HERDSMAN LAKE PESTICIDE STUDY

SUMMARY OF RESULTS FROM THE OCTOBER SAMPLING OF PESTICIDE LEVELS IN WATER, SEDIMENTS, INVERTEBRATES, FISH AND WATERBIRDS

AND

RECOMMENDATIONS ARISING FROM STUDY

PREPARED BY

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INTRODUCTION

Further sampling of pesticide levels in the water, sediments, fish and invertebrate fauna of Herdsman Lake occurred in October 1986 approximately seven months after the north - eastern region of the lake was sprayed for the control of Argentine ants. In addition to the sampling of all previous sites, water and sediments were also collected from three drains and two sites on the innermost side of the moat in the Herdsman Lake Industrial Park region.

In addition to the above sampling, Swamphens were collected at the northern and southern ends of the lake and Little Grass Birds were collected from the northern end within the sprayed area in October. Livers were analysed for pesticides and in some cases mesenteric fat was also analysed.

All pesticide analyses were carried out by the Government Chemical Laboratories.

To enable comparison of pesticide levels in Herdsman Lake with levels in lakes elsewhere in the Perth region and to reveal possible rates of decline in pesticide levels over longer time scales, water and sediment samples were collected from six other lakes with known spraying histories in December. The results of this survey were not known at the time of writing this summary.

SUMMARY OF RESULTS

A. Water Samples (Fig.1)

1. Levels of chlordane and heptachlor in the water samples appeared to have evened out between sites and there was an overall decrease between the May post - rain sampling and the October sampling (Fig.1). This may be partly a dilution effect because lake levels had risen since May. Uptake by sediments may also account for the loss of pesticides from the water column (see Fig.2)
2. Levels of heptachlor were still above the Recommended Criteria for Freshwater Life (0.001 ug/l) in October but levels of chlordane had fallen below the Recommended Criteria (0.01 ug/l).
3. The pesticide levels in Drain 1 (the northernmost drain) were higher than in the lake and thus the drain must be considered to be a source of heptachlor, chlordane and dieldrin, although it is not known whether the drain is receiving pesticides in the vicinity of the lake only or whether pesticides enter the drain elsewhere.
4. Pesticide levels at the two sites on the innermost edge of the moat in Herdsman Lake Industrial Park were no lower than those recorded from sites at the lake's edge.

B. Sediment Samples (Fig.2)

5. Levels of heptachlor and chlordane in the sediments increased dramatically in October in comparison to the May post - rain sampling (Fig.2) and this result may partly explain the observed decreases in the two pesticides in the October water samples (Fig.1). Large differences in chlordane levels at different sites indicates that uptake by sediments is not constant across the lake but may vary with different sediment types or some other factor.

C. Fish and Invertebrate Samples (Figs 3 and 4)

6. Spraying appeared to be the cause of large scale mortality amongst fish and corixids (Fig.3) and suggests that the animals present in the area in October had probably recolonized the area from non - sprayed regions. This limits the conclusions that can be drawn from the October sampling session.

7. Levels of chlordane and heptachlor in the fish increased immediately after spraying in April but decreased at the later sampling sessions in May and October (Fig.4). Levels at both spray and control sites were similar in October but still higher than at the pre - spray sampling session.

D. Waterbirds

8. Pesticide levels in birds were only measured in October, which makes interpretation of the data difficult. Using the "as received" values for the liver which enables comparison with published information from other studies it would appear that the level of heptachlor is cause for concern. Values are well below those leading to death or reproductive impairment in geese (~10 mg/kg) but not far below those affecting breeding in kestrels (~1.5 mg/kg). The level of heptachlor in birds at Herdsman Lake is high compared with most studies where the pesticide has been measured (in fact, it seems that <u>some</u> deleterious effects were apparent in most, if not all, studies with <u>higher</u> values) and it will probably take well over a year (partly because birds are still eating food containing the pesticide) for the level to return to a pre - spraying figure.

RECOMMENDATIONS

Because of high heptachlor levels in the waterbirds we recommend a moratorium on spraying for one year while more information is collected about pesticide dynamics in the lake. We do not believe it is appropriate at this time to oppose spraying for Argentine ants in principle.

