

Report

Results of the German approach with pesticide aquatic risk indicators REXTOX and ADSCOR

Data base

The indicator approach is based on German pesticide sale data from 1987, 1994, and 1998. The procedure described by Gutsche & Rossberg¹ was applied to estimate pesticide use in that three years. The top 15 herbicides and fungicides, and the top 12 insecticides in arable crops were considered. Tables 1a – 1c show the results of the estimates.

Table 1a

		Herbicides			
Active Substances 1987	Estimated CAT*	Active Substances 1994	Estimated CAT	Active Substances 1998	Estimated CAT
Atrazin	1974517	Isoproturon	1888674	Diflufenican	3254880
Mecoprop	1873728	Fluroxypyr	1060855	Isoproturon	2569312
Dichlorprop	1404020	Dichlorprop-P	1009483	Amidosulfuron	1456672
MCPA	1129640	Mecoprop-P	961958	loxynil	1143520
Isoproturon	928110	Diflufenican	790989	Fluroxypyr	943281
loxynil	757326	Bromoxynil	735198	Glyphosat	923542
2,4-D	724163	Metazachlor	634110	Metazachlor	893905
Bromoxynil	511908	Ethofumesat	572379	Mecoprop-P	670459
Chlortoluron	454884	Phenmedipham	559465	MCPA	666922
Simazin	433848	Glyphosat	507195	Rimsulfuron	635656
Methabenzthiazuron	345113	Bifenox	479498	Thifensulfuron	635015
Fluroxypyr	291517	Metsulfuron	461422	Tribenuron	578534
Bentazon	274707	Bentazon	446935	Metamitron	576228
Metsulfuron	226415	Rimsulfuron	421546	Bentazon	561747
Triallat	221440	MCPA	402359	Metsulfuron	546431

* estimated cumulative area treated

Table 1b

		Fungicides			
Active Substances 1987	Estimated CAT	Active Substances 1994	Estimated CAT	Active Substances 1998	Estimated CAT
Propiconazol	1420855	Fenpropimorph	1246298	Epoxiconazol	2534399
Maneb	866810	Epoxiconazol	807688	Kresoxim-Methyl	2192365
Fenpropimorph	807726	Maneb	786493	Tebuconazol	1879175
Triadimenol	783829	Triadimenol	669946	Carbendazim	1384075
Prochloraz	740727	Propiconazol	663304	Azoxystrobin	1207500
Anilazin	668723	Tebuconazol	562630	Fenpropidin	1185194
Tridemorph	639301	Prochloraz	520953	Mancozeb	1163777
Carbendazim	607188	Mancozeb	472566	Fenpropimorph	1015550
Mancozeb	530692	Carbendazim	457164	Flusilazol	623824
Fentin-acetat	293426	Cyproconazol	367837	Prochloraz	482556

¹ Gutsche, V. & Rossberg, D.: Annex 1: Estimating use data from sales – A proposal for estimating the quantity of pesticide active ingredients applied by crop based on national sales data. OECD Aquatic Risk Indicator Project. Report of Phase I, 2000, 44-49

Metalaxyl	272701	Flusilazol	323162	Metiram	336576
Kupferoxychlorid	258085	Fentin-hydroxid	295150	Maneb	332432
Cymoxanil	166920	Fluazinam	242460	Cyprodinil	268549
Vinclozolin	156583	Metiram	237772	Dithianon	240625
Metiram	148046	Anilazin	174526	Propamocarb	230840

Table 1c

		Insecticides			
Active Substances 1987	Estimated CAT	Active Substances 1994	Estimated CAT	Active Substances 1998	Estimated CAT
Dimethoat	613046	alpha-Cypermethrin	683057	alpha-Cypermethrin	1036726
Oxydemeton-methyl	424049	lambda-Cyhalothrin	591792	Esfenvalerat	795726
Cypermethrin	278439	Cypermethrin	482955	Parathion	551111
Methiocarb	255978	Dimethoat	478262	Dimethoat	533710
Permethrin	186577	Deltamethrin	408625	Cypermethrin	533477
Deltamethrin	161437	Oxydemeton-methyl	362561	Deltamethrin	484333
Pirimicarb	139933	Parathion	285212	Oxydemeton-methyl	297900
Lindan	88074	beta-Cyfluthrin	174078	beta-Cyfluthrin	213943
Parathion	127030	Fenvalerat	171725	Pirimicarb	194252
Methidathion	65995	Permethrin	93200	tau-Fluvalinat	118616
Endosulfan	48980	Methamidophos	83878	Methamidophos	117625
Methamidophos	36794	Pirimicarb	57807	Permethrin	44992

It should be noticed that the magnitude of the estimated area differs between 1987 and the other both years. That huge difference is essentially caused by the German unification in 1990, when the agricultural area increased by about 30 %.

Indicators tested and scaling

Because of difficulties to run the revised version of SYSCOR the indicators REXTOX and ADSCOR have only been tested. The estimation procedure did also not enable a regional differentiation. Therefore the risk trend was tracked on national scale only.

Method of result aggregation

All aggregations were separately carried out for herbicides, fungicides and insecticides, respectively. Depending on the number of its target crops, each pesticide is represented by more than one line in the use table and the related indicator result table. To obtain risk indices per pesticide the indices were averaged over the target crops. Table 2 shows as an example the results of this first aggregation tier for the top 15 fungicides in 1998.

Table 2

Year	Pesticide	Algae_unsc	Daphnia_unsc	Fish_unsc	Cumulated area treated	Weights
1998	Azoxystrobin	0.00164	0.00148	0.00067	1207000	0.09008
1998	Carbendazim	0.00042	0.00212	0.00061	612000	0.04568
1998	Cyprodinil	0.00062	0.00814	0.00033	128761	0.00961
1998	Dithianon	0.0001	0.00197	0.00394	164549	0.01228

1998	Epoxiconazol	0.00016	0.00004	0.00006	2378000	0.17748
1998	Fenpropidin	0.06732	0.00071	0.00015	1184000	0.08837
1998	Fenpropimorph	0.00012	0.00011	0.00005	1414000	0.10553
1998	Flusilazol	0.00004	0.00029	0.00021	664000	0.04956
1998	Kresoxim-Methyl	0.00588	0.00199	0.00034	1963000	0.14651
1998	Mancozeb	0.00142	0.00602	0.00345	685500	0.05116
1998	Maneb	0.00891	0.01231	0.00716	332428.8	0.02481
1998	Metiram	0.00513	0.0006	0.00006	283628	0.02117
1998	Prochloraz	0.03936	0.00032	0.00029	525000	0.03918
1998	Propamocarb	0.00001	0.00001	0.00001	211603	0.01579
1998	Tebuconazol	0.00007	0.00006	0.00004	1645000	0.12278
	Weighted mean	0.00898	0.00137	0.0006		

Please notice that the unscaled risk indices in each cell are mean values over the target crops whereas the cumulated area treated was summed up.

In a second tier of aggregation the weighted mean values over the pesticides used in a single year were calculated. The weights are derived from the cumulated areas treated. In table 2 the weights are given in the last column and the weighted means can be found in the last row.

Because of the essential difference of the agricultural area between 1987 and the years after it was decided to focus on the unscaled indices of the indicators REXTOX and ADSCOR.

