

Integrated biomarker response of oxidative stress parameters in the digestive gland and gills of autochthonous and invasive freshwater mussels from the Sava River, Serbia

Slavica Borković-Mitić^{1*}, Bojan Mitić^{2,3}, Jelena Vranković⁴, Katarina Jovičić⁴, Slađan Pavlović¹

¹ Department of Physiology, University of Belgrade, Institute for Biological Research “Siniša Stanković” – National Institute of the Republic of Serbia, Bulevar Despota Stefana 142, 11108 Belgrade, Serbia; borkos@ibiss.bg.ac.rs

² Institute of Zoology, University of Belgrade – Faculty of Biology, Studentski Trg 16, 11000 Belgrade, Serbia; bojan@bio.bg.ac.rs

³ Faculty of Technology Zvornik, University of East Sarajevo, Karakaj 34a, 75400 Zvornik, Republic of Srpska, Bosnia and Herzegovina; bojan@bio.bg.ac.rs

⁴ Department of Hydroecology and Water Protection, Institute for Biological Research “Siniša Stanković” – National Institute of the Republic of Serbia, University of Belgrade, Bulevar Despota Stefana 142, 11108 Belgrade, Serbia; jeca.s@ibiss.bg.ac.rs, katarina.jovicic@ibiss.bg.ac.rs

* Correspondence: borkos@ibiss.bg.ac.rs.; Tel.: (+381112078341)

Supplementary Table S1. Physical and chemical characteristics of the Sava River on the sampling site.

	River Sava		ŠABAC		
	Parameter	Unit	Left bank	Middle course	Right bank
Temperature	Water temperature	°C	23,0	22,8	23,0
	Air temperature	°C	25,6	26,2	26,4
Oxygen parameters	Dissolved oxygen	mgO ₂ /L	6,4	6,5	6,4
Carbonates, alkalinity and acidity	Alkalinity	mmol/L	3,7	3,6	3,7
	Total hardness (CaCO ₃)	mg/L	241	226	186
	CO ₂ free	mg/L	3,8	3,3	6,4
	Carbonates (CO ₃ ²⁻)	mg/L	0,0	0,0	0,0
	Bicarbonates (HCO ₃ ⁻)	mg/L	224	219	224
	Total alkalinity (CaCO ₃)	mg/L	184	179	183
pH	pH	pH-jed.	7,8	7,8	7,7
Electrical conductivity	Electrical conductivity	μS/cm	420	421	422
Dissolved ions	Total dissolved salts	mg/L		258	
Nutrients-nitrogen and its compounds	Ammonium (NH ₄ -N)	mg/L	0,04	0,06	0,03
	Nitrites (NO ₂ -N)	mg/L	0,002	0,003	0,002
	Nitrates (NO ₃ -N)	mg/L	0,50	0,70	0,50
	Organic nitrogen(N)	mg/L	0,8	0,6	0,9
	Total nitrogen (N)	mg/L	1,4	1,3	1,5

Nutrients-phosphorus and its compounds	Orthophosphates (PO ₄ -P)	mg/L	0,054	0,051	0,053
	Total phosphorus (P)	mg/L	0,059	0,063	0,065
Silicates	Silicates (SiO ₂)-dissolved	mg/L	5	5	6
Inorganic components-Cations	Calcium (Ca ⁺⁺)	mg/L	69	68	74
Inorganic components - Anions	Magnesium (Mg ⁺⁺)	mg/L	17	14	17
	Chlorides (Cl ⁻)	mg/L	8,0	9,0	9,0
	Sulphates (SO ₄ ⁻)	mg/l	22	25	21
Metals-macro elements	Iron (Fe)-dissolved	mg/L	0,05	0,05	0,050
	Manganese (Mn)-dissolved	mg/L	<0.01	<0.01	<0.01
Metals-microelements	Zinc (Zn)-dissolved	µg/L	<1	<1	<1
	Copper (Cu)-dissolved	µg/L	<1	<1	<1
	Total chromium (Cr) dissolved	µg/L	<1	<1	<1
	Lead (Pb)-dissolved	µg/L	<1	<1	<1
	Cadmium (Cd)-dissolved	µg/L	<0.2	<0.2	<0.2
	Nickel (Ni)-dissolved	µg/L	<1	<1	<1
Metalloids and nonmetals	Arsenic (As)-dissolved	µg/L	<1	<1	<1
Organic compounds	α-BHC	µg/L	<0.001	<0.001	<0.001
Organochlorine pesticides	β-BHC	µg/L	<0.001	<0.001	<0.001
	γ-BHC(Lindan)	µg/L	<0.002	<0.002	<0.002
	Hexachlorobenzene	µg/L	<0.001	<0.001	<0.001
	Heptachlor	µg/L	<0.001	<0.001	<0.001
	Heptachlor-epoxide	µg/L	<0.001	<0.001	<0.001
	Aldrin	µg/L	<0.001	<0.001	0,003
	Endrin	µg/L	<0.002	<0.002	<0.002
	DDE	µg/L	<0.002	<0.002	<0.002
	Dieldrin	µg/L	<0.002	<0.002	<0.002
	p,p'-DDD	µg/L	<0.002	<0.002	<0.02
	p,p'-DDT	µg/L	<0.002	<0.002	<0.002
	o,p'DDT	µg/L	<0.002	<0.002	<0.002
	Methoxychlor	µg/L	<0.003	0,020	<0.003
Triazine-based herbicides	Atrazine	µg/L	<0.009	<0.009	<0.009
	Simazine	µg/L	<0.009	<0.009	<0.009
	Propazine	µg/L	<0.009	<0.009	<0.009
PCBs	PCB 28	µg/L	<0.001	<0.001	<0.001
	PCB 52	µg/L	<0.001	<0.001	<0.001
	PCB 101	µg/L	<0.001	<0.001	<0.001
	PCB 138	µg/L	<0.001	<0.001	<0.001
	PCB 153	µg/L	<0.001	<0.001	<0.001

PCB 180	µg/L	<0.001	<0.001	<0.001
PCB 194	µg/l	<0.001	<0.001	<0.001

* Environmental Quality Standards according to TNMN standards (ICPDR, 2006)