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Walter Geller, Jan Blachuta, Šarka Blažková, Evelyn Claus, Alfred Dubicki,
Hildegard Feldmann, Helmut Guhr, Edeltrauda Helios-Rybicka, Hubert
Holzmann, Wiwiana Szalinska, Wolf von Tümpling, Gulay Záray (Eds.)

Department Inland Water Research
UFZ Centre for Environmental Research Leipzig-Halle

Archiv

The authors bear the responsibility for the content of their contributions.

The influence of a regulated river stretch (Saale) on matter transport and metabolism

HELMUT GUHR, MARTINA BABOROWSKI, KARL-ERICH LINDENSCHMIDT, CHRISTINA HOFFMEISTER

UFZ Centre for Environmental Research Leipzig-Halle, Department of River Ecology, Brückstr. 3a, 39114 Magdeburg, Germany, e-mail: helmut.guhr@ufz.de

Due to a large component of its catchment land use contributed to industrial and agricultural use, the Saale (catchment area = 24 079 km²) is one of the most heavy-loading tributaries of the Elbe pertaining to water quality. The river is strongly loaded with salts due to both natural background sources and anthropogenic activities (mining and industry). The implementation of the EU water framework directive requires the holistic view of the activities in the river catchment influencing both water quantity and quality. This investigation, which also considers the influence of the Saale's tributaries, shall elucidate the at present dominant substance turnover processes that occur in the Saale river water. This is in light of the significant reductions of point loads that have been obtained in the last 14 years. The research firstly concentrates on the water column of the lower reach of the Saale with special attention of quantifying the influence of control structures on the substance turnover and transport. The nutrient regime, due to its effects on the river Elbe is also emphasised. In this study, the results of the surveys in the last 3 years are discussed in comparison of concentrations, loads and hydrological conditions.

The river is 413 km in length and records a mean flow of 115 m³/s near the confluence to the Elbe. Sampling took place on the downstream reach from the lock Halle-Trotha (km 89.2). This reach has 6 lock-and-weir structures. The stretch from the confluence (km 0) to the harbour Halle-Trotha (km 87) is designated as a federal water way.

Since 2001, intensive sampling programs were carried out in each year. In 2001, the reach was investigated 14 days; in the following years, the surveys were carried out to the flow rate of the water parcel on its pathway. A nearly continual increase in both the chlorophyll concentrations (3 fold) and loads (4 fold) along the flow direction is evident, indicative of an intensive algal production (Figure 1). In the other years the meteorological conditions influenced the development of chlorophyll-a. The tributaries, other than the Bode, do not significantly contribute to the load. There exist well pronounced correlations (only Saale samples) between chlorophyll-a and the nutrient components silicate, dissolved bound nitrogen, dissolved phosphate, and particulate organically bound carbon. The nitrate content forms the main portion of dissolved nitrogen. The phytoplankton analyses verify the chlorophyll development by their increase in biomass from Halle-Trotha to the mouth. Dominant in biomass and in cell numbers are solitary centric diatoms and Chlorophyceae, respectively. From the metazooplankton analyses (22 - 31 ind./l) indicate that grazing played a subordinate role in the dynamics.

The comparison of the water quality up- and downstream of a weir shows differences. In the tailwater (1.8 km downstream of the weir), we can document an increase in the concentration of particular bound components such as suspended matter, POC, total content of some heavy metals (e. g. Cr, Zn, Pb) (see Figure 2a). But the contents of several dissolved heavy metals (e.g. Cu, Mn, As) also showed higher values in the down-stream water than in the headwater (1.4 km in front of the weir) in 2001 (s. Figure 2b). These results can be caused by the erosion of the sediment upstream or downstream of the weir. During this processes, a change in the redox potential can be expected, which causes a release of soluble metal ions. During the measuring campaign 2002 the differences in the contents of dissolved metals between

upstream and downstream samples were more balanced. The backwater areas of the control structures act as sinks and sources of matter. For the river basin management the interrelations must be investigated.