Results

Risk trend

To handle the huge variation of the index values of the different organisms algae, daphnia and fish, not absolute but relative numbers were used for graphical presentations. For that purposes the maximum number was set to 100% and the values of the remaining both other years were related to that maximum (see table 3)

Table 3: REXTOX unscaled absolute and relative risk indices for herbicides

Year	Algae_unsc	Daphnia_unsc	Fish_unsc
Absolute values			
1998	0.003387809	7.7114E-06	8.46718E-06
1994	0.120804033	2.0394E-05	3.75516E-05
1987	0.008630673	1.1672E-05	2.09124E-05
Relative values			
1998	2.80%	37.81%	22.55%
1994	100.00%	100.00%	100.00%
1987	7.14%	57.23%	55.69%

The risk trends for the different organisms and pesticide groups are given in figures 1a – 1c (REXTOX results) and figures 2a – 2c (ADSCOR results), respectively.

Comparing the results of both indicators it becomes obviously that the risks caused by herbicides follow the same trend. In case of fungicides only the risk trend for fish is comparable between

REXTOX and ADSCOR whereas for insecticides the trend for all three organisms shows quite different figures.

Figure 1a

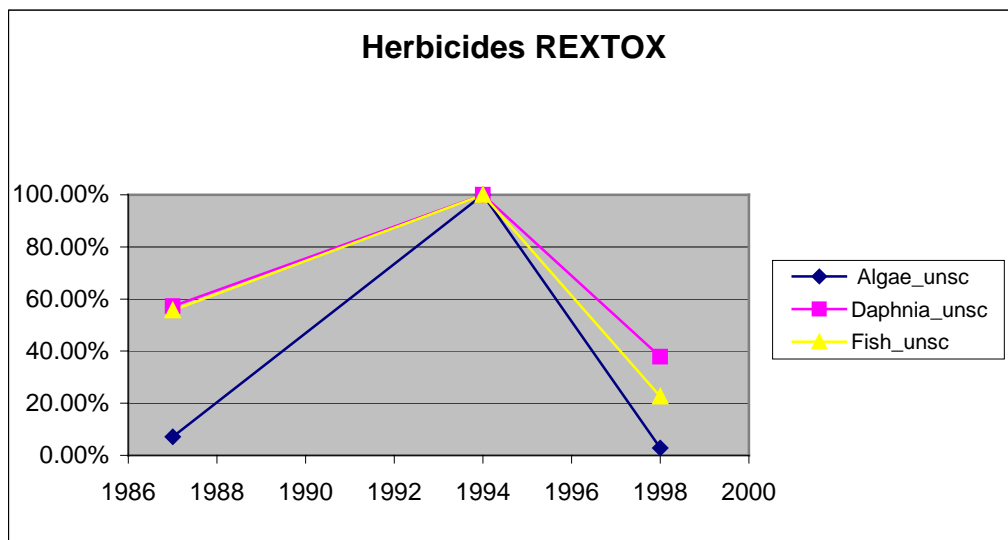


Figure 1b

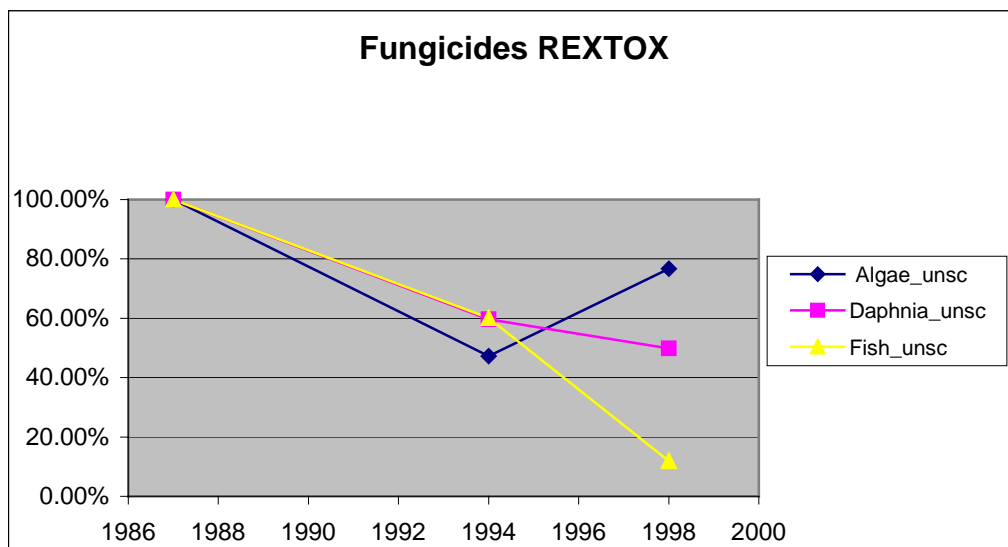


Figure 1c

Insecticides REXTOX

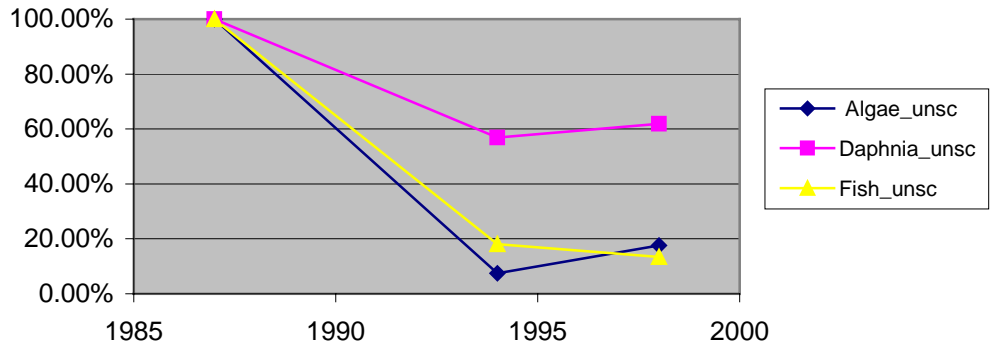


Figure 2a

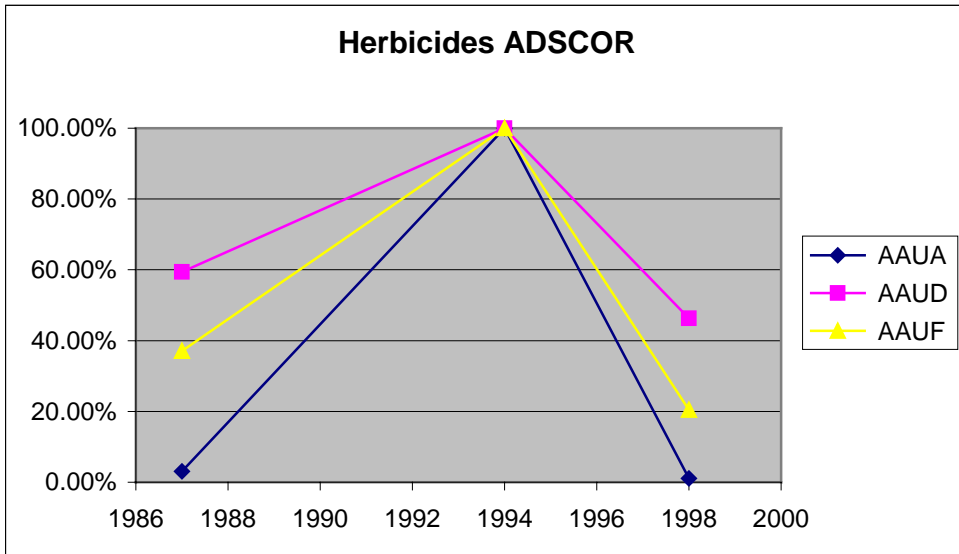


Figure 2b

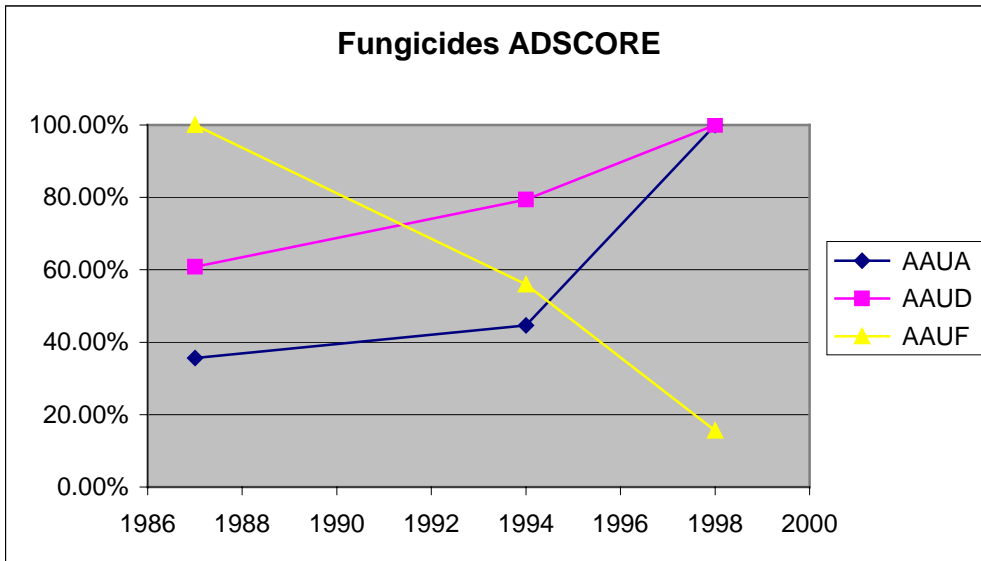
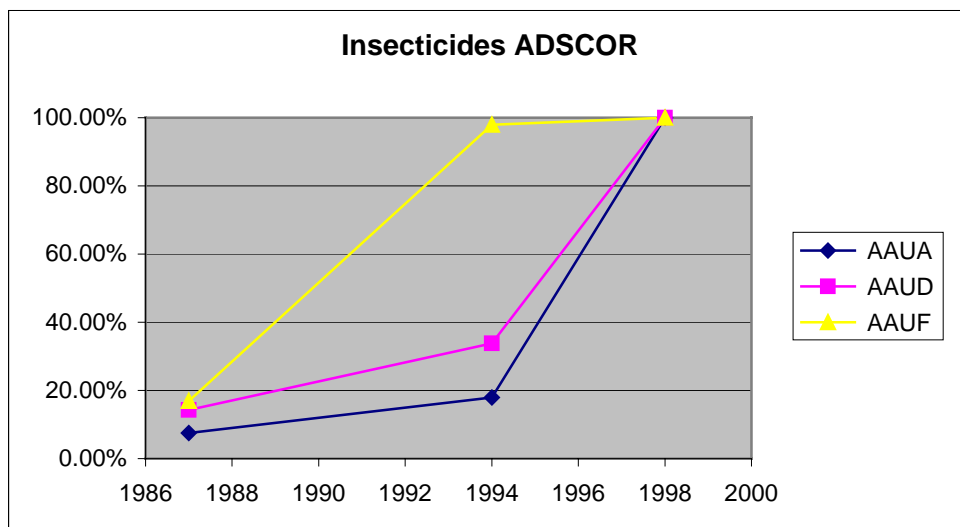


Figure 2c

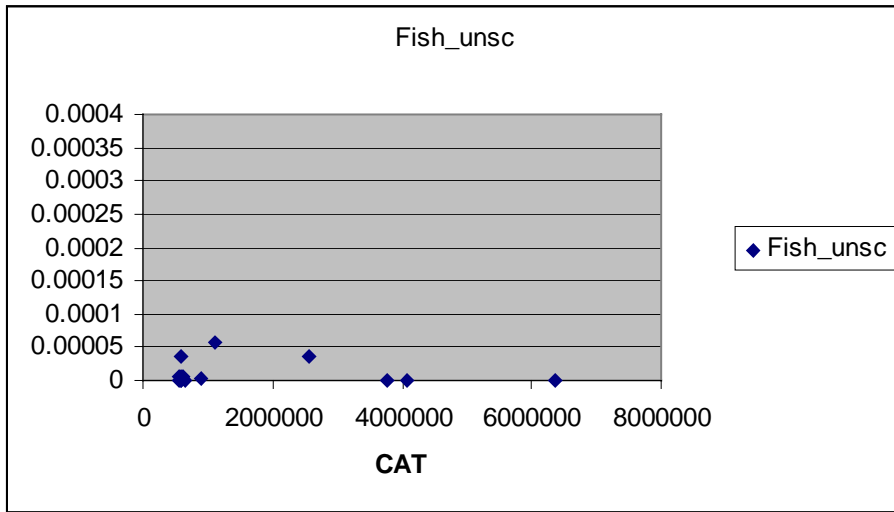


Analysis of particular years

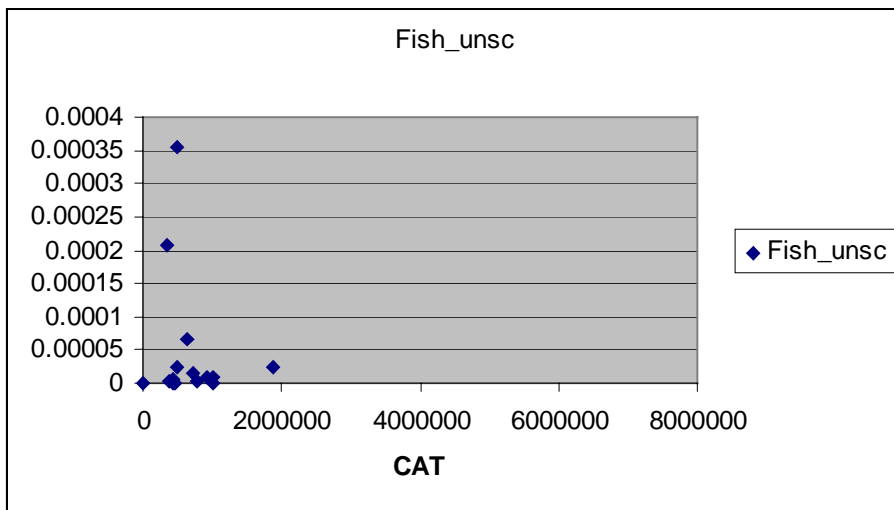
For a better interpretation of the trend graphics it is useful to look behind each singular point by analyzing its composition. It was made by drawing the absolute risk indices of a pesticide versus its cumulated area treated within a x–y-scattering plot. The figures 3a –11c give the results. If appropriating the pesticide with the maximum value is named below the plot.

