EA - Water Quality

WELSH SHEEP DIP MONITORING PROGRAMME

1997

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EXECUTIVE SUMMARY

Introduction

Sheep are prone to infestation by a number of ectoparasites and are therefore dipped for economic, cosmetic and welfare reasons. Many of the ectoparasites can be treated by means other than dipping, but for sheep scab the immersion of sheep in an insecticide is currently the most widely accepted treatment method.

Synthetic pyrethroid pesticides were being incorporated into dip formulations in the early 1990s, partly because of the concern for the effects organophosphate pesticides may have on the health of farmers undertaking the dipping process. Synthetic pyrethroids pose a lower hazard to human health than organophosphate dips but are up to 100 times more toxic to aquatic invertebrates.

During latter years there has been an increasing awareness of the problems associated with the use of synthetic pyrethroid based sheep dips. A number of very serious pollution incidents have occurred, particularly in Scotland and the NW England, where single incidents have resulted in the fauna of some 20-30 km of river being seriously impacted following the discharge of a synthetic pyrethroid sheep dip to a watercourse. Given the importance and prevalence of sheep farming in Wales, the Welsh and Midland Regions of the Environment Agency initiated a monitoring programme for the 1997 dipping season.

Methods

Ten sub-catchments from within the intensive sheep rearing areas were chosen to be included in the full monitoring programme. Sheep dip usage information identified June/July and September/October to be the peak dipping periods. The monitoring programme therefore extended from May 1997 until November 1997.

A network of 39 water quality sampling points was identified within the ten sub-catchments. Fortnightly water column and monthly sediment samples were collected from this sampling network and analysed for pesticides used as active ingredients in sheep dip formulations.

Biological surveys were undertaken in each of the sub-catchments at the end of July and again at the end of October.

A programme of farm visits was also instigated in the monitored catchments.

Stream chemistry

The contamination of watercourses by sheep dip chemicals was found to be widespread throughout Wales. The temporal pattern of detection was in accordance with that expected from known peak dipping periods.

Concentrations of organophosphates were typically in the range 5-20 ng/l, and current limits of detection are therefore adequate. The concentration of synthetic pyrethroid based pesticides recorded in Upper Severn area was typically 0.1-1.0 ng/l, and therefore a limit of detection of at least 0.1 ng/l is required to adequately monitor for these chemicals. The limit of detection used for synthetic pyrethroids in the other three areas of Wales in 1997 was 25 ng/l, and therefore the results for these areas will tend to under-represent true Environmental Quality Standard (EQS) exceedances.

Only two sediment samples proved positive for any sheep dip chemical. The current limit of detection for sediment SP samples (>10 ug/kg) is therefore inadequate to be used as a routine monitoring tool to detect contamination. This method of sampling should, however, be continued as part of pollution incident investigations where concentrations are markedly higher (400-4000 ug/kg).

Nineteen of the monitored sites (49%) failed the maximum allowable concentration (MAC) EQS for one or more of the sheep dip pesticides. 12 (31%) of the sites failed the MAC EQS for one or more of the organophosphate pesticides and 8 (21%) sites failed the draft MAC EQS for cypermethrin. No assessment was made against flumethrin (SP) results since there is no current agreed MAC EQS for this pesticide. Diazinon was the OP pesticide which caused the most frequent MAC EQS failures.

Of the 39 water quality monitoring sites, 22 (56%) failed the Annual Average (AA) Environmental Quality Standard (EQS) for one or more of the sheep dip pesticides. 16 (41%) of the sites failed the AA EQS for one or more of the organophosphate(OP) pesticides and 9 (23%) sites failed the draft EQS for cypermethrin (SP). No assessment was undertaken against flumethrin (SP) results since there is no current agreed AA EQS for this pesticide. There was some variation across Wales in AA EQS compliance with a considerably lower percentage of sites failing the standards in SE and SW Area.

Diazinon was again the OP pesticide which caused the most frequent AA EQS failures, with 33% of sites failing for this chemical.

Stream biology

The distribution of biological sampling sites enabled 679 km of streams to be surveyed in the monitored catchments. Some 33.8 km of streams within these monitored catchments were found or suspected to be impacted by sheep dip. In addition, biology in a further 75.3 km of streams outside the monitored catchments is known to have been impact due to recorded pollution incidents. In total, therefore, there is some 109.5 km of stream length in Wales where biology is known or suspected to have been impacted by sheep dip. Given that the catchments monitored in 1997 covered 4.9% of the high/very high risk areas across Wales, it is possible that some 700 km of stream length may have been impacted in 1997.

The method of sampling and interpreting biological scores in 1997 only allowed sites with marked reductions in biological fauna to be categorised as impacted. It is likely that other sites with intermediatory biological fauna may have been impacted to a lesser degree. This may partly explain the discrepancy in some catchments where no biological impact could be confirmed despite sheep dip chemicals being detected. The estimates of biological impact described in the report are therefore deemed to be conservative.

The understanding of the influence of stream chemistry on toxicity needs to be improved, in particular the possible variations in toxicity of pesticides between poorly and highly buffered waters. This may also partly explain the discrepancy in some catchments where no biological impact could be determined despite sheep dip chemicals being detected.

Farm visits

A total of 117 farms were visited in seven of the ten monitored catchments.

Organophosphate based sheep dips were the most commonly used treatment method (55% of farms) with synthetic pyrethroid dips being used by 19% of farms. Many farmers indicated that they had used SP dips in 1996 but reverted back to OP dips in 1997 due to a perceived lack of efficacy with SP dips. It is likely therefore that had monitoring been undertaken in 1996 the results, in terms of biological impact, may have been worse.

It was evident that as the year progressed the awareness of farmers of the potential problems with sheep dip chemicals improved. To begin with, 'safer to the operator' was being interpreted as 'safer to the environment' for SP chemicals.

There was an indication in most areas that the use of mobile sheep dips and contractors was increasing.

The location of sheep dipping structures was a major area of concern, many being located within 10 m of a watercourse. Most of the permanent dipping structures were in a reasonable state of repair but many of the older structures (>10 years) either had a direct discharge to the watercourse or discharged to a soakaway.

The dipping practice undertaken by farmers also caused concern in a number of cases. The main problems were with spillages occurring during dipping and the access of freshly dipped sheep to a watercourse.

A soakaway was the disposal route used by 25% of farmers, a method which is contrary to current advice. Most (70%) farmers disposed of their used dip by land spreading, although the dilution rates used were found to be variable. Of concern was the finding that 5% of the dipping structures had a direct discharge to a watercourse. There was little evidence of treatment of used dip being undertaken by farmers, despite the manufacturers promoting on-farm treatment from June 1997 onwards.

Overall, 26% of the farms visited were found to be at a high risk of polluting a watercourse from sheep dipping activities.

Pollution Incidents

Thirteen pollution incidents were recorded across Wales. Permanent dipping structures were the main source of pollution incidents (92%) and the synthetic pyrethroid, cypermethrin, was the most common pesticide identified as causing the impact (77% of cases).

The majority of pollution incidents were recorded from the Upper Severn Area. Whilst sheep farming is particularly intensive in this Area, the main reason why more pollution incidents were recorded is believed to be the greater level of routine biological sampling undertaken in this Area in 1997.

Recommendations

1. Resources should be committed to continuing the monitoring programme in 1998. This should primarily be targeted at biological investigations in high risk catchments and water chemistry sampling at appropriate locations in these catchments. The catchments where positive samples of sheep dip chemicals were recorded as part of the 'additional catchments' programme should be prioritised for inclusion in the 1998 programme.

2. The rapid bankside assessment of invertebrate fauna used in the 1997 survey should continue to be used in 1998 since it allows greater coverage of individual catchments. There is, however, a need to develop this method to allow greater confidence in interpreting sites with potentially impacted fauna.

3. The understanding of the influence of stream chemistry on toxicity needs to be improved, in particular the possible variations in toxicity of pesticides between poorly and highly buffered waters.

4. There is currently very limited information upon which to determine the impact of pollution incidents on fish populations. Fish are seldom killed as part of the pollution incident but possible effects such as starvation should be examined. This should be a priority at locations where pollution incidents occurred in 1997 and any that occur in 1998. In addition, knowledge of sub-lethal impacts to fish reproductive potential from exposure to sheep dip chemicals should be examined.

5. The sheep dip awareness campaign launched in 1997 should also be continued and expanded in 1998. This will require a nationally consistent approach and continued working with the farming industry and other relevant organisations.

6. The Agency should deploy resources to undertake pollution prevention and enforcement visits to farms within the catchments where biology was found to be impacted in 1997.

7. Given the limited resources currently available to the Agency, the Regions should seek additional resources through the corporate planning process.

8. Given the current concern within the Fisheries and Conservation functions, the deployment of fisheries staff to this issue should be considered.

9. There is currently considerable need to influence legislative change.

(a) The Agency should use the results of this monitoring programme and knowledge from other Regions as part of its response to the current DETR consultation on the Groundwater Regulations.

(b) The Agency should recommend that a statutory Code of Good Environmental Practice be introduced for sheep dipping.

(c) The Agency should seek to obtain details of the location of sheep dipping structures from the government.

