1.16	1.15	1.17	1.21	1.11	1.15	1.01	0.98	I[st]
Heavy Metals concentrations																			
Mercury (Hg)	µg/l	0.011	0.017	0.012	0.011	0.012	0.014	0.012	0.012	0.011	0.011	0.009	0.011	0.012	0.010	0.009	0.016	0.015	I[st]
Arsenic (As_3^+)	µg/l	0.09	0.12	0.09	0.11	0.12	0.14	0.09	0.10	0.12	0.10	0.11	0.14	0.11	0.09	0.11	0.14	0.14	I[st]
Lead (Pb)	µg/l	0.21	0.24	0.21	0.25	0.28	0.21	0.22	0.18	0.20	0.21	0.22	0.21	0.24	0.22	0.22	0.28	0.31	I[st]
Zinc (Zn_2^+)	µg/l	21.1	18.5	14.5	17.8	20.1	18.5	18.4	20.1	20.2	17.9	19.1	21.0	20.8	19.7	19.4	23.3	18.1	I[st]
Cadmium (Cd)	µg/l	0.004	0.009	0.007	0.005	0.008	0.012	0.005	0.008	0.011	0.014	0.008	0.011	0.018	0.011	0.042	0.107	0.088	I[st]
Manganese (Mn - total)	mg/l	0.011	0.021	0.018	0.011	0.014	0.016	0.020	0.018	0.014	0.011	0.011	0.012	0.011	0.016	0.011	0.018	0.012	I[st]
Iron (Fe – total)	mg/l	0.766	0.821	0.855	0.891	0.685	0.801	0.721	0.689	0.807	0.804	0.792	0.695	0.744	0.803	0.911	1.822	2.193	III[rd]

Conclusions.

In this frame and after analysing the results obtained by AEPS project team experts after sampling and analysis surface water on Danube, one can conclude that Ecological Status Classification varies from **HIGH** (quality) to **GOOD** on Danube, with oxygen concentration parameters (DO, COD and BOD5) are all in II[nd] class, **GOOD**; most of the nutrients (Na^+, Ca_2^+, NH_4^-, NO_3^-, SO_4^{2-}, TN) fall into I[st] class, **HIGH** quality while orthophosphates $P\text{-}PO_4^{3-}$ concentrations classifies Danube water quality in III[rd] class, **MODERATE**. The heavy metals concentration in Danube surface waters in analysed area were all (Hg, As, Pb, Zn, Cd and Mn) very low, well into I[st] class, **HIGH** quality. The only exception was found for Iron (Fe), whose values were constantly, to all length of analysed area, into III[rd] class, **MODERATE** water quality.

Complete results and conclusions drawn can be found at: http://aeps.upt.ro/wp-content/uploads/2021/04/web_Study-on-Danube-surface-water-quality-in-Djerdap-Iron-Gate-protected-area.pdf

Aknowledgment.

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