We recommend that four issues be addressed over the next year :

1. The rate of decline of pesticide levels in water, sediments and biota should be monitored.
2. The role of sediments in the uptake (and release) of pesticides needs to be studied in more detail, with particular emphasis on the differential behaviour of heptachlor and chlordane.
3. The importance of drains in contributing to the pesticide load of the lake and the pattern of pesticide use in the whole catchment (particularly for termite control) needs examination.
4. The impact of Argentine ants on waterbirds (in particular on eggs and young birds) at the lake needs to be thoroughly investigated and the relative impacts of the effects of the ants and the effects of the pesticides on the waterbird populations at the lake needs to be assessed.

S.D. (i) effect on diversity & abundance
(ii) chronic effects on aquatic spp.

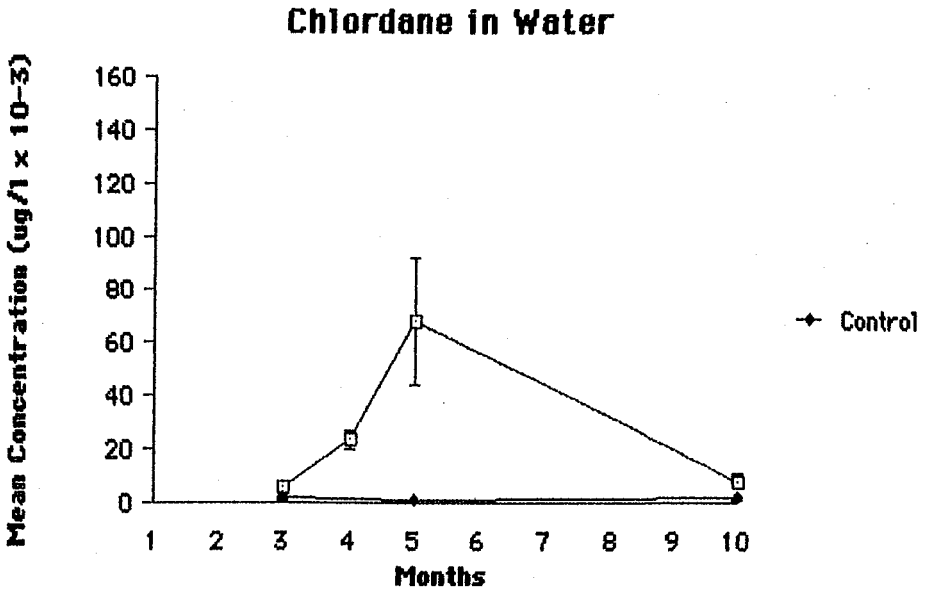
(i) RAOU could examine a range of lakes of known spraying history.

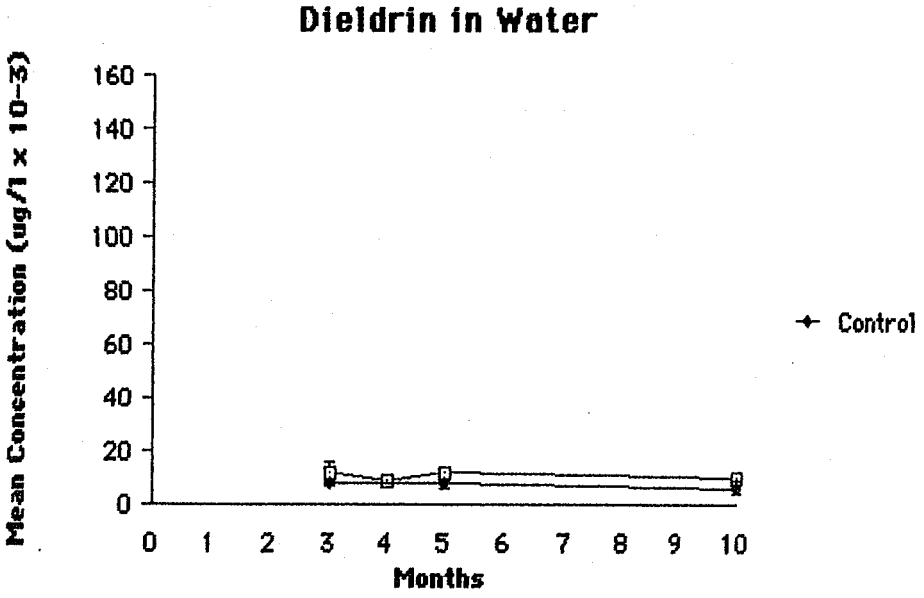
(ii) Breeding birds - failure / success of nesting in Grebes & reed warblers. @ at Herdsman Lake & at two other lakes ants & no spraying ; spraying & no ants.