(d) The Agency should consider pressing for Works Notice Powers, provision for which is made within the Water Resources Act (1991) and the Environment Act (1995).

1.0 INTRODUCTION

Sheep are prone to infestation by a number of ectoparasites and are therefore dipped for a number of economic, cosmetic and welfare reasons. Sheep Scab, caused by the ectoparasites *Psoroptes ovis* or *Sarcoptes scabiei*, is perhaps the most serious condition for sheep and can cause discomfort and even death. There is clearly a need, therefore, for effective treatment systems on sheep welfare grounds. Many of the ectoparasites can be treated by means other than dipping, but for sheep scab the immersion of sheep in an insecticide is currently the most widely accepted treatment method.

Organochlorine chemicals were the main active ingredients in sheep dips until about the mid 1980s; these included lindane, dieldrin and DDT. The organochlorine chemicals were withdrawn from use in sheep dip formulations due to their toxicity, persistence and ability to accumulate in the food chain.

In the early 1980s, sheep dip formulations based on organophosphate chemicals began to be used, due to the withdrawal of organochlorines. The organophosphate pesticides used included coumphos, iodofenphos, chlorpyrifos, fenchlorphos, carbophenothion, propetamphos, diazinon and chlorfenvinphos. For 1997, the Veterinary Medicines Directorate (VMD), which is responsible for licencing the use of pesticides for veterinary purposes, only licenced the use of diazinon and propetamphos as active ingredients for sheep dip formulations based on OPs.

New types of pesticides were being incorporated into dip formulations in the early 1990s, partly because of concern over the effects organophosphate pesticides may have on the health of farmers undertaking the dipping process. These new pesticides were the synthetic pyrethroids, which were deemed less toxic to human health than organophosphate dips but are known to be some 100 times more toxic to some elements of the aquatic environment. These pesticides included flumethrin and cypermethrin.

Since 1995 there has been an increasing awareness of the problems associated with the use of synthetic pyrethroid based sheep dips. A number of serious pollution incidents have occurred, particularly in Scotland and the NW England, where single incidents have resulted in the fauna of some 20-30 km of river being seriously impacted following the discharge of a synthetic based sheep dip to a watercourse. Given the importance and prevalence of sheep farming in Wales, the Welsh and Midland Regions of the Environment Agency initiated a monitoring programme for the 1997 dipping season. The aim of this work was:-

'to determine whether there is evidence of widespread environmental impact from sheep dipping activities, especially from the use of synthetic pyrethroid dip'

The results of this work will enable the Agency in Wales to establish the level of any problem. The work will also contribute to national policy being developed by the Agency in its response to legislative changes.

The report is structured such that the survey design and methodology is presented first. This is followed by sections providing results on a catchment basis for each of the four Agency geographical areas involved. This is followed by a section providing a Welsh synopsis of the main findings. Pollution incidents caused by sheep dip in Wales are also presented in a separate section. Finally, the conclusions and recommendations of the monitoring work are presented.

2.0 SURVEY METHODOLOGY

2.1 Location

Research undertaken in 1994 identified the risk to surface waters in the UK from waste sheep dip (NRA, 1994). The map-based risk assessment for each catchment was determined from sheep density, soil type, rainfall and slope (Fig. 2.1). Based on the risk map, sub-catchments within these high risk areas were chosen to be included in the full monitoring programme (Fig. 2.2). A conscious decision was made, however, to avoid catchments known to be impacted by acidification since the biological fauna in these catchments would already be depleted.

2.2 Sheep dipping - timing

Information detailing when farmers had used sheep dip chemicals in 1996 was purchased from MAFF. This demonstrated a peak in usage in June/July and again in September/October (Table 2.1). Based on this information, the monitoring programme was to extend from May 1997 until November 1997.

2.3 Stream chemistry

A network of 39 water quality sampling points was identified within the sub-catchments (Fig. 3.3). Fortnightly water column and monthly sediment samples were collected from this sampling network between May and November 1997.

The water column samples were analysed for a suite of pesticides which included the organophosphate pesticides diazinon, propetamphos and chlorfenvinphos, and the synthetic pyrethroids cypermethrin and flumethrin (ARG 9F20 in Welsh Region). Chlorfenvinphos is no longer licenced for use as a sheep dip but this determinand was included due to the possible use of stored quantities. The limit of detection (LOD) for organophosphate pesticides was 5 ng/l. In Welsh Region the LOD for cypermethrin and flumethrin was 25 ng/l. The Midlands Region samples for cypermethrin and flumethrin were analysed to a lower LOD (0.1 ng/l) due to the Nottingham laboratory undertaking developmental work on SP analysis in 1997.

Mean and maximum values for each determinand were calculated for water column samples at each site. The mean values were assessed against the relevant annual average environmental quality standard (EQS) for each determinand (Table 2.2). The EQSs for sheep dip pesticides are based on annual averages, i.e. as a measure of long term exposure. This monitoring programme only extended for a seven month period. However, given that the number of samples (typically 12) was adequate to undertake an assessment and the survey was undertaken over a significant time period, it was deemed appropriate to undertake a direct assessment of the survey results against the EQS. The maximum values recorded at each site were assessed against the maximum allowable concentration (MAC) for each pesticide. The MAC should not be exceeded at any given time and therefore an assessment of maximum recorded values against the MAC is appropriate to determine exceedances.

Table 2.1 **Sheep dip usage (grammes active ingredient per 1000 sheep) in Wales for 1996**

1996														
	pesticide	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	YEAR total
DIPS	Diazinon						566	228		179	128			1107
DIPS	Flumethrin						<1	4	3	53	12			73
DIPS	Propetamphos					8	49	160	19	337	109		27	711
DIPS	Cypermethrin						104	15	13	4	103		9	248
POURON	Cryomazine					5.1	84.4	53.1	9.9	21.7				174.2
POURON	Deltamethrin					0.2			0.1					0.2
POURON	Cypermethrin			0.1	0.2	5.7	5.1	4.2	1.7					17.1
Grammes per 1000 sheep														

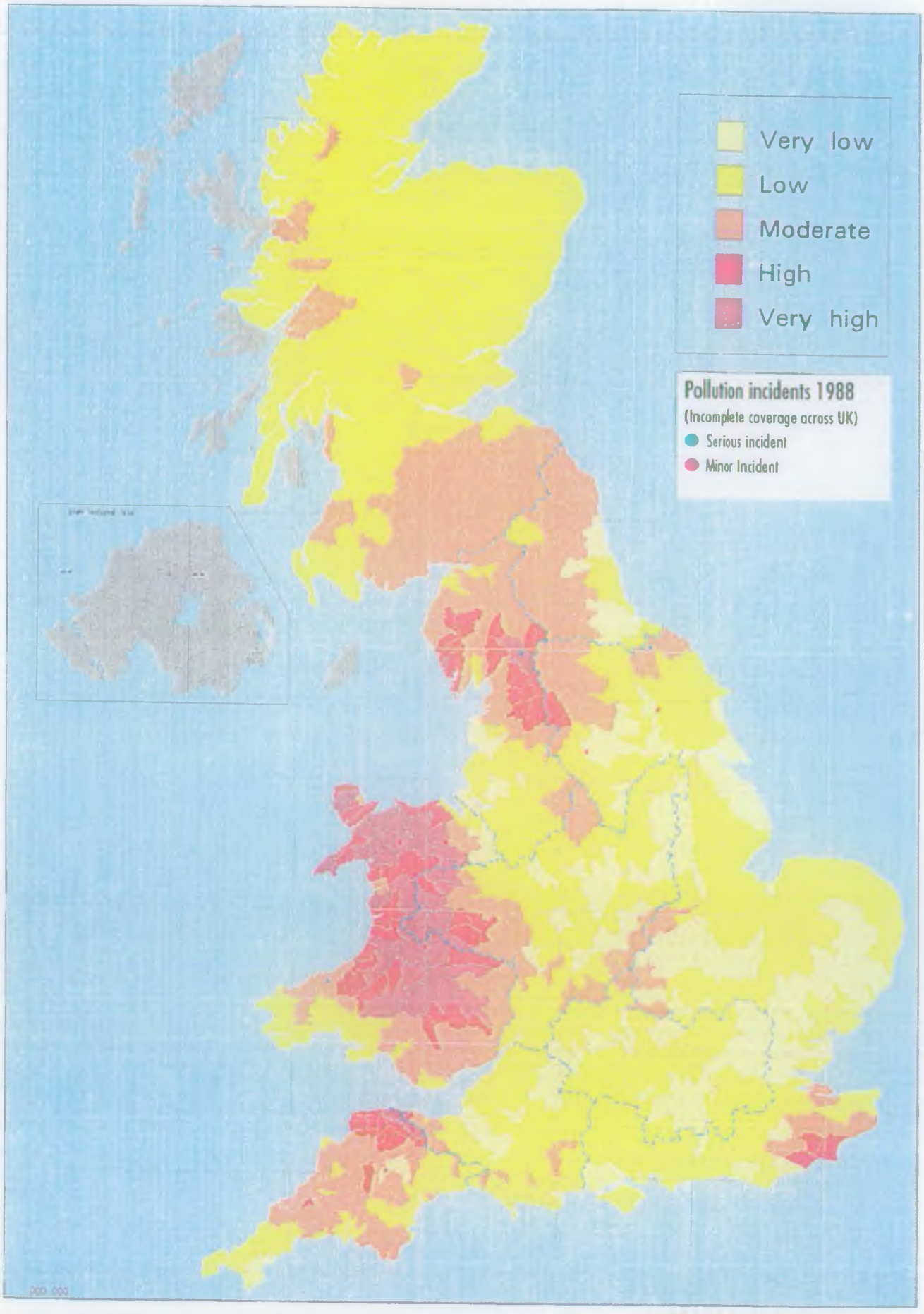


Fig. 2.1 Risk of pollution to surface waters from used sheep dip.

