Oceanological and Hydrobiological Studies
International Journal of Oceanography and Hydrobiology

Volume 40, Issue 4

ISSN 1730-413X
eISSN 1897-3191

(77–85)
2011

VERSITA

DOI: 10.2478/s13545-011-0044-1
Original research paper

Received: *May 15, 2011*
Accepted: *September 26, 2011*

Phyto- and zooplankton in fishponds contaminated with heavy metal runoff from a lead-zinc mine

Elżbieta Wilk-Woźniak[1,*], Agnieszka Pociecha[1], Dariusz Ciszewski[2], Urszula Aleksander-Kwaterczak[2], Edward Walusiak[1]

[1] *Institute of Nature Conservation, Polish Academy of Sciences, al. Mickiewicza 33, 31-120 Kraków, Poland*
[2] *Department of Geology, Geophysics and Environmental Protection AGH, al. Mickiewicza 30, 30-059 Kraków, Poland*

Key words: aquatic ecosystems, heavy metals, industrial impact, lead, plankton, zinc

Abstract

This investigation focused on plankton inhabiting fishponds, which previously received mine waters from the lead-zinc mine 'Matylda', located in southern Poland (Upper Silesia). The purpose of the investigation was to study the effects of chronic and persistent contamination of fishpond bottom sediments with heavy metals originated from the lead and zinc mine. The phyto- and zooplankton in the four fishponds were dominated by diatoms, green algae and rotifers. Plankton composition of the reference non-contaminated pond was different, since Chrysophytes dominated, and Copepoda were the most numerous among zooplankton. In the contaminated fishponds, we observed teratological forms, both for phyto-and zooplankton species, but only as individuals. Our results showed that planktonic communities had adapted to chronic and persistent heavy metal contamination.

* Corresponding author e-mail: wilk@iop.krakow.pl

INTRODUCTION

The anthropogenic contamination of freshwaters and their sediment with heavy metals has an impact on aquatic communities worldwide (e.g. Pawlik-Skowrońska 2001, Balistrieri et al. 2007, Wołowski et al. 2008, Smolyakov et al. 2010a). Ore mining and processing have been recognized as the largest source of contamination of heavy metals in receiving waters and sediments, often exceeding a thousand times the local geochemical background (Förstner, Wittman 1983). In Poland, formerly one of the largest zinc producers in Europe, several lead and zinc ore mines and associated processing plants have been closed recently, or production is scheduled to finish soon due to depletion of ore. The mines have been documented as the principal sources of Cd, Pb and Zn, which have been discharged into river systems with enormous amounts of mine runoff from an exploited water-abundant karst aquifer. The lead and zinc ore mining and processing have resulted in contamination of river channel sediments with cadmium, lead and zinc, up to about 3000 mg kg^{-1}, 30% and 20%, respectively (Ciszewski 1998, Ciszewski 2004). Moreover, overbank sediments deposited for over 100 years as a result of mining, are continuously eroded and leached with flood waters, which contribute to high alluvial sediment and water contamination (Ciszewski et al. 2008; Aleksander-Kwaterczak, Helios-Rybicka 2009).

Numerous studies have indicated that algae may tolerate high concentrations of heavy metals (e.g. Shubert et al. 2001). However, on the other hand, heavy metals at low concentrations may also affect many algae and zooplankton organisms by changing their biomass, species richness, and structure of their relationships by shifting towards the dominance of less sensitive species. Moreover, metals in aquatic ecosystems may be adsorbed onto cell walls and