Figures 3a-3c: Scattering plot herbicides, fish

1998

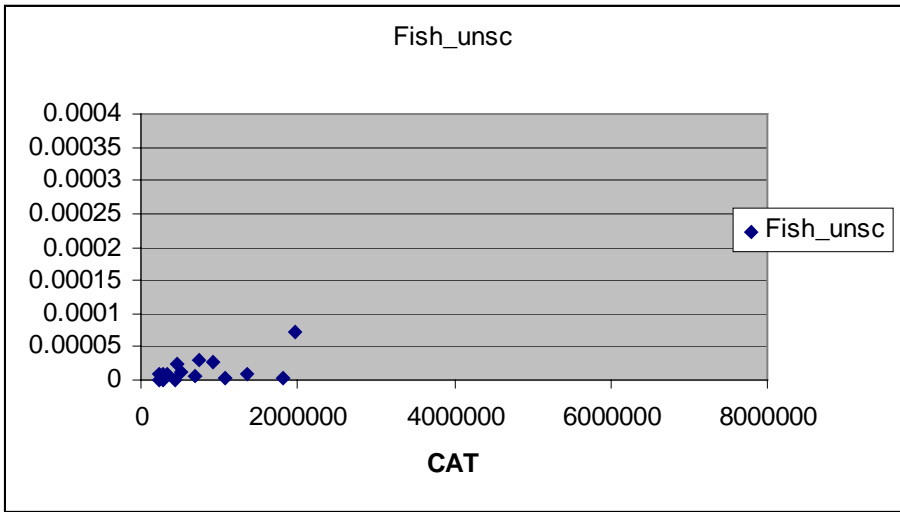


1994

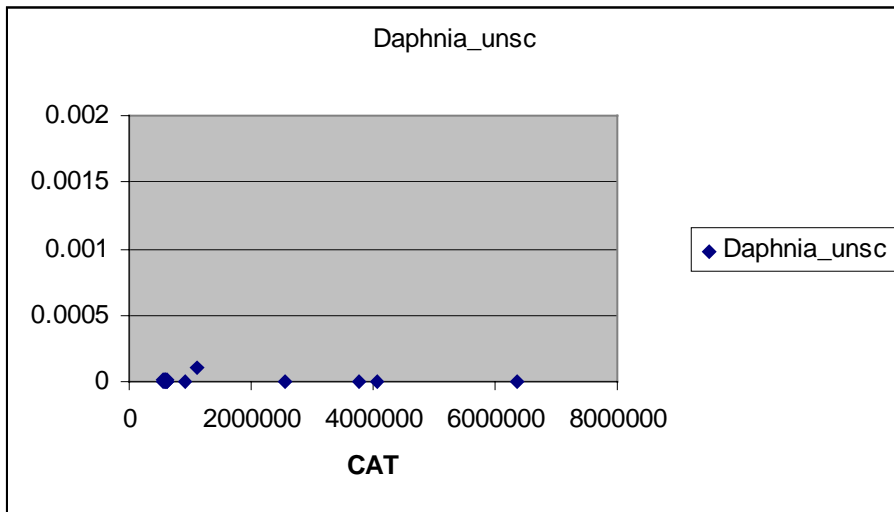


max. values: Bifenox, Phenmedipham

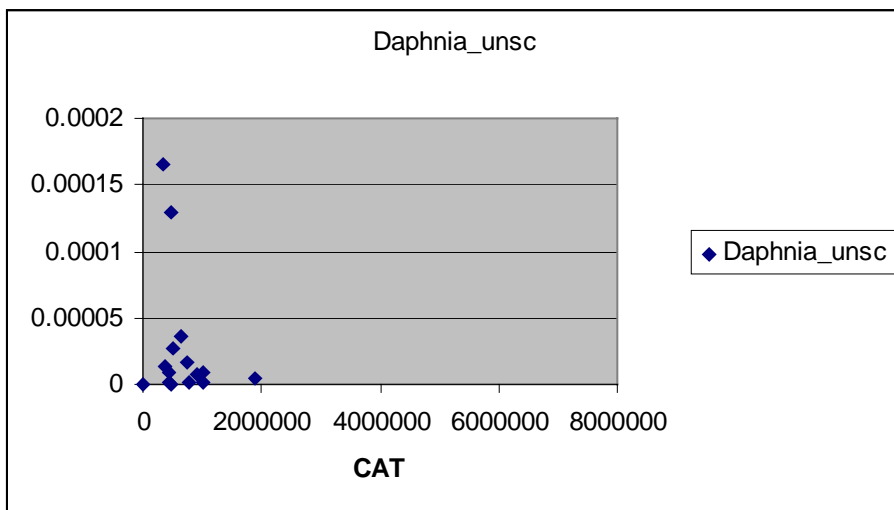
1987



Figures 4a-4c: Scattering plot herbicides, daphnia
1998

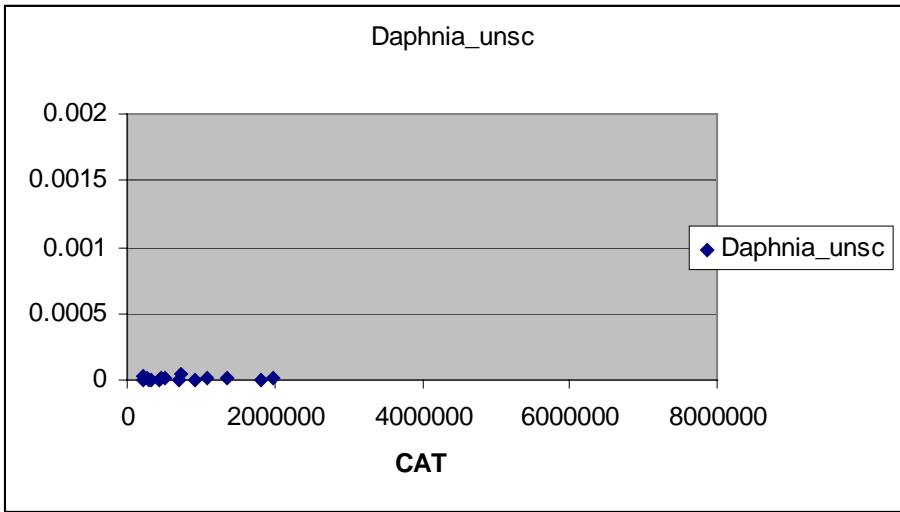


1994

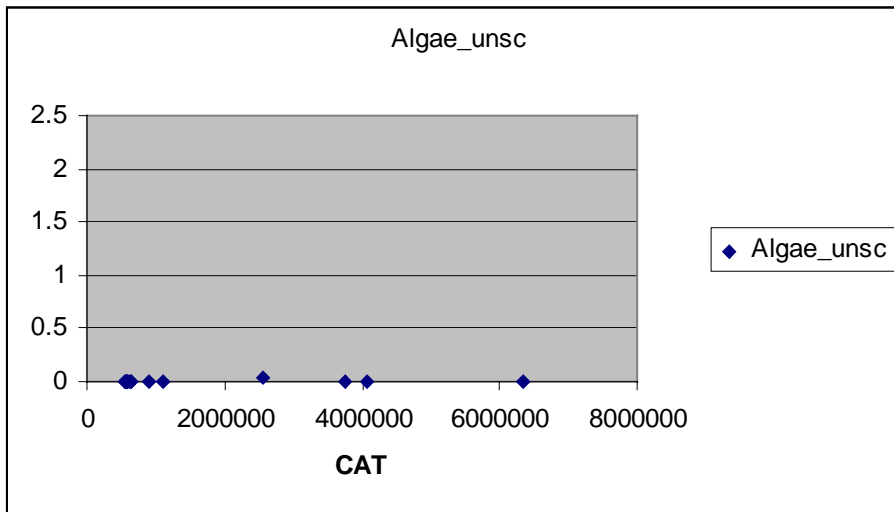


max. values: Phenmedipham, Bifenox

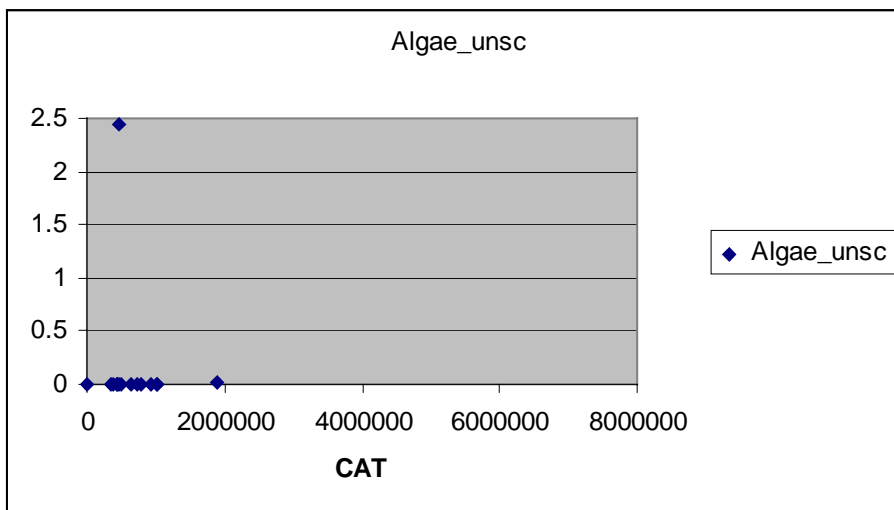