Fig. 2.2 Catchments included as part of the 1997 sheep dip monitoring programme

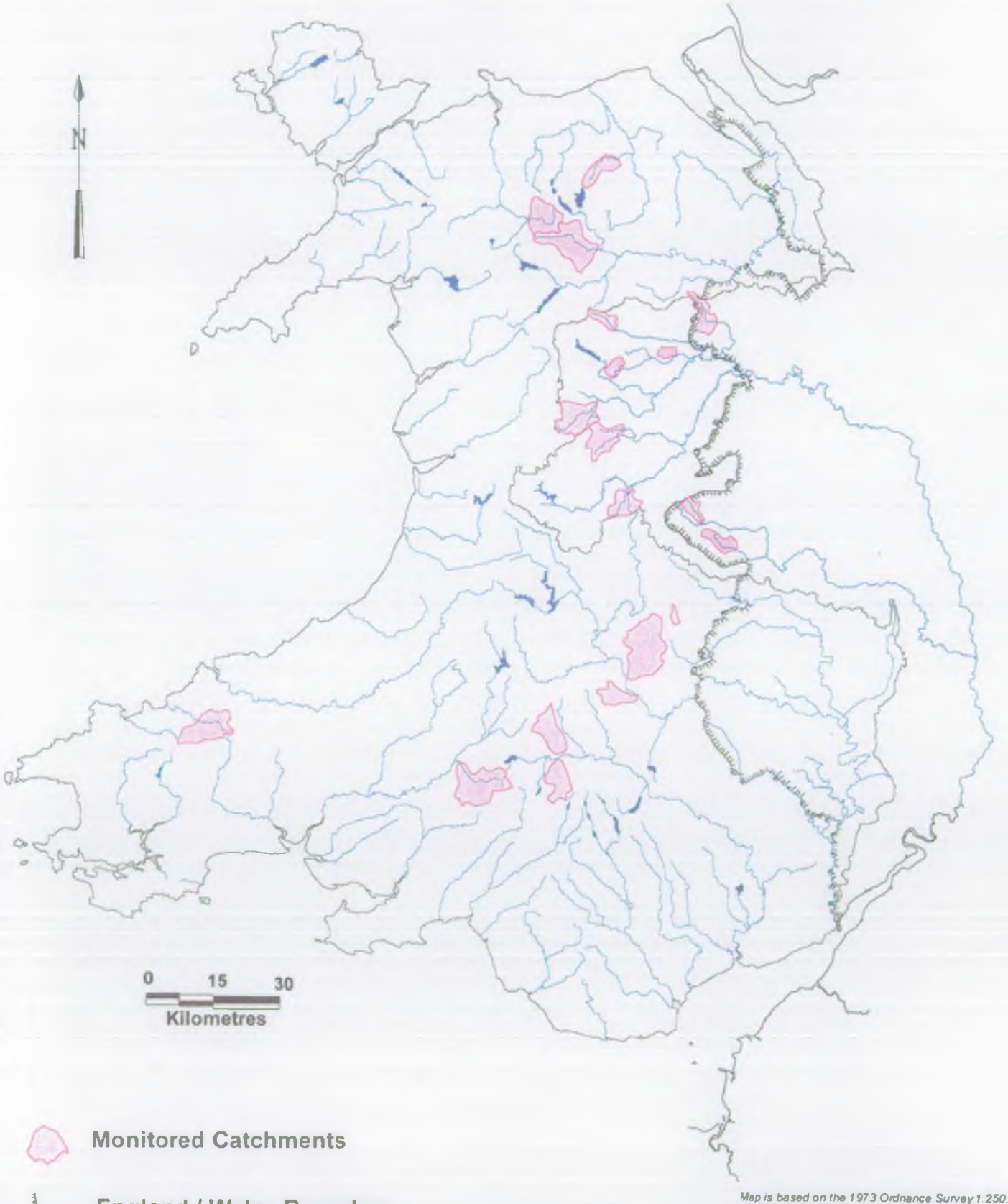
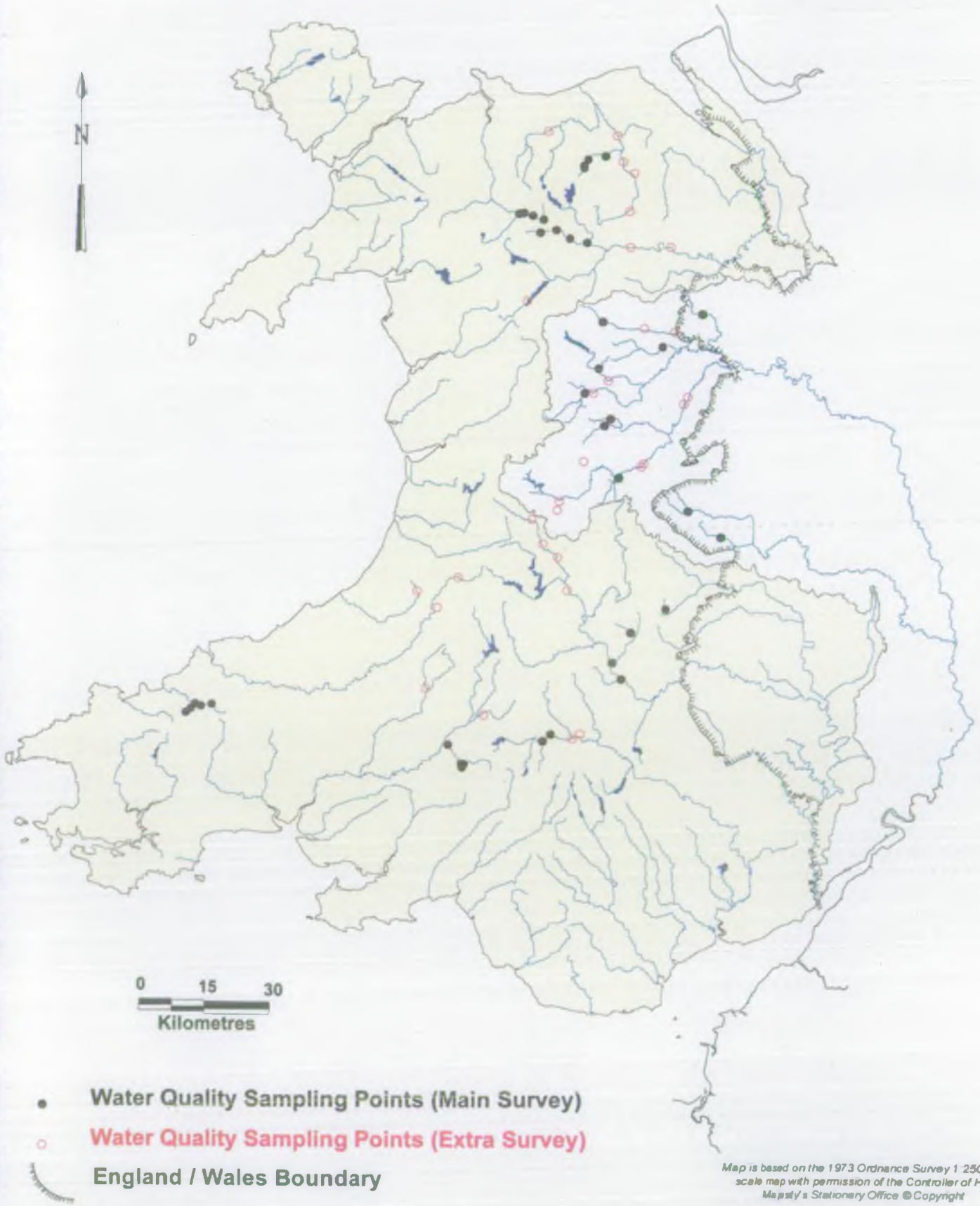


Fig. 3 Water quality monitoring network included in the 1997 sheep dip monitoring programme



The sediment samples were analysed for a similar suite of pesticides (ARG 9F21 in Welsh Region) as the water column samples. The limit of detection was 1 ug/kg and 10 ug/kg for OP and SP pesticides, respectively. There are no standards (EQS) applicable to sediments.

