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Organochlorine Residues in Fish from Lake Mjøsa in Norway

E. M. Brevik[1]

Veterinary College of Norway, Department of Pharmacology and Toxicology

Levels of PCBs, HCB and sum-DDT have been determined in Lagesild (Coregonus albula) from Lake Mjøsa since 1974. This lake, situated in eastern Norway, has become highly polluted over the last twenty-thirty years.

The sources of pollution are the influx of wastewater and sewage from agricultural, industrial and general urban activities in this relatively densely populated area.

Although the most urgent problems are related to this kind of pollution, it is also considered important to examine the levels of organochlorines, and this paper reports some data on PCBs, HCB and sum-DDT in fish.

MATERIALS AND METHODS

The sampling site was at the mouth of the Gudbrandsdalslågen river, near Lillehammer. The samples consisted of liver from lagesild weighing less than 0.3 kg. The fish were caught during the spawning season, from September to October.

Samples were wrapped in aluminium foil and stored frozen until analysis was carried out. The samples were homogenized thoroughly and analyzed for PCBs, HCB and sum-DDT by a gas chromatographic method described by BJERK & SUNDBY (1970). The calculations were based on data from four chromatograms and for the PCBs, peak numbers 7, 8 and 10 were used (JENSEN 1972).

RESULTS

Results presented in Table 1 show that the average levels (fat weight basis) for sum-DDT, PCBs and HCB have decreased between 1974 and 1979 from 3.0 to 1.3 ppm, 6.7 to 3.4 ppm and 0.12 to 0.11 ppm, respectively.

TABLE 1

PCBs, sum-DDT and HCB in lagesild-liver from Lake Mjøsa. Arithmetic mean $\pm$ S.D. (^{x}sum-DDT = 1.11 DDE + 1.11 DDD+DDT)

Sampling year	No. analyzed	Fat %	ppm, fat weight basis		
			sum-DDT^{x}	PCBs	HCB
1974	7	3.5±0.05	3.1±2.1	6.7±3.5	0.12±0.09
1975	24	5.1±2.9	0.7±1.7	1.5±2.5	0.29±0.34
1976	16	3.6±1.2	1.7±1.1	1.4±1.0	0.12±0.10
1977	12	2.4±0.3	0.8±0.1	4.1±1.2	0.12±0.02
1979	13	2.6±0.7	1.3±0.4	3.4±0.7	0.11±0.05

[1] Present address: Institute for Energy Technology, P.O. Box 40, N-2007, Kjeller, Norway

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All these changes were shown by Wilcoxon's matched paired test, not to be significant ($P \leq 0.05$).

DISCUSSION

The apparent tendency to a decrease in the organochlorine levels was found not to be significant ($P \leq 0.05$). This indicates that a steady state has been established for these organochlorine levels in fish from Lake Mjøsa.

The average age of the fish sampled in 1979 was found to be 5.7 years, ranging from 3 to 9 years. No difference was found between the levels of organochlorines in fish at the ages of 3 and 9 years. This is what can be expected if the partition between the fish tissue lipids and the surrounding water is the predominating factor determining the tissue levels of these highly fat soluble compounds (HAMELINK 1971, CROSBY 1975, BROCK NEELY et al. (1974).

The levels of organochlorines (fat weight basis) in the present material is about one fifth of the levels of PCBs and sum-DDT found in liver from cod from comparatively uncontaminated Norwegian fjords and from the open ocean (BREVIK et al. 1978), indicating the lower degree of contamination of organochlorines in fresh water fish.

SØDERGREN (1972) reported that in the southern part of Sweden the deposition of airborne pollutions in 1970-71 was about 1000 ng/m^2/month for DDT and 1800 ng/m^2/month for PCBs. In conclusion it may therefore be stated that there probably is a constant input of chlorinated hydrocarbons in the catchment area of Lake Mjøsa. However, the lack of significant changes in the levels of chlorinated hydrocarbons in biological material from 1974 to 1979 indicates a condition close to steady state.

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