1987



Figures 5a-5c: Scattering plot herbicides, algae
1998

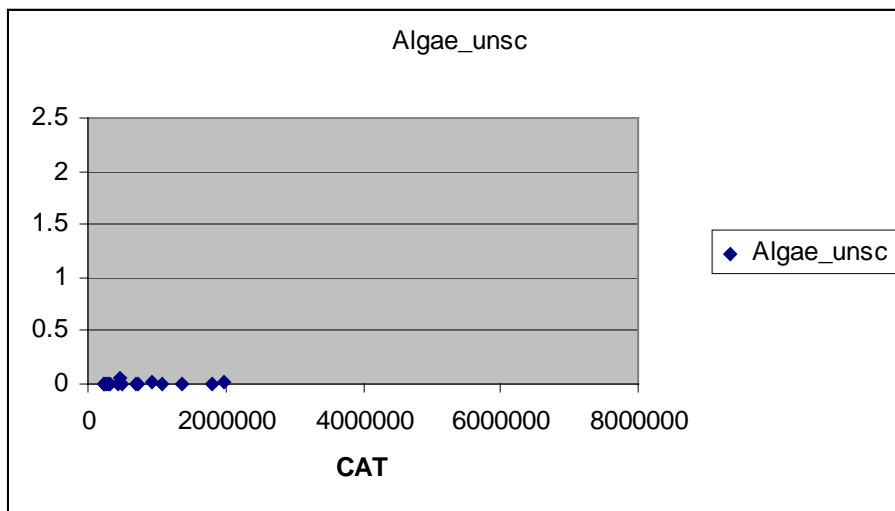


1994



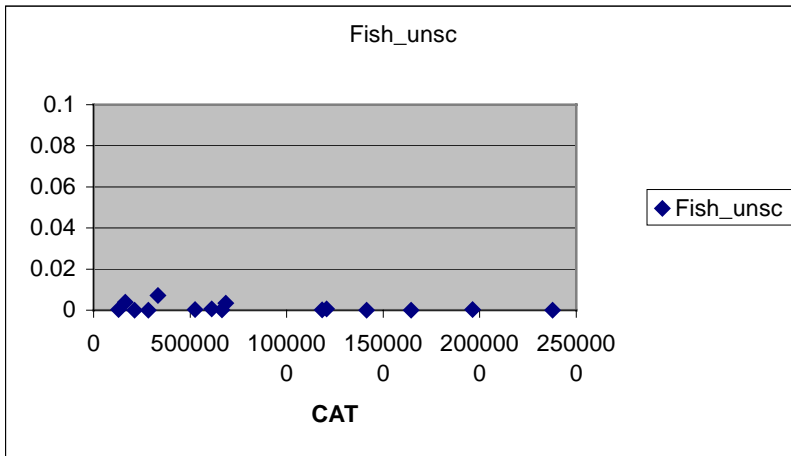
max. value: Bifenox

1987

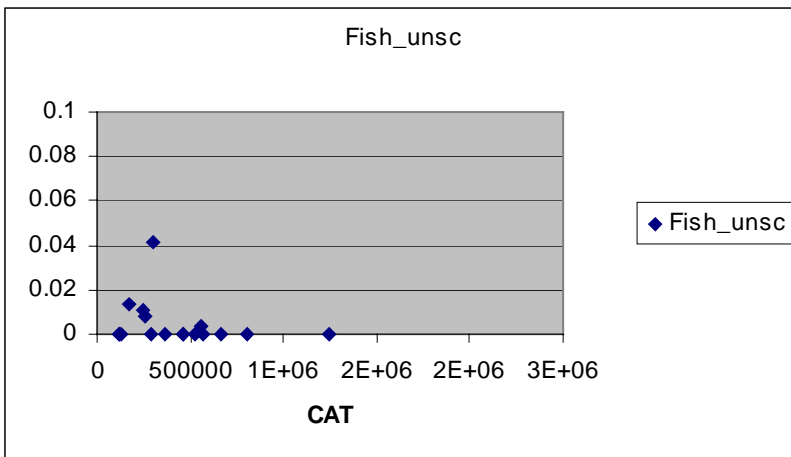


Figures 6a-6c: Scattering plot fungicides, fish

1998

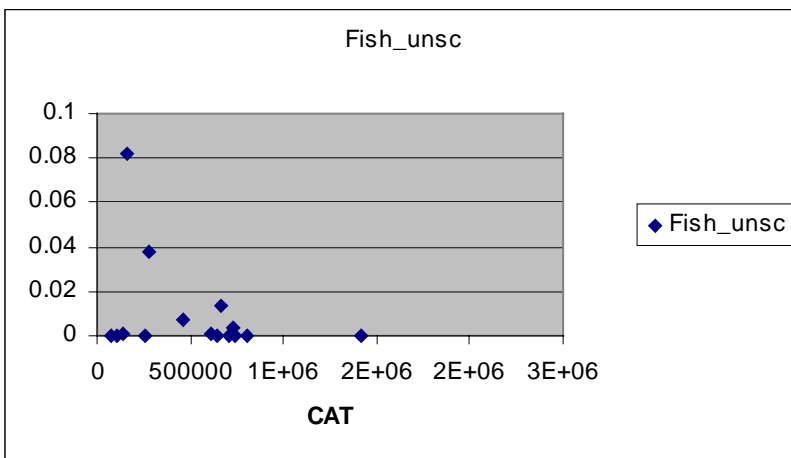


1994



max. value: Fentin-hydroxid

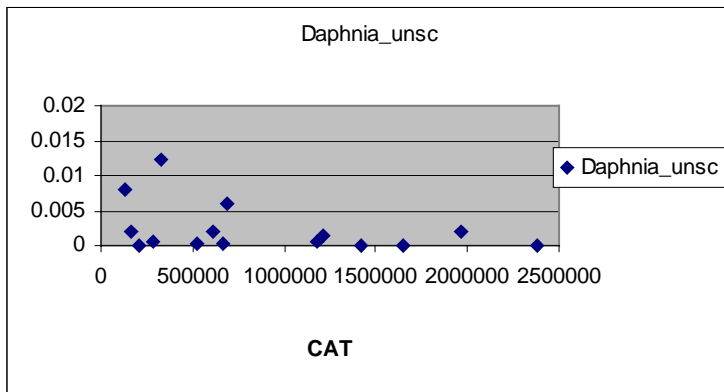
1987