Table 2.2 **Annual Average (AA) and Maximum Allowable Concentration (MAC) Environmental Quality Standards (EQS) for sheep dip pesticides.**

Pesticide	Annual average EQS in ng/l	Maximum Allowable Concentration EQS in ng/l
Diazinon (OP)	10	100
Propetamphos (OP)	10	100
Chlorfenvinphos (OP)	10	100
Cypermethrin (SP) DRAFT	0.1	1
Flumethrin (SP)	No agreed standard	No agreed standard

In addition to the monitoring network within the main catchments surveyed, water column samples were also collected from 27 'additional catchments' between September and November (Fig. 2.3). This sampling was only initiated in July following initial results of the main survey. The aim of this additional monitoring was to assist in interpreting the results from the main survey on a wider scale across Wales. The additional sampling locations were all routine monitoring sites within high risk catchments (Fig. 2.1). The number of samples collected from these additional sites varied between 1 and 3.

2.4 Stream biology

Biological surveys were undertaken in each of the sub-catchments at the end of July and again at the end of October. The biological surveys consisted of one-minute kick samples amongst stream gravels at key locations in each sub-catchment. The samples were assessed on the bank-side for invertebrate composition and each site given a score according to the standard Biological Monitoring Working Party (BMWP) methodology. The interpretation of biological quality at each site was as follows:

a) Sites where fauna are severely impacted and the cause is determined or suspected to be due to sheep dip pesticides.

Sites with a BMWP score <25 or sites with a BMWP score of 25-39 if accompanied with low abundance of taxa.

To attribute the impact to sheep dip pesticides, corroborative evidence was also required that the poor fauna was due to sheep dip. This either took the form of determining markedly better fauna upstream of a dipping structure or sheep dip chemicals being detected at concentrations exceeding EQSs (AA or MAC) in the water course.

If the impact on fauna was characteristic of sheep dip pesticide pollution but not confirmed to be from a dipping structure, the impact was classified as being suspected to be sheep dip pesticides.

b) Sites where fauna are moderately impacted and the cause is determined or suspected to be due to sheep dip pesticides.

Sites with a BMWP score in the range 25-49, or sites with a BMWP score exceeding 49 but with abundances of taxa sensitive to sheep dip pesticides markedly lower than anticipated.

Again corroborative evidence was required before the impact could be definitely attributed to sheep dip chemicals. Impact on fauna characteristic of sheep dip pesticides but not confirmed was classified as being suspected to be due to sheep dip.

c*) Sites affected by sources of pollution other than sheep dip pesticides.*

Sites with a BMWP score <49 but the cause of poor fauna was attributable to causes other than sheep dip pesticides (e.g. slurry, sedimentation).

d)Cause of the poor biological quality was undetermined.

Sites with a BMWP score <49 but there is uncertainty about the cause of the biological impact, viz where the fauna do not provide an indication of the type of pollution and there is no association with a discrete discharge or other chemical or habitat factor.

e) Sites where no impact was detectable and thus termed unpolluted

Sites with a BMWP score >49 and with a fauna typical of the stream type with no characteristic taxa missing or at low abundance.

2.5 Farm visits

A programme of farm visits was undertaken within seven of the 10 catchments using a common site inspection form to collect relevant information (Appendix 1). This information included the site location details, type of dip used, structure of dipping facility, disposal of used dip and the overall risk to watercourses from the sheep dipping operation.

3.0 SURVEY RESULTS

3.1 UPPER SEVERN AREA

Ten river sub-catchments within the Welsh and borders sections of the Midlands Region were studied as part of this survey, they were grouped together into three larger catchments: the River Vyrnwy, River Severn and River Teme. The principle land use in these areas is sheep and beef rearing. The upland farms in these areas are at an approximate altitude of 3-400 metres above ordnance datum.

3.1.1 Vyrnwy catchment

3.1.1.1 Stream chemistry

Water column samples were taken from a total of five sites in the Vyrnwy catchment between 12 May and 31 October 1997 (Table 3.1).

Cypermethrin failed the annual average (AA) EQS at one site, the River Morda. The only organophosphate chemical to exceed an AA EQS was diazinon, with an average concentration of 0.011ug/l on the River Eirth.

The Maximum Allowable Concentration (MAC) EQS for cypermethrin was breached on the River Morda and Afon Gam. The Afon Eirth failed the MAC EQS for diazinon on 20 August with a recorded concentration of 0.11ug/l.

Sheep dip chemicals were found, at lower concentrations, at all of these sites at some point during the sampling programme. The synthetic pyrethroid, flumethrin, was recorded at all of the sites. The occurrence of sheep dip chemicals in this catchment appeared to be evenly spread through the dipping months of June to October. Diazinon seemed to be more prevalent in the late summer and autumn.

3.1.1.2 Stream Biology

A total of 22 sites were sampled in the Vyrnwy catchment.

Surveys undertaken in both July and October on the River Morda indicated that the biological quality of all 5 sites on the River Morda had not recently been adversely affected by sheep dip chemicals (Fig. 3.1). Site 18, however had been affected by sheep dip in autumn 1996 and it appeared not to have fully recovered. At some sites BMWP scores were relatively low but high numbers of taxa sensitive to sheep dip pesticides were present, suggesting no problems from sheep dips at these sites.

Table 3.1 **A summary of water column sampling results for the Vyrnwy catchment. EQS failures in bold.**

SITE			AA (ng/l)	Max (ng/l)	No. samples	No. positive	Date first sampled	Date last sampled
Name	Code	Det.						
River Morda	30697180	Diazinon	0.8	10	12	1	12/5/97	31/10/97
		Propetamphos	3	37	12	1	12/5/97	31/10/97
		Cypermethrin	**2**	**25**	12	1	12/5/97	31/10/97
		Flumethrin	0.2	2	12	1	12/5/97	31/10/97
Afon Cain	31467390	Diazinon	6	51	12	2	12/5/97	31/10/97
		Propetamphos	**10**	59	12	3	12/5/97	31/10/97
		Cypermethrin	0	0	12	0	12/5/97	31/10/97
		Flumethrin	0.3	2	12	2	12/5/97	31/10/97
Afon Eirth	31381030	Diazinon	**11**	**110**	12	2	12/5/97	31/10/97
		Propetamphos	1	14	12	1	12/5/97	31/10/97
		Cypermethrin	0	0	12	0	12/5/97	31/10/97
		Flumethrin	0.1	1	12	1	12/5/97	31/10/97
Llwyd iarth Bk.	32451080	Diazinon	1	13	12	1	12/5/97	31/10/97
		Propetamphos	0	0	12	0	12/5/97	31/10/97
		Cypermethrin	0	0	12	0	12/5/97	31/10/97
		Flumethrin	0.9	6	12	2	12/5/97	31/10/97
Afon Gam	32069140	Diazinon	**19**	93	12	5	12/5/97	31/10/97
		Propetamphos	2	17	12	2	12/5/97	31/10/97
		Cypermethrin	**5**	**60**	12	1	12/5/97	31/10/97
		Flumethrin	0.3	2	12	2	12/5/97	31/10/97

