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Organochlorine Levels in Edible Marine Organisms from Kuwaiti Coastal Waters

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The Gulf region has been studied primarily for pollution by petroleum hydrocarbons because the risk of contamination by these compounds is high in this area (Oostdam 1980; Gupta and Kureishy 1981; Anderlini and Al-Harmi 1979; Anderlini et al. 1981). In contrast, very little is known about the level of chlorinated hydrocarbon contamination in the Gulf. The only available published data appear to be those pertaining to Omani waters (Burns et al. 1982) and for a single species of oyster in Kuwait (Anderlini et al. 1981). Although there are relatively few sources of organochlorine compounds within Kuwait, coastal waters and organisms could be exposed to biocides and other organochlorine compounds used on agricultural land draining to the Shatt Al Arab delta, or those adsorbed on airborne particulates transported during severe seasonal storms which deposit tons of sediment into Kuwaiti territorial waters.

As a preliminary survey of various organochlorine compounds, we analysed 24 samples of different edible marine organisms collected from the coast of Kuwait in February–March 1979. We present here the results for polychlorinated biphenyls, pp'DDE, pp'DDD and pp'DDT in this set of samples.

MATERIAL AND METHODS

Samples were collected in nearshore waters by means of a shrimp trawl (Fig. 1). Freshly caught fish, shrimp and other organisms were sorted aboard ship, immediately frozen and transported to the laboratory. These samples were subsequently defrosted and carefully dissected with stainless steel blades in order to prevent any possible contamination (F.A.O. 1976). Immediately after dissection, the muscle tissue was freeze-dried. Freeze-dried samples were extracted and treated as described by Elder and Fowler (1977) and Fowler and Elder (1978). The samples were quantified by electron capture gas chromatography using Aroclor 1254, pp'DDE, pp'DDD and pp'DDT as external standards.

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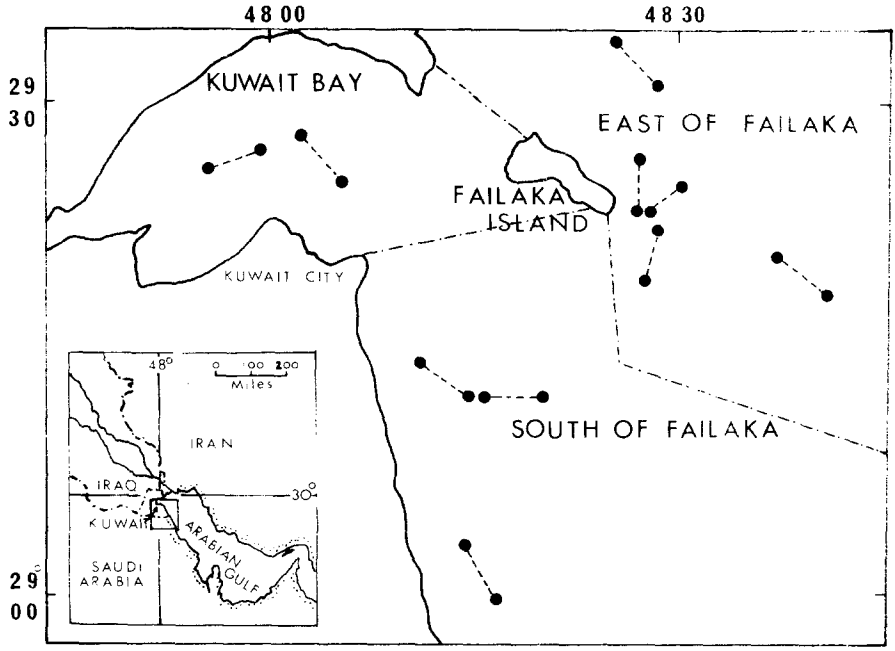

Figure 1. Fish and shrimp trawl transects in Kuwaiti coastal waters.

RESULTS AND DISCUSSIONS

Results of the analyses are reported in Table 1. Examining the results in terms of distribution frequency and using an arbitrary interval of 5 ng/g (Fig. 2), we note that the most frequent concentration interval found is 0 – 5 ng/g for both PCBs and pp'DDE. In general, the values are relatively low and are similar to those for PCB ($\bar{x}$=31 ng/g dry) measured in pearl oysters from the same waters (Anderlini et al., 1981).

For each sample, the pp'DDE/PCB ratio is also calculated. When comparing DDE/PCB ratios for shrimp and fish from Kuwaiti waters, it is evident that the ratios are significantly different: 0.17 + 0.1 for shrimp; 0.54 + 0.33 for fish. Comparison of this ratio for fish from Kuwait (0.54 + 0.33) with the same ratio obtained for fish in Oman (0.34 + 0.22) (Burns et al., 1982) and in similar species from the Adriatic Sea (0.37 + 0.27) (Smodlaka et al., 1981) indicates no statistical differences between areas when using a t test at the 95% confidence level. This observation suggests that the same distribution between PCB (industrial markers) and DDE (agricultural markers) exists in the Gulf region as in the Adriatic Sea. Finally, if we compare PCB concentrations in fish from the Gulf area with concentrations in similar species from the Mediterranean Sea (Table 2), it appears that on the average, concentrations of organochlorine compounds are more than one order of magnitude lower in organisms from Kuwaiti waters and other regions of the Gulf as well.

Table 1. Organochlorine residues in organisms from coastal waters of Kuwait.