Max. values: Copper-oxyclorid, Fentin-acetat

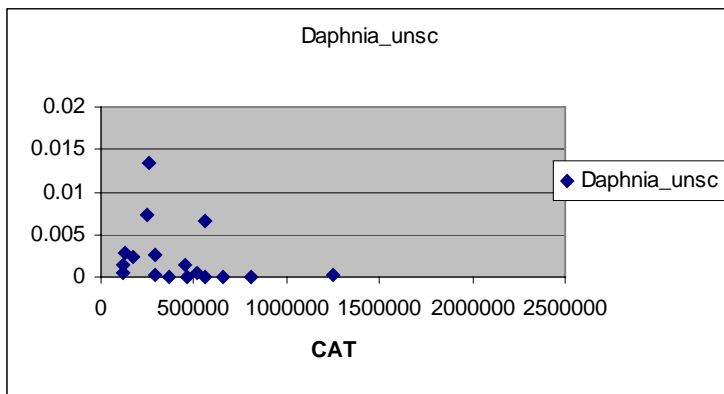
Figures 7a-7c: Scattering plot fungicides, daphnia

1998



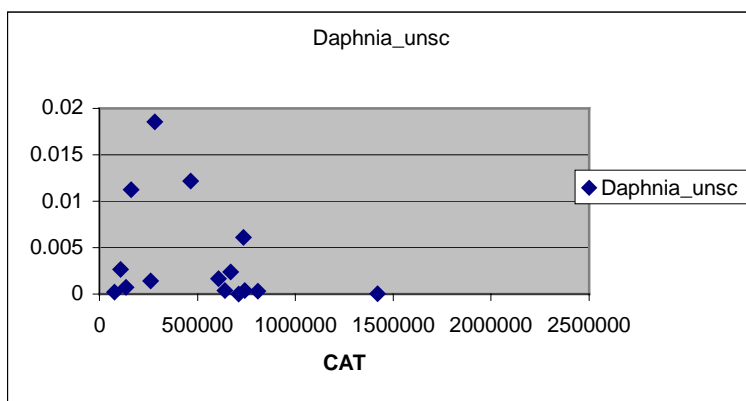
Max. value: Maneb

1994



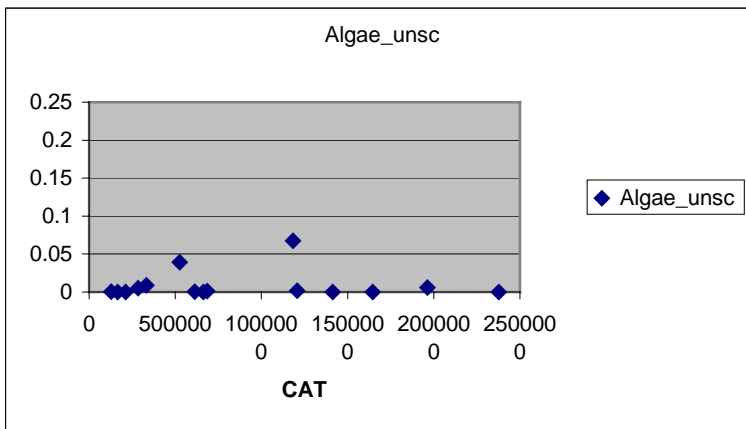
Max. value: Mancozeb

1987

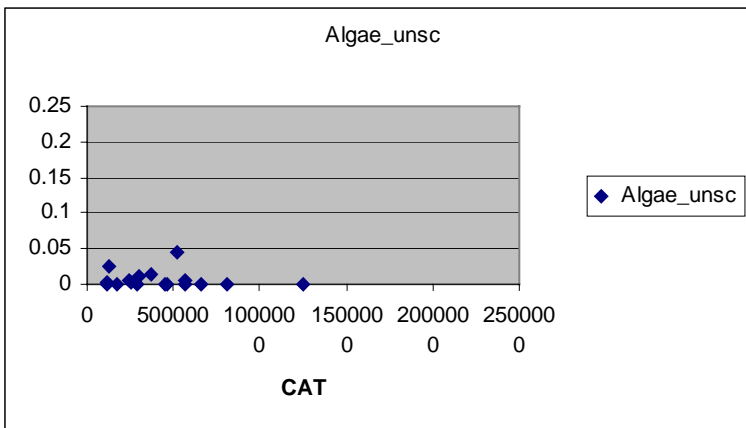


Max. value : Fentin-acetat

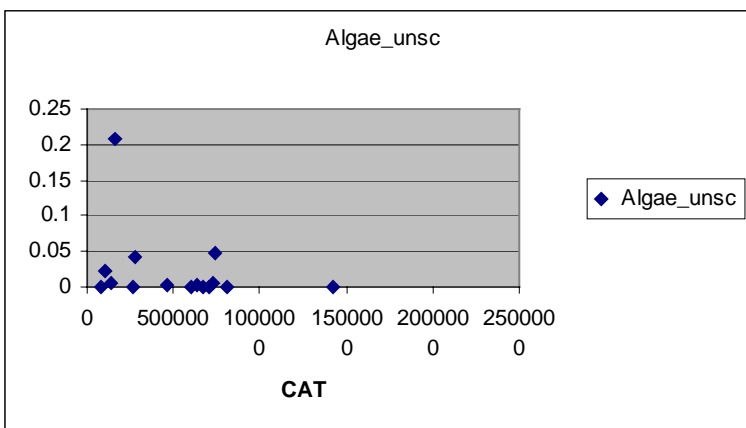
Figures 8a-8c: Scattering plot fungicides, algae
1998