SHEEP DIP SURVEY

Fig 3.1 - Vyrnwy Catchment

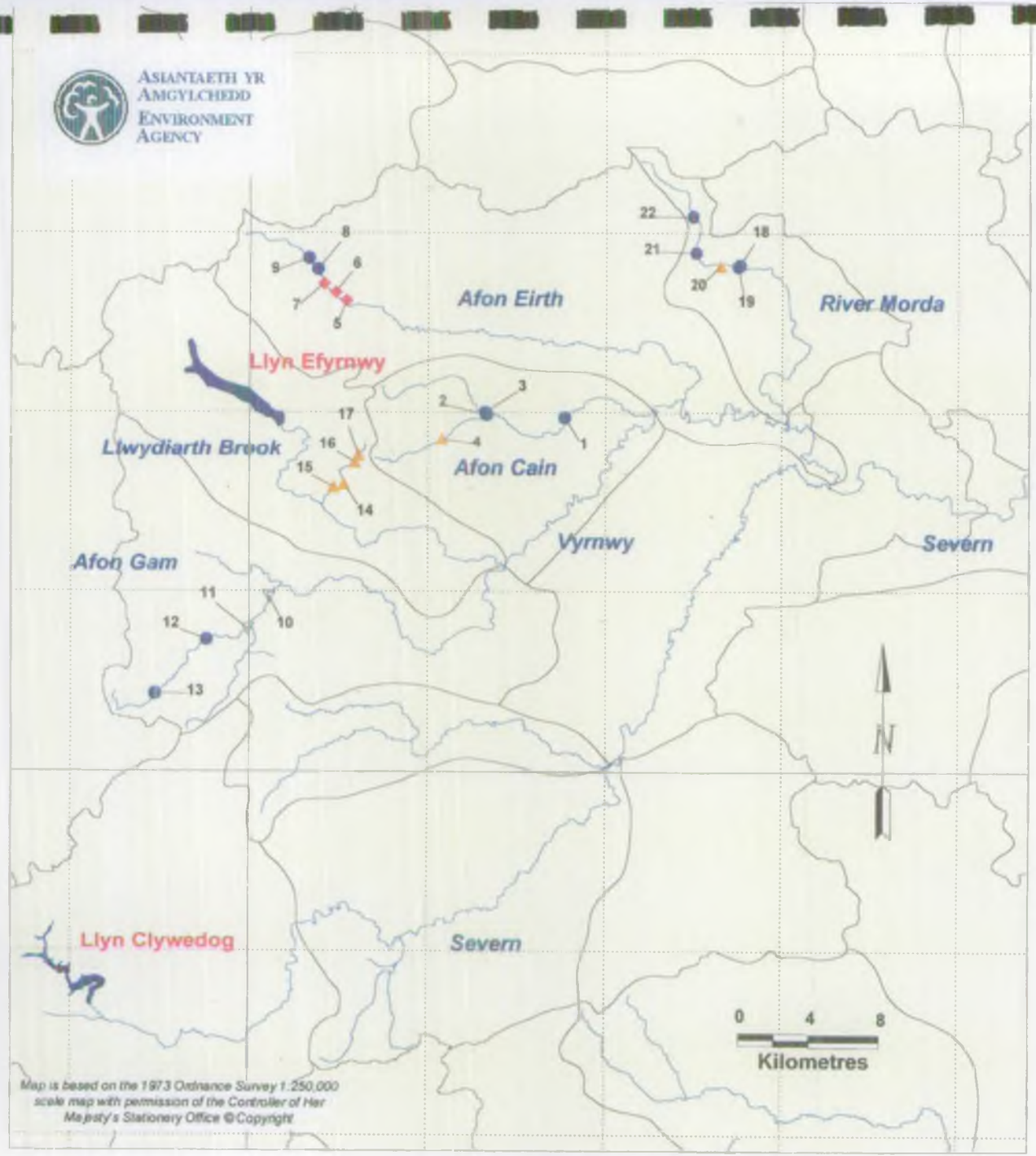


Table showing BMWP scores for 1997 Survey

Site	Description	NGR	Summer	Autumn
1	Cain @ Pentre	SJ 177 197	73	90
2	Alan u/s Fyllon confl	SJ 183 199	77	88
3	Fyllon u/s Alan confl	SJ 182 200	92	112
4	Alan @ Ty Crwyn	SJ 108 185	56	88
5	Eirth @ Llangynog	SJ 064 282	70	91
6	Eirth @ Footbridge	SJ 044 269	53	72
7	Eirth u/s Cwm Orog	SJ 042 272	66	54
8	Eirth @ Ty Mawr	SJ 038 280	91	86
9	Eirth @ Cwm Rhiwarth	SJ 033 286	91	90
10	Gam @ Llangadfan - ROP	SJ 011 097	64	91
11	Gam d/s Moel Ddolwen trib	SH 999 078	81	119
12	Gam @ Dolwen	SH 976 073	96	120
13	Gam @ Ffridd fawr - ROP	SH 947 043	125	117
14	Llwydiarth Brook u/s pipe	SJ 053 160	76	78
15	Llwydiarth Brook d/s pipe	SJ 052 159	64	89
16	Llwydiarth Brook d/s B4393	SJ 050 172	60	49
17	Llwydiarth Brook u/s sheepdip + trib	SJ 051 176	64	117
18	Morda d/s Llwynymaen Farm	SJ 276 282	84	81
19	Trefonen trib.	SJ 275 281	49	56
20	Morda u/s Llwynymaen Farm	SJ 269 283	65	110
21	Nant y gollen	SJ 251 289	96	118
22	Morda @ Llawnt	SJ 249 308	106	94

Key to Symbols

? *Sheep dip suspected but not determined*

● *Unpolluted*

▲ *Pollution - cause not determined*

◆ *Moderately affected by sheep dip pesticides*

■ *Severely affected by sheep dip pesticides*

▽ *Pollution - other than sheep dip*

The surveys undertaken in July and October on the Afon Cain indicated that the biological quality of all 4 sites on the Afon Cain were of good quality and had not been affected by sheep dip chemicals (Fig 3.1). Site 4 had a score that was lower than expected in the July survey. It is suspected that an undetected pollution had occurred in the past but this was not thought to be due to sheep dip. It was not possible to confirm the source of this decline.

Biological monitoring was undertaken at 5 sites on the Afon Eirth. The routine GQA sampling point (Site 5; Fig 3.1)) had been affected by a toxic pollutant in Autumn 1996. The problem was not pinpointed to a specific source. In the July survey, sites 5 to 7 were lower in biological quality than expected but still contained sensitive life, although in low abundance. It was thought to still be recovering from the previous problem. The autumn survey results demonstrated some improvement although biological quality at sites 6 and 7 were still lower than expected. Further investigation was not conclusive in pinpointing the source of the problem as the main Afon Eirth has partially recovered. Previous farm visits had highlighted a sheep dip adjacent to the Nant Y Pantiau (a tributary of the Afon Eirth). A further biological investigation was undertaken on the Nant Y Pantiau. The cause of the poor biological quality in the Nant Y Pantiau was found to be a sheep dip and associated practices located on land adjacent to the watercourse.

The total length of river affected by sheep dip in Autumn 1997 was 0.7 km of the Nant Y Pantiau. 2.5 km of the Afon Eirth and at least 10 km of the Afon Tanat were also affected by the sheep dip in Autumn 1996.

The July survey in the Llywdiarth Brook indicated that there was no evidence of adverse impact on fauna sensitive to sheep dip chemicals (Fig 3.1). However, results were slightly lower than expected and some sensitive life was limited. It proved difficult to trace any source of the decline, although this was not thought to be due to pollution by sheep dip. Slightly higher BMWP scores were gained from the October survey with the exception to site 16. There was a decline in biological quality between site 17 and 16 but it was not possible to pinpoint the cause of the decline. A further survey is due to be undertaken in the near future as the biological quality at all sites was lower than expected. There was chemical evidence of problems with sheep dip between sites 14 and 15. However, biological samples taken on the main Llwydiarth did not show a decline due to partial recovery and poor upstream samples.

In the July survey on the Afan Gam, the biological quality of the routine GQA sampling point was lower than expected (Fig 3.1). The problem was traced to an organic input between site 12 and 11. The biological quality of the other sites was considered good and there was no evidence of pollution due to sheep dip chemicals in the rest of the catchment. The survey undertaken in October indicated good biological quality and there was no evidence of impact from pollution by sheep dip chemicals in the Gam catchment.

3.1.1.3 Farm visit programme

Thirteen farms were visited within this Vyrnwy catchment.

Type of treatment

Organophosphate based sheep dips were the most commonly used followed by SP-based dips. No farms reported using injection or pour-on treatments.

Table 3.2 Treatment methods used in the Vyrnwy catchment

Treatment method	% sites visited
O/P dips	62
S/P dips	31
S/P & O/P dips	7
Injection	0
Pour on	0
Don't know	0

Sheep dipping structures

Whilst most of the dips were in a reasonable state of repair, at least half gave cause for concern through being within 10 metres of a river or pond. Two baths had been left brim full with dip and the farmers intended to leave them full until the next dipping period. Some dip baths were constructed so that yard or roof drainage flowed through them when it rained. This made them vulnerable to overflowing whilst dipping was in progress. These baths also had drain holes which were bunged during dipping but provided another route for dip to enter watercourses either through leakage or deliberate discharge. Two farms were using mobile dippers.

Chemical stores

Sheep dip containers were often left next to the dip baths, rather than in locked stores. At one farm the corner of an old dairy was being used as a general chemical store, any spillages would have flowed directly into a watercourse.

Disposal

The use of soakaways was quite widespread within this catchment. Two of these were in high risk locations, the soakaway being in very marshy ground. It was common practice to mix the spent dip solution with slurry and to spread the mixture on hillsides with a vacuum tanker.

3.1.2 Severn catchment

3.1.2.1 Stream chemistry

Water column samples were taken from a total of three sites in this catchment between 12 May and 31 October 1997.

The annual average (AA) EQS for diazinon was breached at two of the three sites examined in this catchment (Table 3.3).

Peaks in diazinon concentrations on the Mochdre Brook in July and on the Afon Rhiw(N) in September both breached the Maximum Allowable Concentration EQS. Flumethrin was recorded in the north and south arms of the Afon Rhiw. The recorded occurrence of each chemical during the sampling programme revealed that diazinon is most common of the dip chemicals found in watercourses and is most prevalent during the summer months of July to September. Cypermethrin was not detected in this catchment.

Table 3.3 **Summary of water quality results from the Severn catchment. EQS failures in bold.**

SITE			AA (ng/l)	Max (ng/l)	No. samples	No. positive	Date first sampled	Date last sampled
Name	Code	Det.						
Rhiw (N)	33851280	Diazinon	**36**	**178**	12	5	12/5/97	31/10/97
		Propetamphos	0	0	12	0	12/5/97	31/10/97
		Cypermethrin	0	0	12	0	12/5/97	31/10/97
		Flumethrin	0.2	2	12	1	12/5/97	31/10/97
Rhiw (S)	33672020	Diazinon	5	30	12	3	12/5/97	31/10/97
		Propetamphos	1	11	12	**1**	12/5/97	31/10/97
		Cypermethrin	0	0	12	0	12/5/97	31/10/97
		Flumethrin	0.3	2	12	2	12/5/97	31/10/97
Mochdre Brook	34664250	Diazinon	**49**	**504**	12	3	12/5/97	31/10/97
		Propetamphos	6	58	12	2	12/5/97	31/10/97
		Cypermethrin	0	0.	12	0	12/5/97	31/10/97
		Flumethrin	0	0	12	0	12/5/97	31/10/97

3.1.2.2 Stream biology

A total of 16 sites were sampled in the Severn catchment.

