

COMPARISON OF PREWAR AND POSTWAR PCB AND DDT LEVELS IN FISH FROM THE ZADAR AND DUBROVNIK COASTAL AREAS ENCOMPASSED BY WARFARE DURING 1991/1995

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Abstract

The karstic area of Croatia warrants particular ecological attention because of its exceptional sensitivity to technology and hazardous wastes. The territory that was encompassed by warfare during 1991/1995 is in even greater jeopardy due to the unscrupulous destruction of natural resources, infrastructures, homes and enterprises. There are fears and concrete evidence that polychlorinated biphenyls were released into the environment during the warfare in Zadar and Dubrovnik areas. Results show significant higher levels of PCB in the fish samples collected after the war in comparison with the levels of these pollutants before the war in Dubrovnik and Zadar areas. On contrary, levels of DDT in fish are significantly lower in samples collected after the war in comparison with the levels of DDT in samples collected before the war.

Keywords: Adriatic Sea, monitoring, PCB, pollution

Introduction

After the war, the proposed priorities for investigation of the karstic area of Croatia jeopardized during the war are as follows:

Priority 1. Inspection of the terrain at polluted sites and control of the polychlorinated biphenyl pollution levels, with assessment of the subterranean pollution penetration based on existing hydrogeological data.

Priority 2. Monitoring the level of hazardous chlorinated hydrocarbons (mainly PCB) generated by warfare in the soil and water at the pumping sites of the Zadar and Sibenik waterworks and the sea around Zadar, Sibenik and Dubrovnik (1).

Taking into account the location of the destroyed Zadar and Dubrovnik electrical transformer stations, there is some speculation regarding the potential hazard from toxic organohalogenated compounds to the sea around the Zadar and Dubrovnik areas (2). The aim of this paper is to compare the prewar and postwar PCB compound levels in fish samples from the Zadar and Dubrovnik coastal areas that were impacted by warfare in 1991/1995. It should be emphasized that all the samples were analyzed by a single analytical group (mostly by the same analyst), using a uniform methodology that has been very successfully intercalibrated during eleven international intercalibration exercise (3).

Methodology

Muscle tissue and anhydrous Na_2SO_4 were concurrently homogenized and extracted with petroleum ether in a blender. The analytical method used for the analysis of fish extracts included filtration through a column of Na_2SO_4 anh., cleaning on an alumina column and separation of the PCBs from organochlorine insecticides on a miniature silica gel column. After concentration to 1 cm^{-3} , elutes were analyzed by EC gas chromatography. During all the analytical procedures, the Mirex standard was used as the internal standard (4).

Results and discussion

Pollutants mass fractions in the fish samples ranged from <0.5 to 353 (before the war) and from <0.1 to 35.8 (after the war) for DDTs_{ww} and from <0.5 to 311 (before the war) and from 74 to 4004. 10^9 for PCBs_{ww} after the war. The highest levels of PCBs and DDTs in fish samples were found in Zadar and Dubrovnik areas in comparison with other areas investigated in the Eastern coastal waters of the Middle Adriatic during 1997. The box-and-whisker plots show significant higher the mass fractions of PCBs in the fish samples collected after the war in comparison with the levels before the war in Dubrovnik and Zadar areas. Such differences are not observed for the DDTs levels. Trends of DDTs and PCBs levels in fish samples were investigated by using linear regression analysis of the mass fractions of DDTs and PCBs (natural logarithmic values) with the year of collection.

Correlation of DDTs levels in fishes from the Zadar and Dubrovnik area with the year of collection for 1974-1980 period shows significant negative correlation coefficient, ratios of PCBs/ DDTs show significant positive correlation coefficient, correlation coefficient for PCBs is positive but statistically nonsignificant.

Taking into statistical analysis data obtained after the war (1997), for DDTs correlation coefficient is negative but for PCBs is highly significantly positive. It means that only DDT and its metabolites show a

statistically significant yearly trend of decrease in samples investigated, but the levels of PCBs significantly increase in fishes from the Zadar and Dubrovnik areas.

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