Heavy metal concentration in fish tissues inhabiting waters of “Buško Blato” reservoar (Bosnia and Herzegovina)

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Abstract Heavy metals concentration (mercury, lead, cadmium, arsenic, copper, zinc and chromium) in tissues (muscles, liver, kidney and gonads) of Dalmatian barbelgudgeon, the nase, the souffie and brown trout, inhabiting waters of Buško Blato reservoir in Bosnia and Herzegovina, has been determined by atomic absorption spectrophotometry. The meat of the tested fish sorts does not contain elevated concentration of most analyzed heavy metals with exception of lead (higher than MAC in Italy, Germany and Denmark) and mercury (in muscles of brown trout higher than MAC in most countries). The lowest level of all heavy metals is always detected in gonads, with higher values in fry compared to milt for copper, zinc, chromium and arsenic. The highest copper concentration is observed in the liver from the souffie which is suggested as a suitable biomonitor for copper intoxication. In muscles of all fish sorts, lead was always present in much higher concentration than cadmium, while in kidneys of most fish sorts, lead and cadmium concentrations were similar. We showed that bioaccumulation of some heavy metals in the fish sorts analyzed is tissue and sex dependent. Also, we concluded that the small water exchange in reversible shallow reservoir does not induce elevated concentration of heavy metals in fish tissues inhabiting Buško Blato.

Keywords Heavy metals · Brown trout (Salmo trutta) · The souffie (Leuciscus turskyi) · The nase (Chondrostoma phoxinus) · Dalmatian barbelgudgeon (Aulopyge hügeli) · Buško Blato

Introduction

Buško Blato reservoir is located in Bosnia and Herzegovina, at the frontier with Croatia (Fig. 1). It was built in the year 1972 and covers the largest area in Europe (57 km², containing ca. 790 million m³ of water). It is relatively shallow, with a mean depth of 5 m. The central position and the terrain morphology of this area make possible water storage from the wider catchments of the Cetina River in Croatia (Štambuk-Giljanović 2001). The reservoir water is used directly for the Orlovac hydroelectric power plant (HE) and indirectly for the plants in downstream
sections: HE Djale, HE Kraljevac and HE Split (Božičević 1992), all of them located in Croatia. The area where Buško Blato reservoir is located is not densely populated and no waste water is directly released into the reservoir (Štambuk-Giljanović 2001). The pollution sources are the torrents which wash off the agricultural areas and the groundwater which is polluted by waste water from distant settlements (Štambuk-Giljanović 1998). Already mentioned study of Štambuk-Giljanović (2001) showed a satisfactory water quality of Buško Blato reservoir, what has been explained by intensive auto-purification processes, assisted by heavy winds that blow on the Buško Blato surface directly mixing the sediment with the reservoir water.

The aim of our study was to find out if the small water exchange in this reversible shallow reservoir covering large area influences the heavy metal content in fish sorts inhabiting Buško Blato water. Most of them (apart from brown trout) are endemic, what increased our curiosity concerning heavy metal content in different tissues of these fish sorts. Also, our idea was to find out if any fish sort analyzed, as well as some of its particular tissue(s) can be selected as a suitable biomonitor for certain heavy metal.

**Materials and methods**

Four fish sorts (Dalmatian barbelgudgeon-Aulopyge hügeli, the nase-Chondrostoma phoxinus, the souffie-Leuciscus turskyi, and brown trout-Salmo trutta) inhabiting waters of Buško Blato were analyzed for heavy metal content (mercury Hg, lead Pb, cadmium Cd, arsenic As, copper Cu, zinc Zn and chromium Cr) in selected tissues (muscles, liver, kidneys and gonads). Analyzed fish differ according to their eating habits: the souffie and Dalmatian barbelgudgeon are typical omnivora, while brown trout belongs to carnivora group. Finally, the nase is a typical herbivor, preferring algae as the main food constituent.

Fish were angled using fishing net in the middle part of the reservoir on several occasions during the summer (July and August) of the year 2005. Each fish...