The survey undertaken in the Mochdre Brook in July revealed that sites 6, 7 and 9 were of good biological quality (Fig 3.2). However, site 8 appeared to have sparse sensitive life. A further investigation was undertaken in order to pinpoint the source of the decline. The problem was found to be sheep dip entering the Cwmyrwhirdre Brook via a small watercourse. The organophosphate Diazinon was detected. The survey was repeated in October when poor biological quality was demonstrated at sites 6 and 9. Site 8 was still recovering from the pollution detected in the July survey and site 7 was similar to the previous survey result. The decline in biological quality at sites 6 and 9 was investigated and was traced to a field drain. The stream had BMWP score of 114 upstream of the drain whilst downstream it scored 8. The synthetic pyrethroid cypermethrin was found in the water sample from the field drain. The total length of watercourse affected by sheep dip chemicals was approximately 10.5 km

Surveys undertaken at 5 sites on the N Rhiw in July and October indicated that the biological quality of all the sites on the North Rhiw were of good biological quality (Fig 3.2). There was no evidence of an impact caused by sheep dip chemicals in the catchment.

Surveys undertaken at 5 sites on the S. Rhiw in July and October indicated consistently good biological quality at all the sites sampled with a good selection of sensitive invertebrate life (Fig 3.2). There was no evidence of an impact caused by sheep dip chemicals in the catchment.

3.1.2.3 Farm visit programme

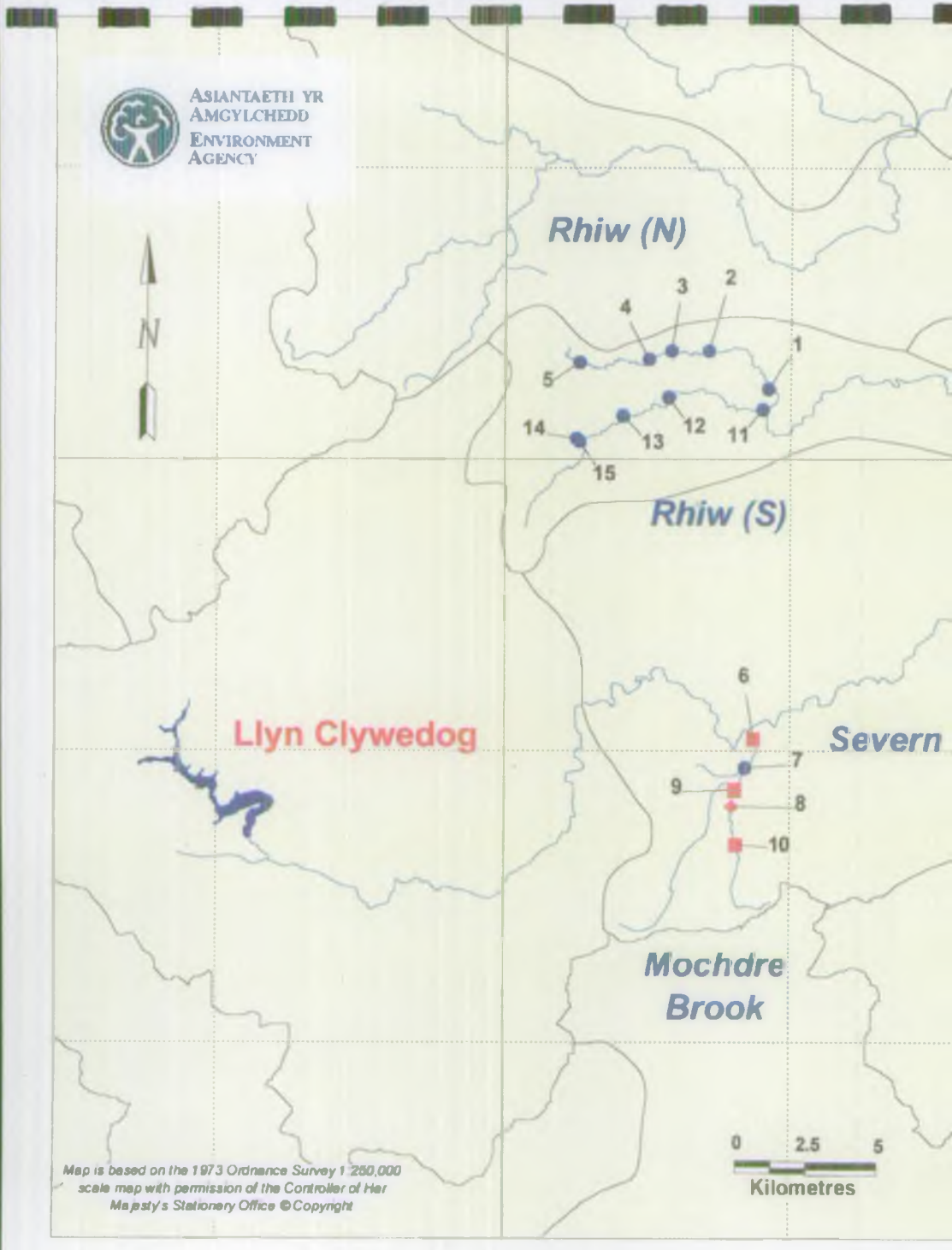
Twenty four farms were visited within the River Rhiw and Mochdre Brook sub-catchments.

Treatment methods

Organophosphate based dips were again the most commonly used treatment although 16% of farmers reported using pour-on treatments.

Table 3.4 Treatment methods used in the Severn catchment

Treatment method	% sites visited
O/P dips	50
S/P dips	25
S/P & O/P dips	4
Injection	0
Pour on	16
Didn't know	4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Llyn Clywedog
Mochdre Brook
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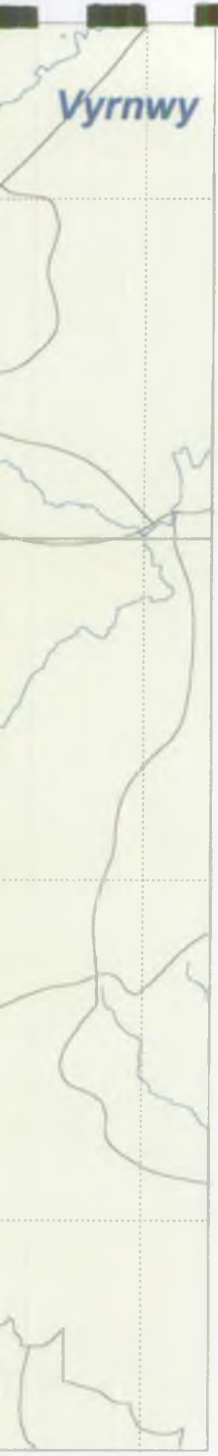
Map is based on the 1973 Ordnance Survey 1:250,000 scale map with permission of the Controller of Her Majesty's Stationery Office © Copyright



SHEEP DIP SURVEY

Fig 3.2 - Severn Catchment

Table showing BMWP scores for 1997 Survey

Site	Description	NGR	Summer	Autumn
1	Rhiw (N) @ Gwernydd	SJ 092 024	113	83
2	Rhiw (N) @ Pont Ystrad	SJ 071 037	99	116
3	Rhiw (N) @ Minor road	SJ 058 037	69	108
4	Rhiw (N) @ Llety Gwilym Isaf	SJ 050 034	127	97
5	Rhiw (N) @ Foel Fawr	SJ 026 033	111	120
6	Mochdre @ A458	SO 087 904	77	36
7	Llyfnant Brook	SO 084 894	56	56
8	Lake trib, u/s Mochdre	SO 081 887	56	37
9	Mochdre Brook	SO 080 886	75	21
10	Lake trib, u/s lake	SO 081 868	13	
11	Rhiw (S) u/s Rhiw (N)	SJ 090 017	91	47
12	Rhiw (S) @ Llanluggan	SJ 067 021	81	80
13	Sychnant trib	SJ 041 016	81	87
14	Ddol gwyn trib	SJ 026 007	93	88
15	Nant y Llyn trib	SJ 026 006	80	65

Key to Symbols

? *Sheep dip suspected but not determined*

● *Unpolluted*

▲ *Pollution - cause not determined*

◆ *Moderately affected by sheep dip pesticides*

■ *Severely affected by sheep dip pesticides*

▽ *Pollution - other than sheep dip*

Structures

The majority of dip baths were of sound construction in this catchment. In this area it is common practice for one bath to be used by several farmers in a locality. These baths are often in remote locations and treated as common property. Farmers are reluctant to undertake routine maintenance and if a pollution incident does occur it becomes hard to find the person responsible.

Chemical stores

The common problem of leaving full and empty containers next to dipping structures was noted.

