Levels and trends of the pollution of chlorinated hydrocarbons in sediments from the Mediterranean Sea

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The Mediterranean Sea, as a semienclosed body of water is of special interest and there are many monitoring activities that estimate the existing levels of chlorinated hydrocarbons in various components of the ecosystem, in order to gauge the magnitude of future pollution by these or other similar chemicals. Sediment is very suitable for monitoring purposes because of its stability and relatively simple sampling. Besides that, sediment analysis is significant also because sediments play an important role in the distribution of chlorinated hydrocarbons in the aquatic ecosystem. The levels of these pollutants in the water environment are regulated by adsorption and desorption processes and by the sediment--water interface (DUINKER and BOON, 1985; OLSEN et al., 1982). Figure 1 presents summarized data of such baseline monitoring activities of DDTs, BHCs, and PCBs pollution of sediments from the Mediterranean Sea, published in the literature or available in other ways. The presented averages were calculated as arithmetic means by using separate data. When such data were not available for the investigated area, averages were calculated by combining available arithmetic means ("weighted" arithmetic means if the number of samples was known) and arithmetic means obtained from single data. It means that for some averages are presented as arithmetic means obtained from arithmetic means available in previously published papers. Data are presented as concentrations on a dry weight basis. In the case when the data in literature were published only on a wet weight basis, concentrations on dry weight basis were calculated by multiplying concentrations on a wet weight basis by a factor of 2.0. Variations in the chlorinated hydrocarbons residue concentrations in the sediment from the Mediterranean Sea, their trends and various methodological difficulties encountered in the comparison of the obtained results are discussed.

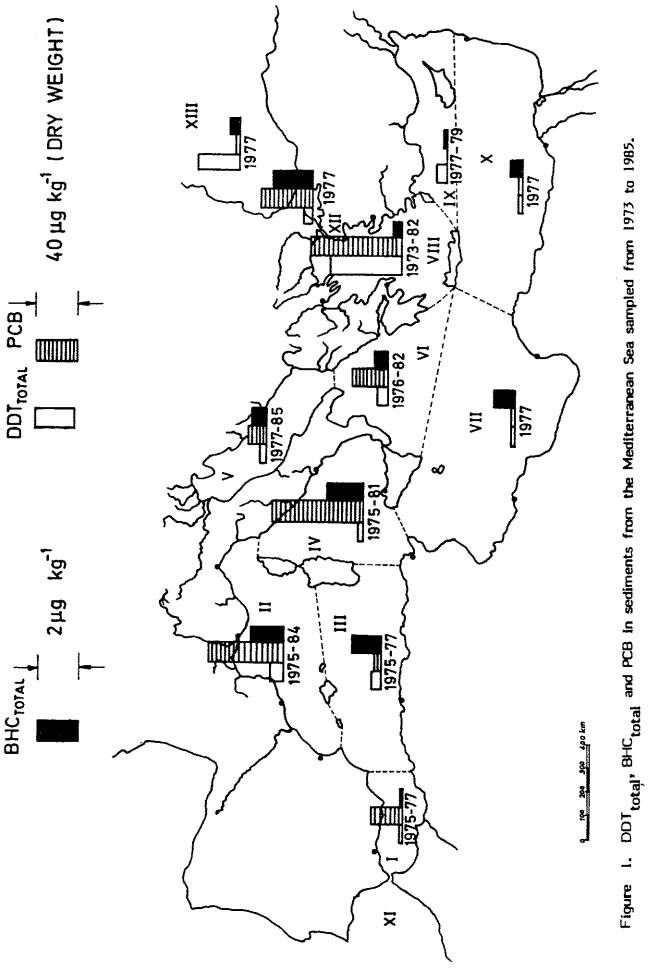

Figure 1. DDT_{total}, BHC_{total} and PCB in sediments from the Mediterranean Sea sampled from 1973 to 1985.

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Levels of chlorinated hydrocarbons and metals in demersal Fishes

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INTRODUCTION Past work on marine organisms for Greek waters in relation to the level of organochlorines concerns the Saronikos gulf (1). (2) and the Thermaikos, Strymonikos and Kavala gulfs (3). As regards the concentration of heavy metals, the studied areas were the Saronikos gulf (4) and other coastal areas of the Aegean Sea(5).

MATERIALS AND METHODS Samples of a large number of fishes, almost always Mullus barbatus (red mullet), once only Mullus surmuletus (striped mullet) were collected from various parts of the Aegean Sea between October 1986 to February 1987.

The determination of chlorinated hydrocarbons was performed on composite samples according to the procedure by Satsmadjis et al (6) and heavy metals analysis on pooled samples according to UNEP procedure (7).

TABLE 1. Organochlorine concentrations (ng/g dry weight)

	Tissue	lipids %	EPCBs	EPDTs	EBHCs	Etest
Alexandroupolis	Flesh	4.94	9.6	20.6	20.1	1.9
Chios	Flesh	11.07	39.9	55.2	15.4	1.3
Canea	Flesh	8.01	42.3	66.8	11.1	1.3
Saronikos	Flesh	16.75	84.3	47.8	65.1	4.7

RESULTS AND DISCUSSION Table 1 gives figures for organochlorines after grouping them into four categories. All the levels are far below what could be considered dangerous for human consumption by the strictest standard. As a rule, the concentration of organochlorines in organisms rises more or less in direct proportion to the lipids contents, since they dissolve in them. Thus, the Alexandroupolis sample, holding less lipids displays the lowest levels of chlorinated hydrocarbons. The opposite occurs in the case of the Saronikos sample. When taking into consideration the percentage of lipids, there is no substantial difference between studied areas.

TABLE 2. Trace metal concentrations in mg/Kg

STATION	TISSUE	Cd Average	Cd SD	Ni Average	Ni SD	Cu Average	Cu SD
Alexandroupolis	Flesh	0.84	0.22	5.59	1.61	16.33	13.16
	Gills	2.97	0.81	17.09	4.30	44.31	31.99
	(Liver)*	4.55	-	18.18	-	31.82	-
Chios	Flesh	0.66	0.33	3.50	0.55	17.67	14.17
	Gills	2.98	0.85	14.73	1.49	36.60	20.60
	(Liver)*	1.57	-	4.13	-	23.01	-
Canea	Flesh	0.70	0.24	4.04	0.34	18.47	14.04
	Gills	2.95	0.66	16.77	4.08	33.47	23.61
	(Liver)*	0.80	-	5.37	-	9.76	-
Saronikos	Flesh	0.78	0.15	2.66	0.58	2.26	0.50
	Gills	2.85	0.59	10.95	1.59	4.79	0.89
	(Liver)*	4.26	2.27	12.86	11.12	10.71	10.43

* Composite samples

Table 2 shows the concentrations of Cadmium, Nickel and Copper. The results are similar to those observed in other Mediterranean areas. Flesh samples exhibit lower concentrations than the other samples, fact due to the lower metabolic activity of the tissue in comparison with the others: gills, liver. We can also observe a relation between the increase of the metabolic itensity (e.g. in gills) and the elevation of the variation of the metal content. As the collection of fish samples was realised from October to February, during the reproduction repose of the studied species, the different sampling period did not play any important role in metal bioaccumulation results. When taking into consideration the Standard Deviation of the metal concentration in samples, there is no substantial difference between studied areas, although north samples seem to be a little more polluted. This hypothesis requires further investigation.

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