B.C. ? Comparison of northern area and that around wildlife centre.

JB seek proposals from Murdoch & RAOU
Propose funding to APB, & SPC & EPA.

Fig. 1


Chlordane in Water
Mean Concentration (ug/l x 10-3)
160
140
120
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10
Months
Control


Dieldrin in Water
Mean Concentration (ug/l x 10-3)
160
140
120
100
80
60
40
20
0
0 1 2 3 4 5 6 7 8 9 10
Months
Control

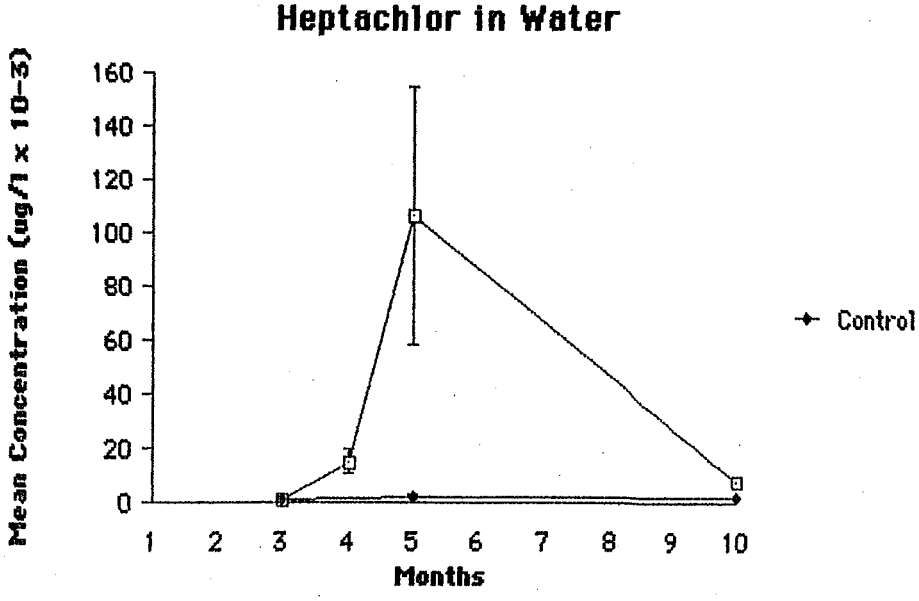
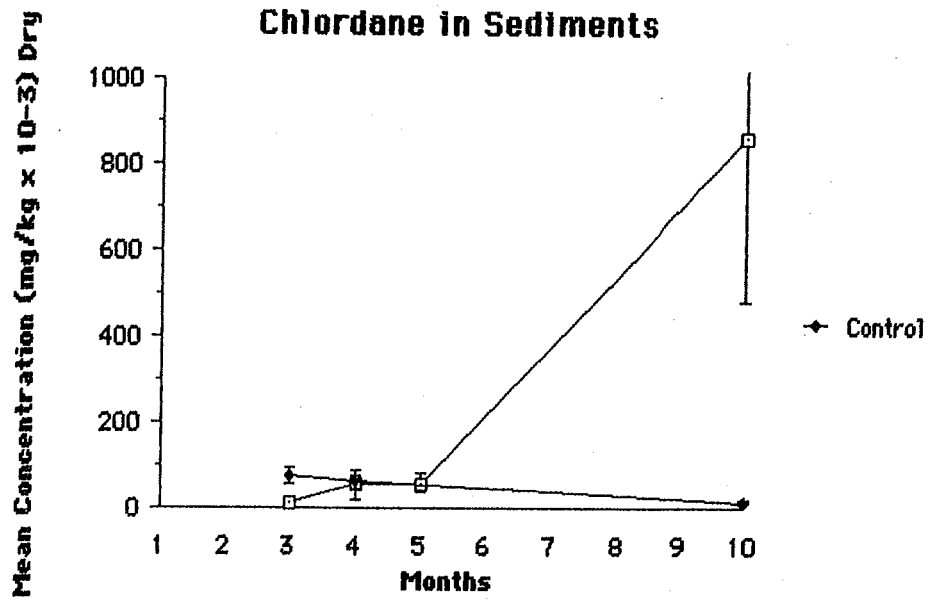
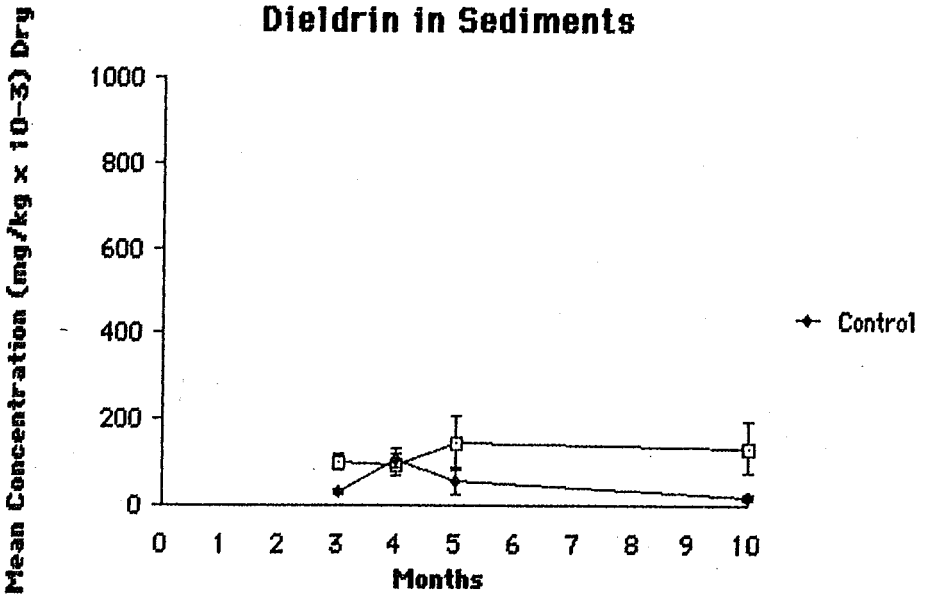