Group	Species/ Common name	pp'DDE	pp'DDD	pp'DDT	Ar.1254	DDE/PCB
		ng/g dry/weight				
Squid						
	Loligo duvauceli	1.3	0.4	n.d.	6.2	0.21
Crab						
	Portunus pelagicus	1.0	0.3	n.d.	3.4	0.29
Shrimp						
	Penaeus semisulcatus	0.3	n.d.	n.d.	2.4	0.13
	" "	0.4	n.d.	n.d.	1.5	0.27
	" "	n.d.	n.d.	n.d.	1.3	
	" "	0.3	n.d.	n.d.	3.4	0.1
	Metapenaeus affinis	0.5	0.1	n.d.	2.1	0.24
	Metapenaeus stebbingi	0.4	0.2	n.d.	3.8	0.11
	Parapenaeopsis stylifera	1.9	0.6	n.d.	9.6	0.2
	Squilla sp.	3.6	1.8	0.8	12	0.3
Fish						
	Pampus argentus (Silvery pomfret)	2.3	n.d.	n.d.	13.5	0.17
	Cynoglossus macrolepidotus (Large-scaled tongue sole)	2.9	n.d.	n.d.	25.7	0.11
	" "	3.1	0.3	n.d.	6.9	0.45
	Otolithus argenteus (Silvery croaker)	5.6	n.d.	n.d.	21.2	0.26
	" "	10.3	0.8	1.7	14.2	0.73
	Leiognathus fasciatus (Long-finned slipmouth)	15.6	8.2	8.9	38	0.41
	Therapon puta (Small-scale banded therapon)	7.7	n.d.	n.d.	7.2	1.07
	Polydactylus sextarius (Six-threads threadfin)	5.5	0.3	0.9	6.4	0.86
	Crenidens crenidens (Crenate-toothed sea bream)	8.3	0.9	0.2	7.3	1.1
	Ilisha indica (Indian shad)	3.7	0.7	0.3	6.9	0.54
	Platycephalus indicus (Indian flathead)	1.8	0.2	0.1	3.9	0.46
	Arius thalassinus (Giant sea catfish)	19.5	3.9	0.4	22	0.89
	Trichiurus haumela (Large-headed cutlassfish)	3.2	0.5	n.d.	14	0.23
	Brachirius orientalis (Spotted sole)	1.5	n.d.	n.d.	5	0.3

n.d.: not detected

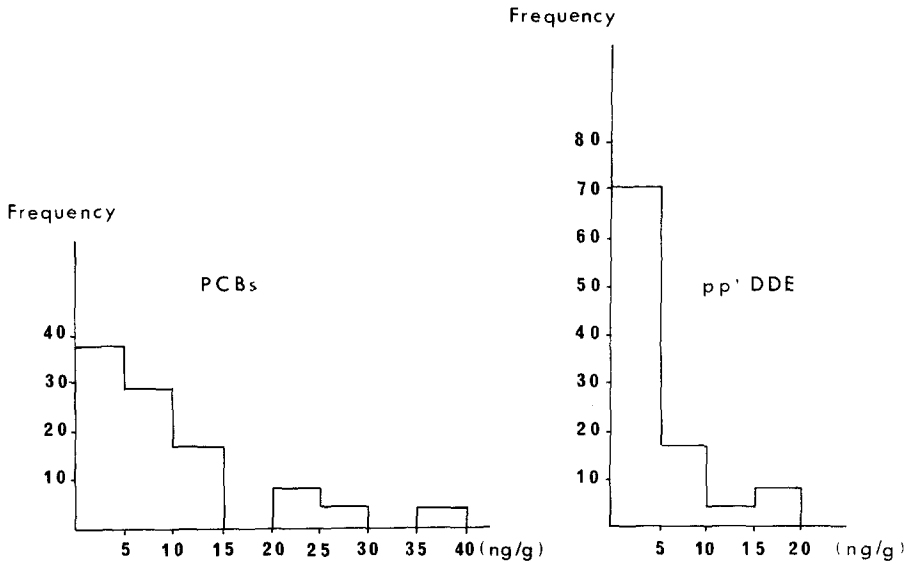

Figure 2. Frequency distribution of PCBs and pp'DDE in samples collected along the coast of Kuwait.

Table 2. Comparison of levels of PCBs in fish from the Mediterranean Sea and the Gulf. Results expressed in ng/g of Aroclor 1254 wet weight (*: computed from original data using 0.3 dry/wet weight ratio).

Region	Range	Average	Reference
Adriatic Sea Yugoslavia	n.d.–15000	690	Smodlaka et al. (1981)
Sicilian coast Italy	n.d.–6100	990	Castelli et al. (1983)
Sicilian coast Italy	10 –370	70	Amico et al. (1979)
North Adriatic	100 –870	50	Viviani et al. (1974)
Israeli coast	n.d.–1200	160	Ravid et al. (1985)
Gulf (coast of Oman)	0.24–0.54	0.4	Burns et al. (1984)
Gulf (coast of Kuwait)*	1.3 –11.4	4.2	This study

Although marine species from Kuwaiti waters contain measurable amounts of chlorinated hydrocarbon compounds, the level of contamination is relatively low. For example, using PCBs as a marker, concentrations in fish from Kuwait and other Gulf areas are approximately an order of magnitude lower than those found in similar organisms from the Mediterranean Sea. The relative importance of DDE compared to PCBs is statistically similar in the Gulf region and in the Adriatic Sea. This suggests that input source terms (agricultural and industrial) contain similar ratios of these compounds in both areas.

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