1994



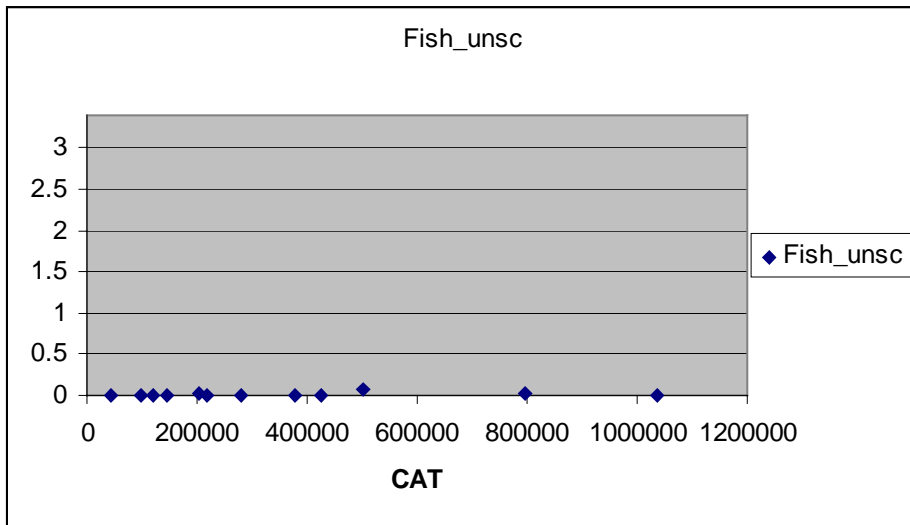
1987



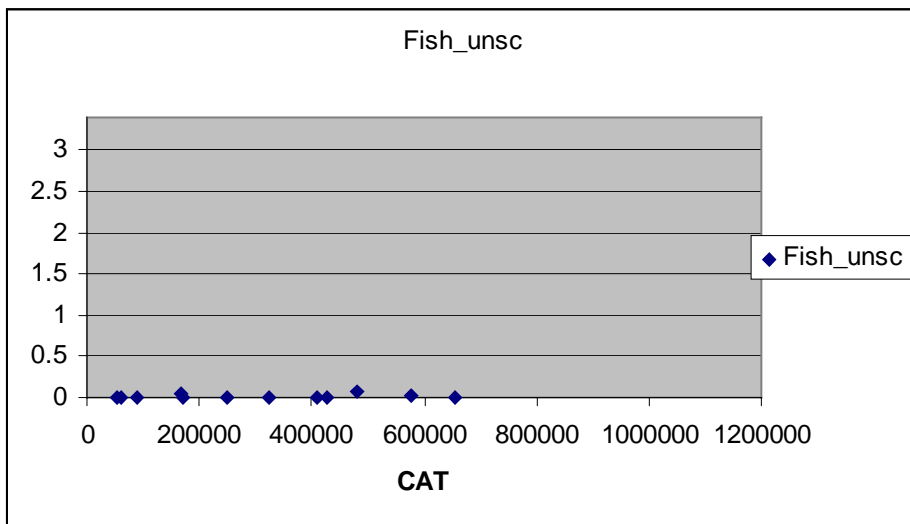
Max. value: Copper-oxychlorid

Figures 9a-9c: Scattering plot insecticides, fish

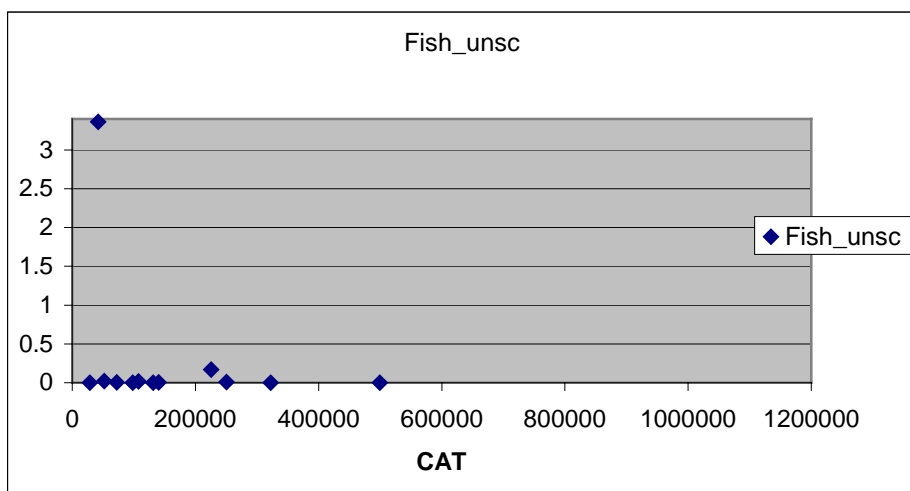
1998



1994



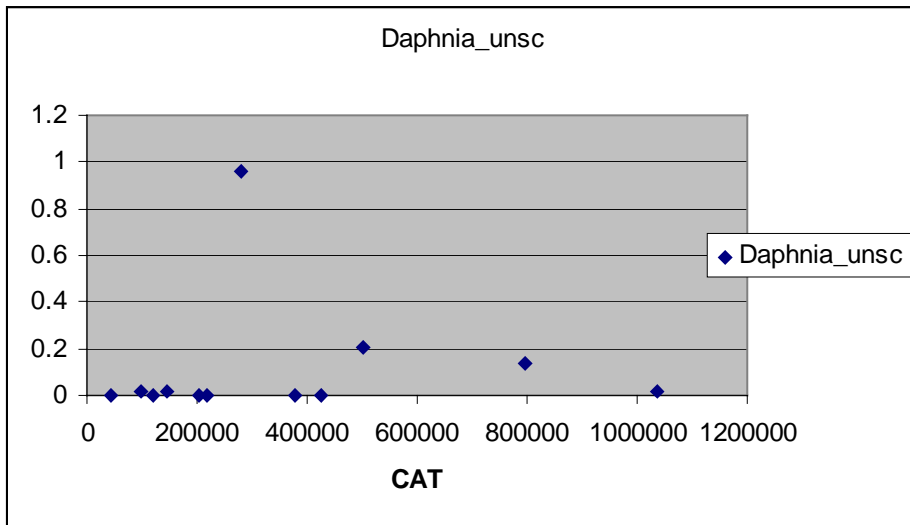
1987



max. value: Endosulfan

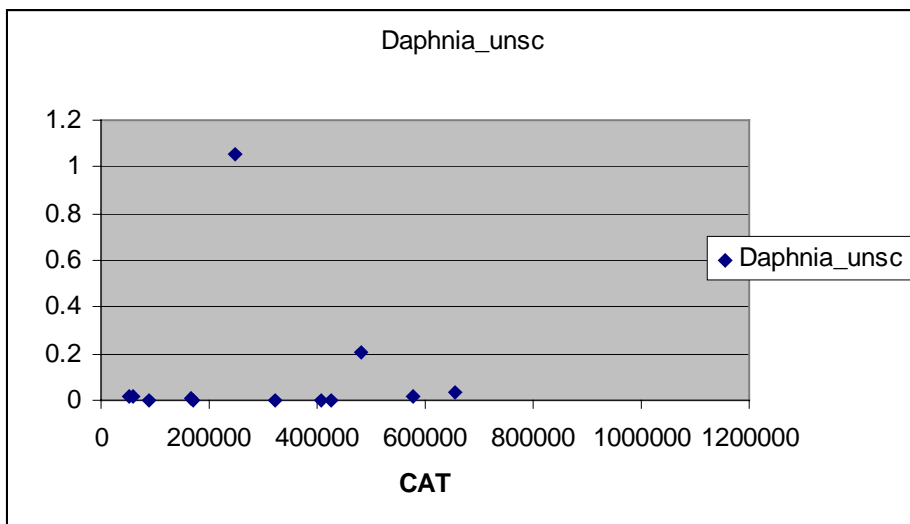
Figures 10a-10c: Scattering plot insecticides, daphnia