Heptachlor in Water
Mean Concentration (ug/l x 10-3)
160
140
120
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10
Months
Control

Fig. 2.


Chlordane in Sediments
Mean Concentration (mg/kg x 10-3) Dry
1000
800
600
400
200
0
1 2 3 4 5 6 7 8 9 10
Months
Control


Dieldrin in Sediments
Mean Concentration (mg/kg x 10-3) Dry
1000
800
600
400
200
0
0 1 2 3 4 5 6 7 8 9 10
Months
Control

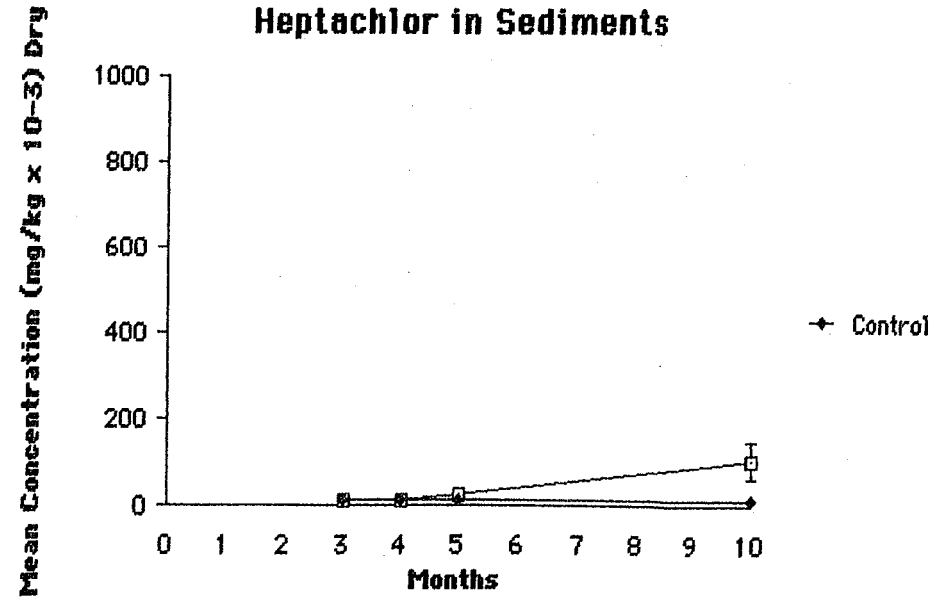
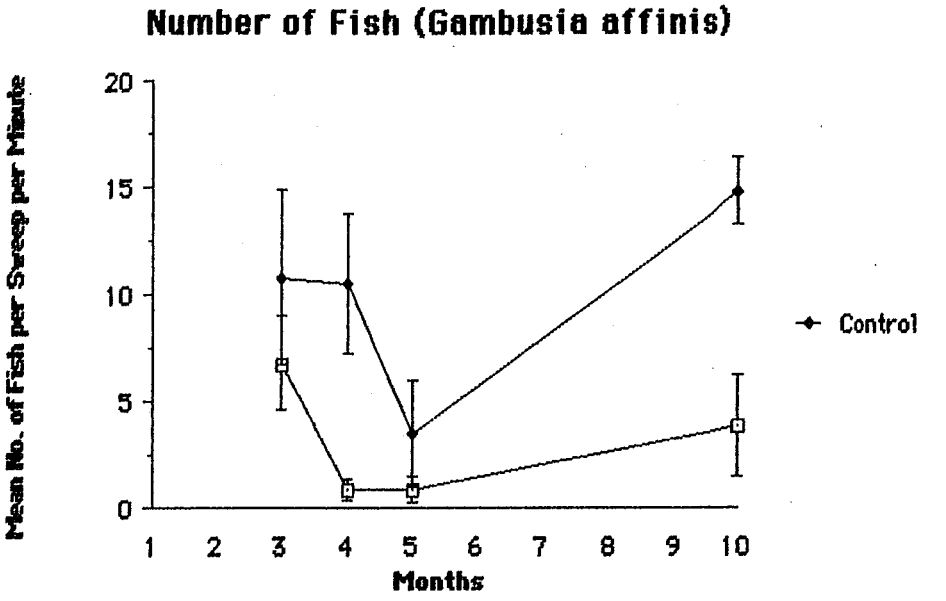

Heptachlor in Sediments
Mean Concentration (mg/kg x 10-3) Dry
1000
800
600
400
200
0
0 1 2 3 4 5 6 7 8 9 10
Months
Control

Fig 3.


Number of Fish (Gambusia affinis)
Mean No. of Fish per Sweep per Minute
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
Months
Control