Disposal

No particular problems were noted on the farms visited. All farmers were spreading spent dip on poor land away from watercourses.

3.1.3 Teme catchment

3.1.3.1 Stream chemistry

Water samples were taken from two sites within this catchment between 12 May and 31 October 1997 (Table 3.5).

The cypermethrin annual average (AA) EQS was exceeded on the River Redlake and the diazinon AA EQS on the Folly Brook (Table 3.5). These sites and chemicals also breached their respective Maximum Allowable Concentration EQS (Table 3.5). A maximum concentration of 675 ng/l was detected for diazinon on the Folly Brook in September. Flumethrin was detected on both rivers in this catchment.

No diazinon was detected in the Redlake and no cypermethrin was detected in the Folly Brook. The distribution of positive samples did not demonstrate a clear temporal pattern through the monitoring period.

Table 3.5 A summary of water quality results from the Teme catchment. EQS failures in bold.

SITE			AA (ng/l)	Max (ng/l)	No. samples	No. positive	Date first sampled	Date last sampled
Name	Code	Det.						
Folly Brook.	21133110	Diazinon	**60**	**675**	12	3	12/5/97	31/10/97
		Propetamphos	1	12	12	1	12/5/97	31/10/97
		Cypermethrin	0	0	12	0	12/5/97	31/10/97
		Flumethrin	0.3	3	12	2	12/5/97	31/10/97
River Redlake	20369430	Diazinon	0	0	12	0	12/5/97	31/10/97
		Propetamphos	2	19	12	1	12/5/97	31/10/97
		Cypermethrin	**0.2**	**2**	12	1	12/5/97	31/10/97
		Flumethrin	0.3	2	12	2	12/5/97	31/10/97

3.1.3.2 Stream Biology

A total of 8 sites were sampled in the Teme catchment (Fig 3.3)

SHEEP DIP SURVEY

Fig 3.3 - Teme Catchment

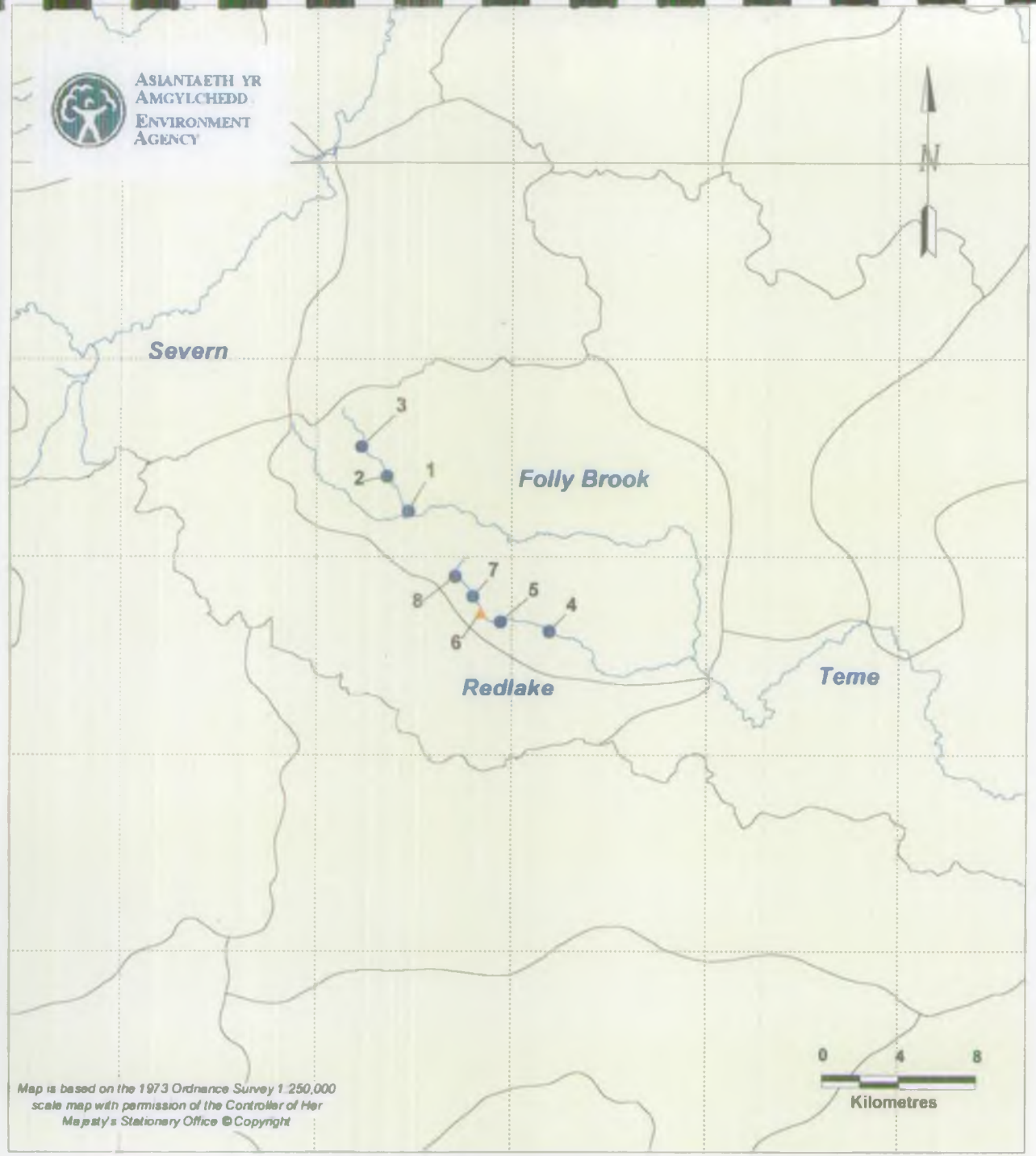


Table showing BMWP scores for 1997 Survey

Site	Description	NGR	Summer	Autumn
1	Folly Brook @ plc Clun	SO 247 823	77	125
2	Folly Brook @ Gogin	SO 236 841	75	110
3	Folly Brook @ Brook House	SO 223 856	66	132
4	Redlake @ Chapel Lawn	SO 319 782	82	71
5	Redlake @ New Invention	SO 294 767	63	58
6	Redlake @ Bwich Farm	SO 284 768	15	
7	Redlake @ Treverward Farm	SO 280 780	77	39
8	Redlake @ Upper Treverward	SO 271 790	62	67

Key to Symbols

? *Sheep dip suspected but not determined*

● *Unpolluted*

▲ *Pollution - cause not determined*

◆ *Moderately affected by sheep dip pesticides*

■ *Severely affected by sheep dip pesticides*

▽ *Pollution - other than sheep dip*

The surveys undertaken in July and October on the Folly Brook indicated good biological quality at all 3 sites sampled (Fig 3.3). There was no evidence of impact caused by sheep dip chemicals in the catchment.

The July and October surveys in the River Redlake indicated good biological quality at most of the sites (Fig 3.3). The exception was site 15. This sample was taken from a poor site in terms of habitat. However, good numbers of shrimps were present suggesting there was no problem with sheep dip chemicals. There was no evidence of problems from sheep dip chemicals in the catchment and the biological life appeared to have recovered from the sheep dip pollution in autumn 1996.

3.1.3.3 Farm visit programme

Nine farms were visited within the Folly Brook and river Redlake sub-catchments.

Treatment methods

A high proportion of farms were using synthetic pyrethroid dips (Table 3.6). Towards the end of the year, after considerable coverage in the media, the majority of farmers were aware of the dangers to the aquatic environment from these SP dips.

Table 3.6 Treatment methods used in the Teme catchment

Treatment method	% sites visited
O/P dips	33
S/P dips	56
S/P & O/P dips	11
Injection	0
Pour on	0
Didn't know	0

Structures

The structures inspected in this catchment were found to be of good order.

Chemical stores

No particular problems with storage of sheep dip chemicals were noted in the catchment.

Disposal

One farmer disposed of spent dip by pumping it into barrels then pouring this out onto waste land on the hills. All other farmers diluted the dip and spread it with a slurry spreader or vacuum tanker.

3.1.4 Additional catchments

The sampling sites in the full monitoring programme demonstrated a high frequency of contamination with sheep dips. To try to determine whether this was also the case in other areas, an additional seven sub-catchments were sampled on two occasions, once in September and again in October. Sheep dip chemicals were detected in three of the seven sub-catchments (Table 3.7). Given that the additional catchments were sampled only twice, the results tended to support the findings from the main catchments surveyed, i.e widespread contamination of watercourses with sheep dip pesticides.

Table 3.7. Results from additional catchments. Blank records represent no detectable presence of a sheep dip chemical.

River	Sampling Date	Diazinon ng/l	Propetamphos ng/l	Cypermethrin ng/l	Flumethrin ng/l
Afon Garno	Sep Oct				
River Vyrnwy	Sep Oct	59			
River Severn	Sep Oct				
Afon Dulas	Sep Oct				
Afon Banwy	Sep Oct	42 23	22 11	3	
Afon Iwrch	Sep Oct				
Afon Cynllaith	Sep Oct	14			3

In addition to sampling additional river catchments, the effluents from two sewage treatment plants were also monitored on four separate occasions in the period September/October. Samples were also taken in the River Severn downstream of the effluent discharge points (Table 3.8) but not always on the same day as sampling the waste effluent. This demonstrated inputs of diazinon and cypermethrin from Welshpool sewage treatment works (STW), and diazinon and flumethrin from Newtown STW. Welshpool has a large sheep market and Newtown has a fellmongery. Effluents from these are discharged as trade effluents to the public sewer under discharge consents with the water company, Severn Trent Water.