1998



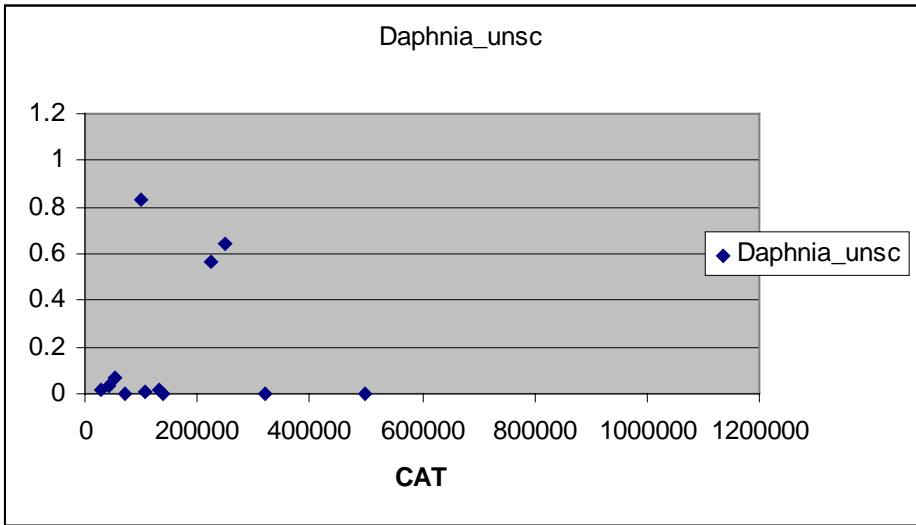
max. value: Parathion

1994



max. value: Parathion

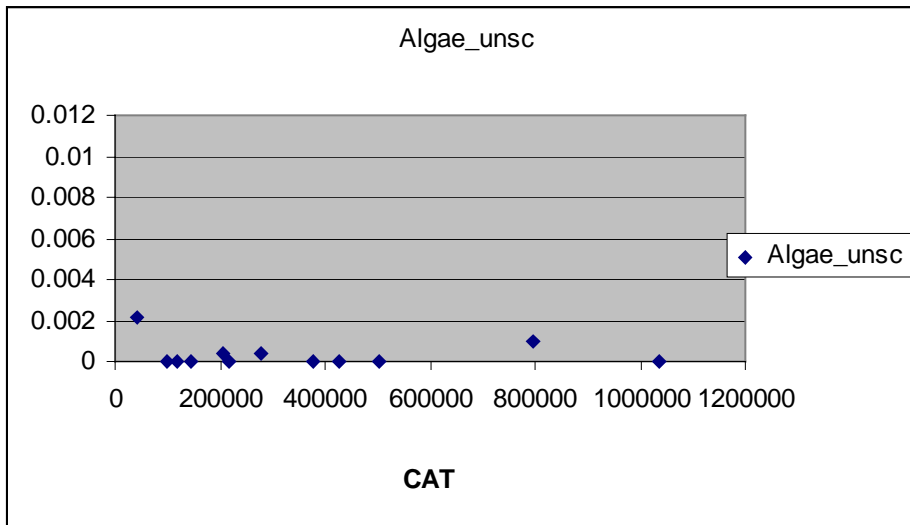
1987



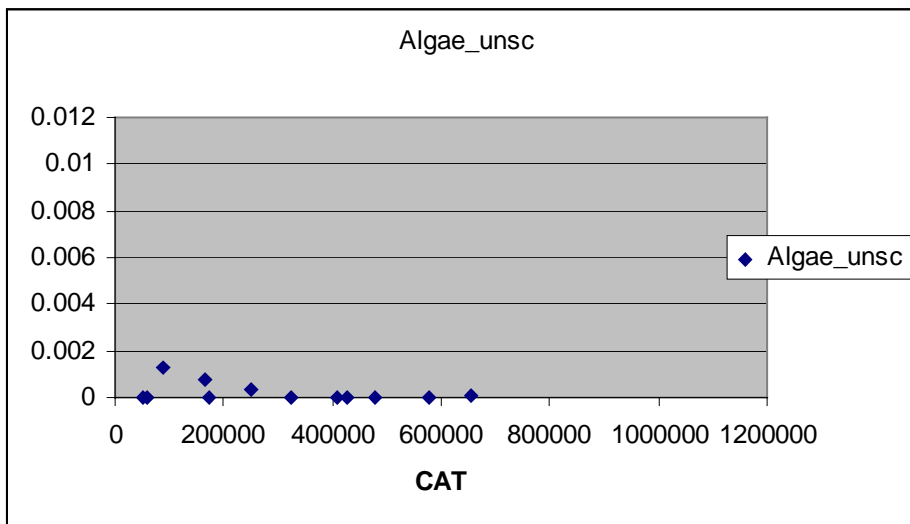
max values: Parathion, Methiocarb, Cypermethrin

Figures11a-11c: Scattering plot insecticides, algae

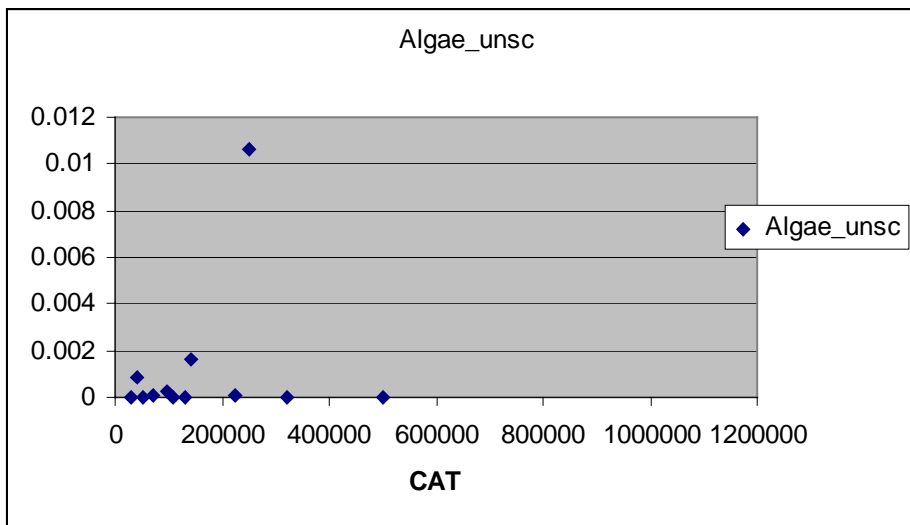
1998



1994



1987



max. value: Methiocarb