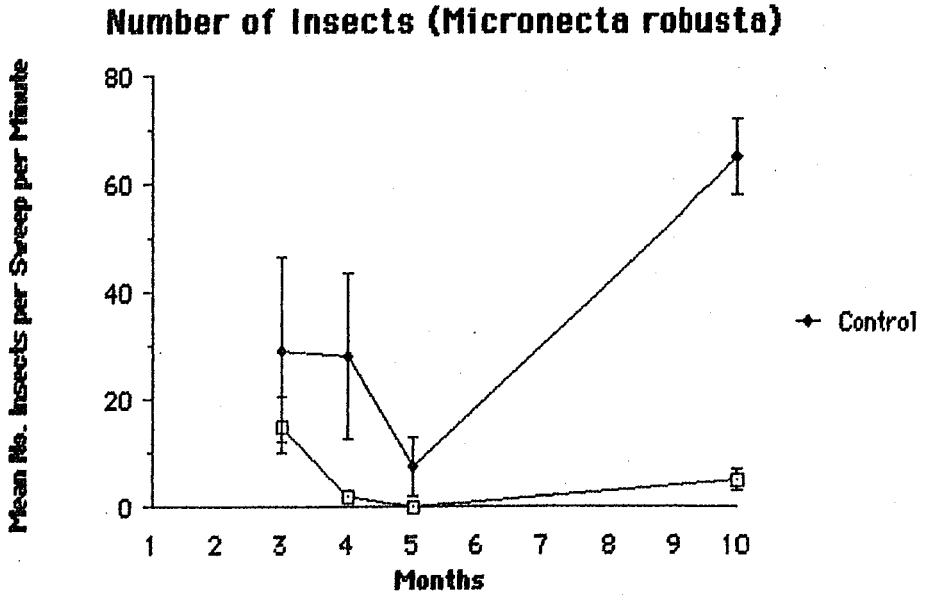
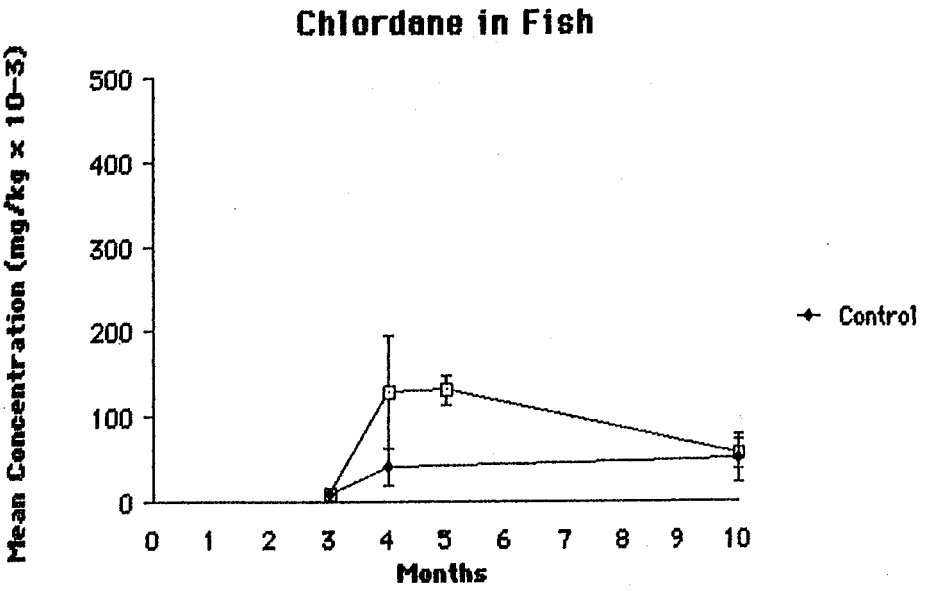
