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Author(s)	Yohannes, Yared Beyene
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学位論文内容の要旨

Abstract of the dissertation

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Name

学位論文題名

Levels and Effects of Organochlorine Pesticides and Heavy Metals in Aquatic Ecosystem from the Rift Valley Region, Ethiopia

(エチオピア・リフトバレーにおける有機塩素系農薬と重金属による汚染状況の解明と水圏生態系への影響評価)

Organochlorine pesticides (OCPs) and heavy metals are ubiquitous contaminants in the aquatic environment, and of great concern globally because of their persistence, bioaccumulation, and toxic effects such as endocrine disruption, cancer, serious illness and even death. OCPs and heavy metals in water can transfer into the food chain, and as a consequence high concentrations can be found in high trophic level organisms including humans and wildlife. Although application of OCPs has been banned in developed countries, they are still being used in developing countries like Ethiopia. DDT, especially, is still used for agricultural and vector control because of its low cost and versatility. Furthermore, stockpiles of obsolete pesticides are a severe problem. The Ethiopian Rift Valley region which encompasses seven lakes is a populated and important area for agricultural and industrial development. At the same time it is one of the most environmentally vulnerable areas influenced by heavy pollution from urban, agricultural and industrial activities. As a result, the Rift Valley is exposed to environmental pollutants including pesticides and heavy metals.

Therefore, the aims of this study were: (i) to investigate bioaccumulation levels of OCPs and heavy metals from two Rift Valley Lakes, Ethiopia, and (ii) to assess ecotoxicological risk of these pollutants for the welfare of humans and wildlife. In response, twenty five surface sediment samples and three fish species from Lake Awassa, and five fish species and four bird species from Lake Ziway were collected.

Significant differences of DDTs and heavy metals levels were found among the studied fish species from Lake Awassa. High levels of DDTs were observed in fish species found at higher trophic level, indicating bioaccumulation of DDTs. Investigations from 25 surface

sediments showed varied levels of DDTs depending on sampling sites, and high levels of DDTs were observed in vicinity of the inflow river side and close to agriculture areas. Eco-toxicological significance of DDT contamination is concerning in Lake Awassa.

This is the first study reporting levels and risk assessment of OCPs in fish and bird species from Lake Ziway. Concentrations of HCHs, heptachlors, chlordanes, and DDTs varied among studied species. An overall appraisal suggested that DDTs were the most abundant pollutants, attributing to current use in vector control and illegal usage, as well as contamination from past usage and spills from obsolete pesticides. The human health risk assessment based on carcinogenic hazard ratio and cancer risk estimates indicated that consumption of most of the fish species could cause potential health risk. Cumulative daily exposure to OCPs through fish consumption would yield a lifetime cancer risk of greater than one in a million. The main DDT metabolite, *p,p′*–DDE had significantly high burden in bird species, which could be sufficient to cause deleterious effects on survival and/or reproduction.

In general, results from this study call for further research to evaluate the level and adverse effects of persistent organic pollutants in the Rift Valley region. It is necessary to continue monitoring the ecological risk assessment of pesticides in terrestrial and aquatic environment of Ethiopia.