RESEARCH NOTE ON CHEMICAL LOADS AND ECOLOGICAL CONTEXT OF PESTICIDES AND POPs IN BAHLUI RIVER, ROMANIA

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Abstract. In sediments along river Bahlui, in northern Romania, chemical loads of PCBs, HCHs, DDTs and PAHs are lower than the admitted thresholds. Biological indices derived from phytoplankton show moderate levels of pollution. Ecotoxicological bioassays indicated low/no toxicity for river waters, but high toxicity for certain discharge points near the river. The general quality of the river waters appears to be average, but with important signals on the dangers posed by domestic discharges. In the wider geographical context of the Danube basin, we see even moderate levels of local pollution as menacing, because of pollution accumulation effects.

Key words: PCBs, HCHs, DDTs, PAHs, phytoplankton, ecotoxicity, river, Bahlui

INTRODUCTION

Given the complexity of the aquatic ecosystems, the huge number of potential pollutants and considering their effects on ecosystems and human health, the Directive 2000/60/EC of the European Parliament (the Water Framework Directive) recommends the use of integrated, chemical and biological approaches (WFD, 2000). We have carried out such an interdisciplinary approach, one of the first of this kind, within an independent Swiss-Romanian research project which was part of the ESTROM programme. While the approach and main technical results are already described elsewhere (Neamțu *et al.,* 2008, Ciumaşu and Costică, 2008), we aim at presenting here a research note which is meant to explain the importance of the main results for a more local audience.

Bahlui River is part of the Prut River Basin – District of the lower Danube Basin. The river is 104 km long, all on Romanian territory, but close to the border with the Republic of Moldova, has an average annual flow of 2.8 m^3s^{-1} and falls into the WFD river intercalibration type R-E2. The study river basin is characterised by medium-sized lowlands (<200 m altitude), with mixed geology dominated by sand and silt. During our survey, we have established a body of baseline information for future studies and management actions in the study area, which is known to be affected by important agricultural and industrial activities.

RESULTS AND DISCUSSION

According to our results (Table 1), the loads of the looked-for pollutants are lower or similar to those reported by earlier studies (RIZA, 2000; Dragan *et al*., 2006), and lower than the national pollution thresholds.

Values calculated for the Saprobic and Diatoms' Indices indicate moderate levels of pollution, with pollution increasing from source to river mouth. Species richness (number of species) in phytoplankton displayed no clear pattern along the river. A survey on benthic invertebrates indicates the same pattern of moderate pollution (Nicoara *et al*., in preparation).

Results from standard toxicity testing with invertebrates (*Daphnia magna*) and algae (*Pseudokirchneriella subcapitata*) indicate low toxicity of river waters. But strong toxicity was found at domestic wastewater treatment discharges and with surface leachate from an old open-air deposit of domestic wastes. Thus, the most important local issue is represented by domestic and industrial point pollution.

Table 1. Main results obtained with chemical and biological survey methods in Bahlui River. Samples were river sediments and water and sewage water. Test species were *Daphnia magna* and *Pseudokirchneriella subcapitata* Sandy coastal systems were studied extensively in the last decades, resulting in a global vision expressed especially in the well-known descriptions of the sequential states of the coastal zone (Wright and Short, 1984; Masselink and Short, 1993). Particular emphasis was put on the existence of sedimentary sand bars, that are, indeed, a special feature. They contain large volumes of sand, play a major role in the nearshore sediment budget and beach variability an

Parameter	Values	Significance
PCBs, HCHs, DDTs, PAHs (all in sediments)	0.2 – 155 ng/g dw	Below admitted thresholds
Saprobity Index (river water) Diatoms Index (river water) Phytoplankton diversity (nr of species)	2.35 ± 0.35 3.3 ± 0.2 39 ± 11 species	β-α-mesosaprobic (moderate organic load) Moderate pollution Within known limits for such rivers
Acute toxicity (river water; *D.m.*) Acute toxicity (sewage water; *D.m.*) Acute toxicity (river water; *P.s.*) Acute toxicity (sewage water; *P.s.*)	$EC_{10} > 100$ % sample $EC_{50} = 28$ % sample $EC_{50} = 91$ % sample $EC_{50} = 16$ % sample	No toxicity High toxicity Low toxicity High toxicity

However, diffuse pollution without particular local importance may gain in importance when considered on a wider geographic scale. First, Bahlui River encompasses the Iași urban area, the largest human agglomeration in the wider Prut River basin – with ca 0.4 million inhabitants from the total of 3 million (Teodosiu *et al.*, 2003). In addition, the study area is also a strong agricultural and industrial area. Most importantly, these are main types of pollution sources for Danube and Black Sea waters (Zessner *et al*., 2006). Although our study area is not, according to our results, an excessive contributor to the pollution pooled in the Black Sea, it can be seen as a significant contributor. This happens because of the formidable magnitude of flow from throughout the entire Danube river basin (Kroiss *et al*., 2003). Riverine transport, particularly from the Danube basin, is a main source of domestic pollution in the Black Sea (Maldonado *et al*., 1999; Zessner *et al*., 2006). Terrestrial organic matter is omnipresent in the North-Western part of the Black Sea, the area of maximum influence of Danube inputs, with sewage-derived carbon being largely sunk in the river-marine water mixing zone (Saliot *et al*., 2002). Second, the pollution originating in the Danube Basin tends to accumulate at higher levels in the Black Sea, because of its closed-sea character, thus being a pollution source for surface waters of the Mediterranean – Aegean Sea (Zeri *et al*., 2000). Third, such pollution tends to have serious ecological, health and economical impacts on the EU coast of the Black Sea (Zessner *et al.*, 2006; Banaru *et al.*, 2007).

In perspective, further studies may help understand the spatial patterns of terrestrial contributions to the pollution of the Black Sea, their ecological consequences, also including air-land-water interactions (Ciumaşu and Costică, 2008). For example, ratios of individual PAH compounds calculated from our Bahlui data (important pyrolytic inputs) seem to support that PAHs resulted mostly from the combustion of fossil fuels. In the Black Sea, pyrolytic sources prevail in the Bosphorus region (Readman *et al.,* 2002). Whether the two facts (and their ecological contexts) are connected or not, is a question that may in principle be answerable via replicating our three-tier study throughout the entire Danube basin. Another example comes from DDTs: our results show a contribution of only 30 % of the parent compound, p,p'-DDT, to the total amount of DDTs, thus indicating low fresh inputs of DDTs in our local study area. On the contrary, low DDE/DDT ratios found by Fillman et al (2002) in marine sediments influenced by the Danube Delta indicate current usage of DDTs. Further, they find concentrations of HCHs among the highest known worldwide, while our study shows that the Bahlui River is not a contributor to this. More precise indications on the sources of such pollutions throughout the Danube Basin can be found via further basin-wide studies.

We hope that our project, together with the other projects within the ESTROM programme, can function as a starting platform for further, larger and multidisciplinary projects that can help accomplish more integrated and applied research at the Danube basin scale.

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