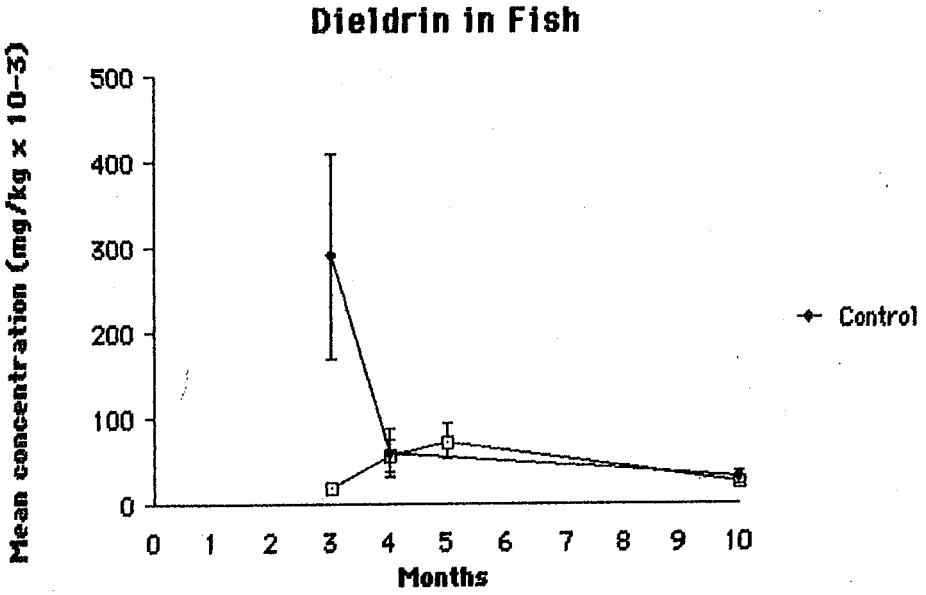
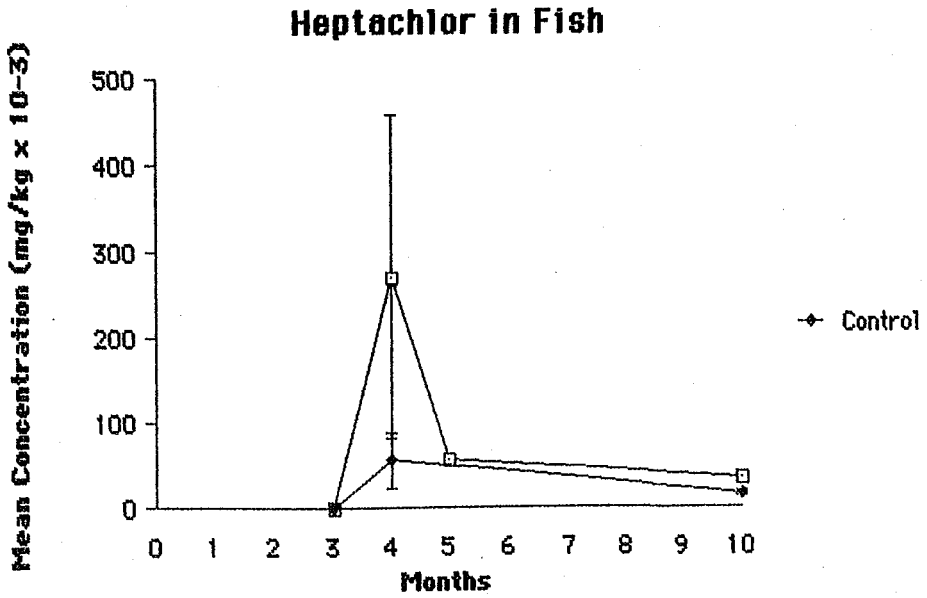

