

Impact of Mining Operations on the Ecology of River Offin in Ghana

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Abstract

Five sites in the Offin river basin were studied with respect to the quality of water and bottom sediment, as well as the community structure of both fish and phytoplankton along the river course to assess the effects of gold mining operations on the aquatic ecosystem. Turbidity, conductivity and concentrations of lead and cadmium in the water column showed a decreasing trend from the dredging area. Sediments upstream of and around the dredging area were sandy with low concentrations of organic (0.01-0.02% DW) and inorganic (e.g. CaCO_3 , 1.1-1.2 mg g^{-1} DW; PO_4 , 1.2-3.5 mg g^{-1} DW) materials, including trace metals (e.g. $\text{Hg} < 0.05 \text{ mg g}^{-1}$ DW, $\text{Pb} < 0.20 \text{ mg g}^{-1}$ DW, $\text{As} < 0.50 \text{ mg g}^{-1}$ DW). Fish in the dredging area had accumulated higher mean concentrations of trace metals in their tissues compared to those from the non-impacted sites. Higher diversities of phytoplankton were recorded at sites where turbidity was lower. Autotrophs (blue-green and green algae) were virtually absent from sites with high turbidities. The structure of the fish community in the dredging area was different from other adjacent areas. However, the diversity and richness indices (0.56-0.67 and 1.12-1.67, respectively) of the fish communities along the river course were similar except for the most polluted site, which had the lowest indices.

Introduction

Mining and its associated activities can be responsible for considerable environmental damage. Pollution of water, damage to land and habitat destruction are some of the impacts that have been recorded in the past (UNEP, 1991). For example, mercury used in gold mining in the Amazon Basin in Brazil contaminated vast areas of the Amazon river with about 200 tons being deposited per year in the basin (Malm *et al.*, 1990). Grösser *et al.* (1994) also reported mercury contamination in a gold-mining area in Southern Colombia.

Contamination of water bodies has degraded aquatic ecosystems especially in most of the industrialized world, resulting in altered fish populations and, in some cases, complete loss of fish (Down & Stocks, 1978; Welcomme, 1992). Chemicals used

in mining operations may, consequently, affect man through the food chain such as occurred in Minamata Bay in southern Kyushu, Japan, due to discharge of mercury-laden effluents (Fujiki, 1980). Apart from chemicals, large quantities of solids are suspended in the water column due to mining operation, especially in alluvial dredging. Suspended solids may affect biological resources in various ways (Chansang, 1988). In Ghana, gold is currently the leading export commodity, and mining occurs within the catchment of such rivers as Birim, Pra, Offin and Ankobra. Alluvial dredging practiced in certain parts of the River Offin could result in the release of residual chemicals, not only in the dredging area but also further downstream. This study assessed the effect of mining operations on the ecology of the River Offin in the Western