Pesticides in Fish from a Hawaiian Canal

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The Ala Wai Canal serves as a drainage unit for the city of Honolulu and it receives the water from two streams which pass through residential areas of the city and runoff water from a golf course which borders one-third of the canal's length. Samples of sediment, water, and biota were obtained from the canal to determine the degree of pesticide contamination of this environment.

Brain, muscle, and liver from two species of fish, the Ten Pounder (Elops hawaiensis), a carnivore of about two feet in length, and the Milkfish (Chanos chanos), a plankton and detrital feeder three feet in length were analyzed for chlorinated pesticide residues; muscle tissue was taken from the left side above the pectoral fin of the fish. Residue analyses were also made on samples of water, sediment, algae (Ulva, Pithophora), guppies (Lebistes reticulatus) and mollies (Mollienisia sphenops). Hexane extracts of the samples were cleaned up on a silica gel column as described by Kadoum (1967). Residue determinations were made by gas chromatography with an electron capture detector.

The chlorinated pesticide residues found in the samplings obtained from the canal are given in Tables I and II. No polychlorobiphenyls (PCB's) were found in any of the samples. The marked difference of the percentage distribution of DDT and its metabolites in the Elops species when compared to the Chanos may be partially attributed to the different feeding habits of the two types of fish. The differences noted in the organic parts of the two species are not readily explainable. Macek and Korn (1970) concluded from feeding studies with brook trout that the food chain was the major source of DDT contamination in fish, and Woodwell et al (1967) noted that this pesticide and its metabolites

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TABLE I

Data on Elops hawaiensis and Chanos chanos[a]

	Brain		Liver		Muscle	
	Elops	Chanos	Elops	Chanos	Elops	Chanos
Crude Lipid, %	39.1	50.2	26.8	25.8	5.2	5.8
Pesticide Residue, ppm[b]						
p,p'-DDE	0.26	0.55	0.61	0.08	0.18	0.30
p,p'-DDD	0.63	0.48	1.73	0.02	0.57	0.15
p,p'-DDT	0.15	0.37	0.36	0.04	0.10	0.16
Dieldrin	0.16	0.56	0.37	0.08	0.14	0.49
Total	1.20	1.96	3.07	0.22	0.99	1.10
Total DDE + DDD + DDT	1.04	1.40	2.70	0.14	0.85	0.61
%DDE	25	39	23	57	21	49
%DDD	61	34	64	14	67	25
%DDT	14	27	13	29	12	26

[a] Average values from 30 Elops and 11 Chanos samples.
[b] Fresh wt. basis.

TABLE II

Chlorinated Pesticide Residues (ppm) in Ala Wai Canal Environment[a]

Sample Specimen	DDE	DDD	DDT	Dieldrin	Total
Water	2×10^{-7}	2.2×10^{-6}	1.8×10^{-6}	1.1×10^{-5}	1.5×10^{-5}
Algae	0.01	0.03	0.04	0.04	0.12
Sediment	0.04	0.12	0.07	0.04	0.27
Guppies	0.07	0.16	0.17	0.22	0.62
Mollies	0.06	0.12	0.13	0.24	0.55
Chanos, muscle	0.30	0.15	0.16	0.49	1.10
Elops, muscle	0.18	0.57	0.10	0.14	0.99

[a] Samples obtained during Fall-Spring 1970-1971.

increased with trophic level. Moriarty (1972) questioned the correlation of food chain level to pesticide residue concentration and suggested that differences in residue accumulation may be related to fat content and rate of metabolism in the fish. Holden (1962) and Hopkins (1969) reported correlations between residue levels and lipid content of fish tissue. However, Henderson (1971) observed no correlation between these two parameters; similarly, in this study (Table I), no correlation was evident.

The residue data on water, guppies, and mollies (Table II) suggest agreement with Murphy (1971) that small fish remove DDT from water more efficiently than large fish, that large fish remove pesticides more efficiently from their diet. The data also indicates agreement with Vance and Drummond (1969) that algae are efficient accumulators of pesticide residues and may be a partial source of residues in fish found in waters which contain only trace amounts of pesticides.

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