Number of Insects (Micronecta robusta)
Mean No. Insects per Sweep per Minute
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
Months
Control

Fig 4.


Chlordane in Fish
Mean Concentration (mg/kg x 10-3)
500
400
300
200
100
0
0 1 2 3 4 5 6 7 8 9 10
Months
Control


Dieldrin in Fish
Mean concentration (mg/kg x 10-3)
500
400
300
200
100
0
0 1 2 3 4 5 6 7 8 9 10
Months
Control


Heptachlor in Fish
Mean Concentration (mg/kg x 10-3)
500
400
300
200
100
0
0 1 2 3 4 5 6 7 8 9 10
Months
Control

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Director
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CRAWLEY W A 6009
Attention: Mr. J.D. Blyth.

OUR REF:
YOUR REF:
ENQUIRIES TO:

16 January 1987. CC

MATERIAL: Forty-two samples consisting of twenty-one water and twenty-one sediments from Metropolitan Lakes in connection with Herdsman Lake Argentine Ant Control Investigation, as below.

LAB. No. 86F5709-50.

FROM WHOM RECEIVED AND DATE: Department of Conservation & Land Management on 19/12/86.

RESULT OF EXAMINATION:

WATER

Marks		Lab.No. 86F	Aldrin	Chlordane	DDT and metabolites	Dieldrin	Heptachlor & its epoxide
			µg/L				
Lake	Site						
Carabooda	1	5709	<0.001	0.031*	<0.001	0.015*	0.004*
	2	5710	0.002	0.076*	<0.001	0.089*	0.031*
	3	5711	0.021*	1.1*	0.093*	1.6*	0.42*
Goolelal	1	5712	<0.001	0.36*	<0.001	0.014*	0.045*
	2	5713	<0.001	0.17*	<0.001	0.012*	0.026*
	3	5714	<0.001	0.044*	<0.001	0.006*	0.012*
Gwellup	1	5715	<0.001	0.003	<0.001	0.010*	0.006*
	2	5716	<0.001	0.001	<0.001	0.012*	0.004*
	3	5717	<0.001	0.004	<0.001	0.019*	0.016*
Herdsman	1	5718	<0.001	0.013*	<0.001	0.007*	0.007*
	2	5719	<0.001	0.001	<0.001	0.004*	0.001
	3	5720	<0.001	0.001	<0.001	0.009*	0.001
Monger	1	5721	<0.001	0.002	0.001	0.003	0.001
	2	5722	<0.001	0.002	<0.001	0.003	<0.001
	3	5723	<0.001	0.002	0.001	0.005*	0.001
Neerabup	1	5724	<0.001	0.014*	0.002*	0.046*	0.004*
	2	5725	0.13*	0.19*	<0.001	1.1*	0.011*
	3	5726	0.068*	0.26*	<0.001	0.75*	0.050*
Thomson	1	5727	<0.001	0.02*	<0.001	0.002	<0.001
	2	5728	<0.001	<0.001	<0.001	0.002	<0.001
	3	5729	<0.001	0.01	<0.001	0.002	<0.001
Maximum Residue Limit			1	6	3	1	3
Recommended Criteria for Freshwater Life			0.003	0.01	0.001	0.003	0.001

.../2

Results marked with an asterisk are in excess of the recommended criteria for freshwater life.

SEDIMENTS

Marks		Lab.No. 86F	Aldrin	Chlordane	DDT and metabolites	Dieldrin	Heptachlor & its epoxide
			mg/kg (dry basis)				
Lake	Site						
Carabooda	1	5730	0.04	0.31	0.03	0.07	0.02
	2	5731	0.12	0.50	0.09	0.41	0.04
	3	5732	1.3	6.8	0.27	2.1	0.29
Goolelal	1	5733	0.07	4.6	0.05	0.32	0.76
	2	5734	0.01	0.13	<0.01	0.05	0.06
	3	5735	<0.01	9.6	0.01	0.02	0.62
Gwellup	1	5736	<0.01	<0.01	<0.01	0.01	0.01
	2	5737	<0.01	0.02	0.01	0.01	<0.01
	3	5738	0.09	1.3	0.01	0.21	0.23
Herdsman	1	5739	<0.01	<0.01	<0.01	<0.01	<0 01
	2	5740	<0.01	<0.01	<0.01	<0.01	<0.01
	3	5741	0.05	0.03	<0.01	0.27	0.01
Monger	1	5742	<0.01	<0.01	<0.01	0.01	<0.01
	2	5743	<0.01	<0.01	0.01	0.01	<0.01
	3	5744	<0.01	0.01	0.01	0.02	<0.01
Neerabup	1	5745	0.50	0.28	0.12	1.3	0.01
	2	5746	0.03	0.10	0.02	0.15	0.01
	3	5747	0.75	0.90	0.16	2.3	0.03
Thomson	1	5748	0.01	<0.01	<0.01	0.01	<0.01
	2	5749	<0.01	<0.01	0.01	0.01	<0.01
	3	5750	0.01	0.01	0.01	0.03	0.01

No other common organochlorine pesticides were detected.

F.E. UREN
CHIEF
FOOD & INDUSTRIAL HYGIENE LABORATORY.

Copy to: Ms J. Davis, School of Environment & Life Sciences,
Murdoch University, South St. MURDOCH 6150.

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