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THE EVALUATION OF ENVIRONMENTAL IMPACT OF HYDROELECTRIC POWER PLANTS IN THE MIDDLE STREAMS OF RIVER DNIESTER BY MULTI-MARKER APPROACH

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The important issue related freshwater quality is the exploring of freshwater sources in the electricity industry. Hydropower is the most important and most economical of renewable energy sources for electricity generation in Europe. Multipurpose hydropower projects could provide services beyond the electricity sector. Besides, hydropower has been identified as highly valuable for climate change mitigation due to its low carbon footprint and high generation efficiency. However, the environmental relevance of hydropower plants, both large-scale and small ones, still remains the subject of scientific discussions. Particularly, the consequences of the accumulation of wastewater effluents, mainly pharmaceutical and personal care products (PPCPs), and disturbing of hydrological regime in the reservoirs of HPPs can impact biotopes [1, 4, 5]. Therefore, issues connected with production of energy from hydropower are at the crossroads of different policies, from water management for electricity generation to ensuring environmental quality and try to find a balance between these sometimes conflicting objectives.

The aim of this study was the evaluation of the environmental relevance of hydropower plants in the middle streams of River

Dniester by the multi-marker approach based on the analyses of water chemistry, molecular biomarkers of stress and toxicity in bivalve mollusk and abundance of toxic species of bacteria. To the best of our knowledge, such approach for the evaluation of HPPs-related ecosystems is used for the first time.

Adult *Unio tumidus* (Unionidae) were collected before and after dam of Kasperivtsi miniHPP on the river Seret (7,5 MW; 48°40′ N, 25°50′ E) (SHPP) and Kochubiiv microHPP on the river Jvanchik (< 1 MW; 48°49′ N, 26°23′ E) (JHPP). Common chemical characteristis of water (17 indices) and a set of biomarkers of stress and toxicity were determined as it was reported earlier in [2, 3].

Water analysis revealed the particularities of the concentration of sulphates, oxygen, oxidizability, that were dependent on the geographic location. Highest level of phenols was detected in SHPP reservoir. The level of metals, namely Zn, Cd, Cu, was within the permitted scopes. However, the results of biomarker analysis have shown the consequences of chronic multigenerational acclimatization to the distorted hydrological regime and chemical pollution in the transformed water bodies. Particular impact was shown in the reservoir of SHPP before dam. In this site, the lysosomal membrane integrity and lysosomal function assessed as cathepsin D activity and efflux, was most vulnerable, both in digestive gland and hemocytes of mussels. Up-regulated activity of the enzyme of transformation glutathione-S-transferase (GST) indicated the presence of PPCPs. About four times higher level of alkali-labile phosphates (ALP) in the honads of male specimens (characteristic of vitellogenin Vtg) than in the specimens from other sites witnessed endocrine disruption caused by common PPCPs [3, 4]. The level of oxyradical production was lesser in the mussels from this reservoir, probably due to the oppression of oxidative stress response. Moreover, the mussels from this miniHPP demonstrated depletion of cholinesterase activity in digestive gland as a sign of neurotoxicity.

Some features were common for both groups of mussels from SHPP. The toxic metals impact was detected by high metallothionein concentration. Highest DNA instability and apoptotic activity

(assessed by the level of key executor caspase-3) was also detected at SHPP in the digestive gland of specimens in both sites. *Besides, Cylindrospermopsis raciborskii, a potentially toxic c*yanobacteria which is invading from tropical/sub-tropical towards temperate areas, was found in the Kasperivtcy water reservoir (~92.6-98.0 % to the total biovolume). However, the cyanotoxins were not detected in the water samples contained no detectable dissolved and particulate levels of studied cyanotoxins.

The mussels from microHPP had the highest differences in their indices between the sites before and after dam. Probably, it can be explained by frequent change of the working activity of this dam and corresponding fluctuations in the level of water after dam. Particular oxidative stress was detected in the mussels from JHPP due to high level of TBA-reactive substances of lipid peroxidation and lower Cu, Zn- and Mn-superoxide dismutases activities.

To summarize, the biological impacts of hydrological regimes in the vicinities of HPPs are highly dependent on the type of HPP.

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