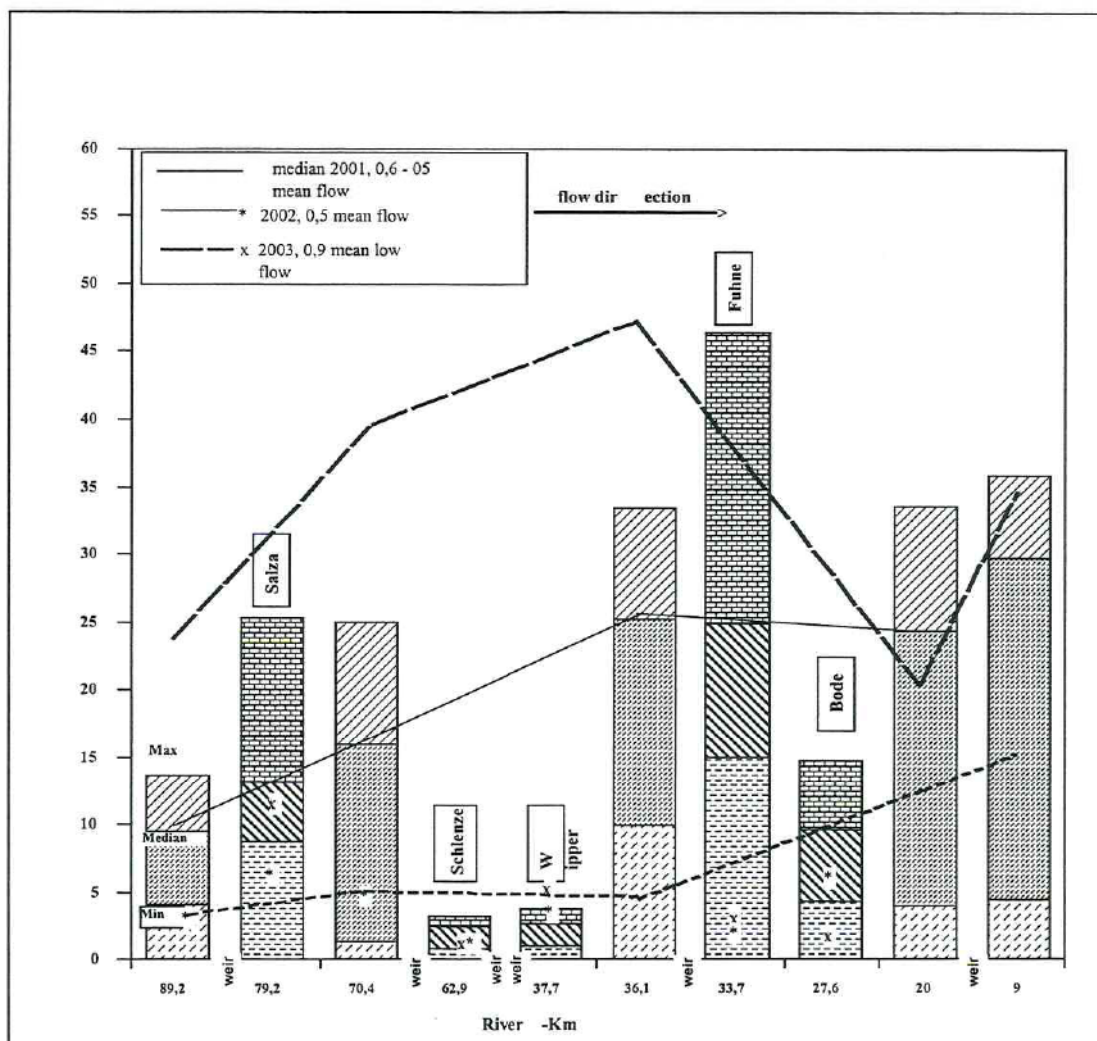


Figure 1: Concentration of chlorophyll-a in the River Saale (lower part) and its tributaries at different spring and summer situations

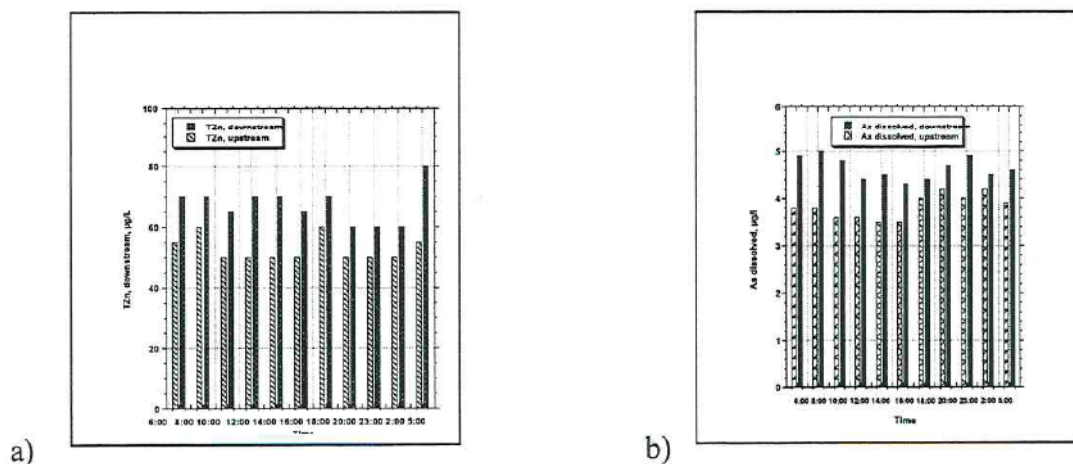


Figure 2: Influence of impounding Saale/Calbe on the content of total zinc (TZn) and dissolved arsenic (diurnal investigation: a: 2002, b: 2001)