Contamination of R. Nzoia and L. Victoria by Aniline Pesticides and their Degradation Products: Lessons for the Environmental Management of Enclosed Coastal Seas

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The R. Nzoia (Kenya) catchment basin is a region endowed with great agricultural potential. The river offloads its water into lake Victoria; the world's second largest fresh water lake, shared by the three East African countries: Kenya, Uganda and Tanzania. Both the river and the lake are major sources of fish protein for local consumption and the international market. The ever-increasing human settlement on the catchment basin, and the associated industrial development coupled with mismanagement of watersheds, has however rendered R. Nzoia basin prone to massive soil erosion and consequently pollution of the river by run-off agrochemicals. The presence of the pesticide residues and their toxic and stable degradation products in these water reservoirs, pose a risk of toxicity not only to the diverse aquatic lifeforms therein but also the terrestrial organisms depended on them. This study sought to determine the status of the river water, sediment and fish as relates to pesticidal contamination.

The fairly used herbicides and their stable degradation products were identified and there level determined in R. Nzoia water, sediments and fish. Samples were collected at monthly intervals from August 1998 to February 1999 from nine sampling sites along river Nzoia. Water samples were extracted using acetone and hexane solvent, Sediments with dichloromethane and n-hexane while fish samples were subjected to soxhlet extraction (Mann, 1995; UNEP, 1988). The extracts were cleaned analysed by chromatographic methods using external standards to determine the quantities of these herbicides and their metabolites in the samples.

Alachlor, metolachlor and 2,6, - diethylaniline and 2- ethyl-6-methylaniline (DEMA) were detected in 51.58, 37.03 and 81.48% respectively of all the water samples analysed. In sediments, alachlor was detected in 51.58%, while metolachlor and DEMA were both detected in 70.37%. In fish, alachlor, metolachlor and DEMA were detected in 18.75, 25.00 and 56.25% of the samples respectively. The results indicated that the mean concentrations of alachlor, metolachlor and DEMA were higher in sediments and fish than in water. On the average, the levels of the metabolites were generally higher than each of the parent compound. In an ongoing laboratory toxicity test, the metabolites have paradoxically been shown to be more toxic and stable than the parent compound. A potential risk of toxic exposure on the aquatic and the depended terrestrial organisms exists, despite the absence or satisfying levels of the parent pesticides, which are conventionally monitored. The risk posed by the increasing use of pesticides on the aquatic reservoirs is clearly demonstrated. Sighting the public health implications, the paper suggests the available options for minimising and abating the potential risk. The best management practices for adoption in environmental management of enclosed coastal seas are also suggested.