

# LEVELS AND TEMPORAL TRENDS OF ORGANOCHLORINE COMPOUNDS IN MARINE ORGANISMS FROM GREEK WATERS

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## Abstract

The levels and temporal trends of organochlorine compounds (DDTs and PCBs) were investigated in two edible fish species (the red mullets *Mullus barbatus* and the bogues *Boops boops*) collected from different locations in Greece during a twenty year period 1994 - 2014. A decrease of DDTs levels was observed for both species but in the same period the levels of PCBs do not follow any significant temporal trend. All organochlorine concentrations measured in the red mullets were always clearly higher than those in the bogues.

**Keywords:** *Bio-accumulation, Mediterranean Sea*

## Introduction

Organochlorine compounds, including the DDT group and the polychlorinated biphenyls (PCBs) are persistent environmental contaminants with a high capability for bioaccumulation in the fatty tissues of marine organisms through the food chain. The aim of this work, is to study the levels and the temporal trends of DDTs and PCBs in two fish species belonging to different ecotypes (the demersal red mullets *Mullus barbatus* and the pelagic bogues *Boops boops*) and collected from eight marine locations in Greece during the period 1994-2014.

## Methodology

The analytical method used included freeze drying of the fish flesh, Soxhlet extraction with a mixture of hexane-dichloromethane, clean-up and fractionation on an alumina column and determination by ECD gas chromatography [1]. The quantified compounds included the p,p'-DDT and its metabolites p,p'-DDE and p,p'-DDD and seven PCB congeners (101, 105, 118, 138, 153, 156 and 180).

highest values of DDTs and PCBs were found in the red mullet (mean DDTs values: 10.4 ng/g in the red mullets and 1.6 ng/g in the bogues, mean PCBs values: 5.9 ng/g in the red mullet and 2.1 ng/g in the bogues). These differences is probably attributed to the higher lipid content of the red mullets (1.5 % in the bogues, 3.3 % in the red mullets) and/or to the different feeding conditions of the two species. It is known that the organochlorines are accumulated in the fat tissues of the organisms and therefore their concentrations are positively related with the lipid content. In order to reduce this inter-species variability the results were normalized to the fat content and expressed in ng/g fat units. Then, for the PCBs there is no differentiation between the two species (mean PCBs values: 269 ng/g fat in red mullets and 221 ng/g in bogues) but the DDTs concentrations continue to be significantly higher in the red mullets (mean DDTs values: 424 ng/g fat in the red mullets and 152 ng/g fat in the bogues). This preferential bioaccumulation of DDTs in the red mullets might be related to the different dietary intake of these sea bottom feeders. The spatial distribution of DDTs and PCBs was generally homogeneous for both fish species and only in fishes collected from Saronikos gulf higher PCBs values in comparison with the other marine areas were recorded, probably attributed to inputs from industrial activities from the greater area of Athens. As it can be seen from Figure 1, a decreasing temporal trend for DDTs during the twenty years of the survey is evident. On the contrary, PCBs levels seems to remain constant, especially in red mullets, during these years, probably suggesting continuous PCBs inputs despite the banning of these compounds. The ratio PCBs/DDTs takes its greatest values in the bogues (mean value: 1.3 in bogues, 0.7 in red mullet), further evidencing the different behaviour of the two fish species in relation to their ability to biomagnify the organic pollutants.

The most abundant compound of the DDT family was always the main DDT metabolite p,p'-DDE, in percentages above 80%, suggesting no recent inputs of DDTs in the areas studied. The predominant PCB congeners were the hexachlobiphenyls 151 and 138, in accordance with the common congener distribution pattern encountered in marine organisms.

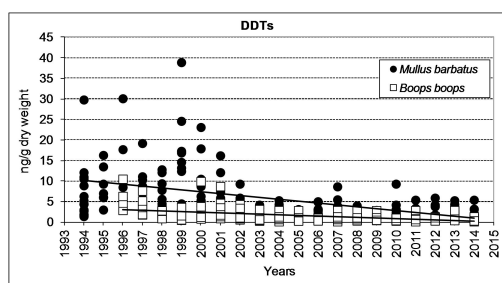


Fig. 1. DDTs concentrations during 1994-2014

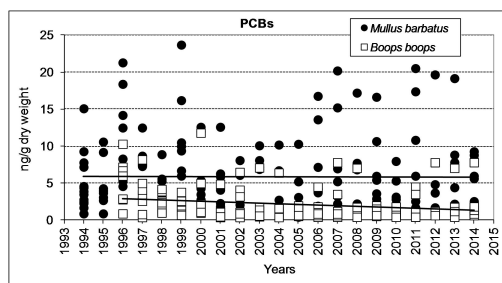


Fig. 2. PCBs concentrations during 1994-2014

## Results and Discussion

All the organochlorine concentrations during 1994-2014 are presented in figures 1 and 2. In all the samples the organochlorine concentrations in the fish samples were quite low compared with those found in other Mediterranean regions [2] and never exceeded human health limits [3]. The

## References

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