Table 3.8. **Results from sampling sewage treatment works and the River Severn downstream of the discharge point. Blank records represent no detectable presence of a sheep dip chemical.**

River	Sampling Date	Diazinon ng/l	Propetamphos ng/l	Cypermethrin ng/l	Flumethrin ng/l
Welshpool STW	18/9/97 25/9/97 8/10/97 20/10/97	93 78		6	
River Severn d/s Welshpool STW	11/9/97 18/9/97 10/10/97 17/10/97	38 14	53		
Newtown STW	16/9/97 25/9/97 9/10/97 22/10/97	50			
River Severn d/s Newtown STW	16/9/97 25/9/97 9/10/97 22/10/97	14			3

3.2 NORTHERN AREA

Three catchments were selected as the principle study areas in North Wales, the Afon Merddwr (Conwy),the Afon Ystrad (Clwyd) and Afon Ceirw (Dee).The principle use of the land within those sub catchments is sheep rearing and beef production with all three rivers flowing from moorland at elevations of up to 500 metres above ordnance datum (AOD).

Soil types vary from the Manod type which are well-drained fine loamy or fine silty soils of variable thickness, sometimes quite shallow over outcropping slate or mudstones to the Cegin type which are slowly permeable and seasonally waterlogged soils overlying slowly permeable subsoils over slaty mud- and siltstones. Soils are reasonably well buffered in these catchments with some limestone outcrops visible.

3.2.1 Merddwr catchment

3.2.1.1 Stream chemistry

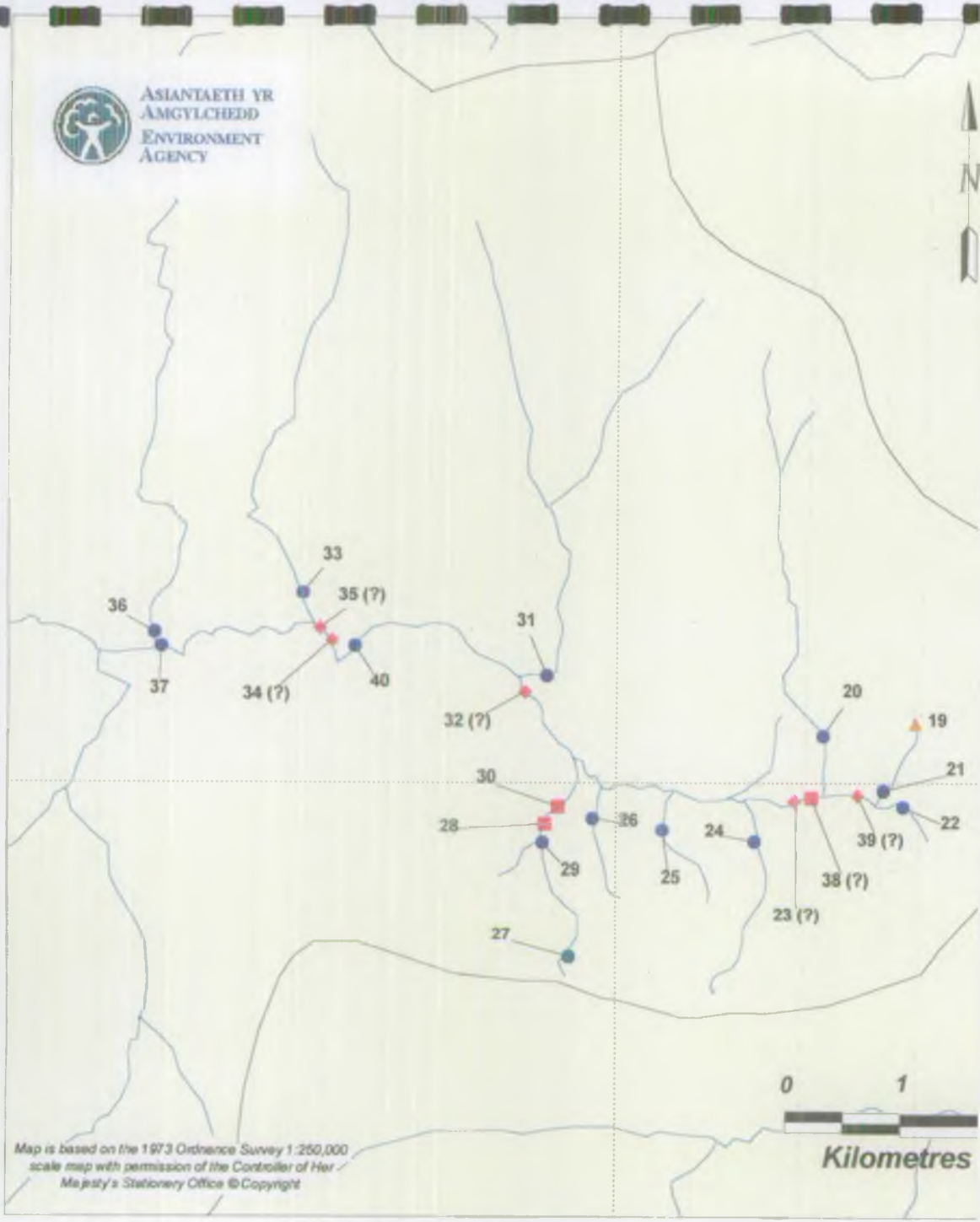
Water quality samples were taken at 4 sites within the catchment. The Merddwr at Glasfryn gave 9 positive samples out of 12 for diazinon (O/P) with the mean exceeding the annual average (AA) EQS (Table 3.9). The highest result recorded exceeded the Maximum Allowable Concentration (MAC) EQS. The mean result for cypermethrin at this site also exceeded the AA EQS for cypermethrin and the maximum exceeded the MAC EQS. Similar results were recorded at sites lower down the catchment (Table 3.9). In addition, the OP pesticide, propetamphos, was also recorded at Rhydlydan, Pentrefoelas and Pont Newydd at levels which caused exceedances of both the AA and MAC EQS limits.

The data obtained demonstrated temporal trends in the contamination of the water course. This was particularly the case with the OP, diazinon. Contamination was evident during the spring/early summer dipping period in the Merddwr catchment with most sites recording high concentrations in the water column. The samples continued to record positive results throughout the survey period on the Merddwr, although there was a reduction in the number of positive samples in September, before another increase in October with the onset of the next peak dipping period.

3.2.1.2 Stream biology

A total of 22 sites were sampled in the Merddwr catchment (Fig 3.4).

The survey undertaken in the summer indicated good biological quality in the lower reaches of the Merddwr at Pont Newydd (Site 37; Fig 3.4). The Afon Cadnant (Site 36) and the Nant-y-Foel (Site 33), both tributaries of the Merddwr, at Pont Newydd and Pentrefoelas, respectively, supported good biological quality and there was no evidence of pollution caused by sheep dip pesticides. A BMWP score of 62 was obtained on the Afon Merddwr at Pentrefoelas (Site 35). This was lower than expected, as previous GQA data (1990-1995) recorded BMWP scores of 150-200, indicating that the site was capable of achieving very good biological quality. The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Map is based on the 1973 Ordnance Survey 1:250,000 scale map with permission of the Controller of Her Majesty's Stationery Office © Copyright

SHEEP DIP SURVEY

Fig 3.4 - Merddwr Catchment

Table showing BMWP scores for 1997 Survey

Site	Description	NGR	Summer	Autumn
19	Un-named trib. at Cefn-Brith u/s Road Bridge	SH 926 505	48	81
20	A.Llaethog at Glasfryn	SH 918 504	82	90
21	Un-named trib. by A5 Road	SH 924 499		75
22	A.Merddwr by public footpath	SH 925 498		88
23	A.Merddwr at Glasfryn	SH 917 499	36	56
24	Un-named trib. near Pant y Griafolen	SH 912 495		105
25	Un-named trib. d/s Cefnhirfynydd	SH 904 496		70
26	Un-named trib. near Gowid	SH 898 497		63
27	Un-named trib. u/s farms	SH 896 495		95
28	Un-named trib. adjacent to Hafodty Bach	SH 894 496		22
29	Un-named trib. at Hafodty Bach	SH 894 495		53
30	Un-named trib d/s Hafodty Bach	SH 895 498		27
31	A.Nug at Rhydlydan	SH 894 510	53	78
32	A.Merddwr atRhydlydan	SH 893 508	54	53
33	Nant y Foel at Pentrefoelas	SH 873 515	77	115
34	A.Merddwr at Pentrefoelas u/s New Bridge	SH 874 514		86
35	A.Merddwr at Pentrefoelas	SH 873 514	52	50
36	A.Cadnant at Pont Newydd	SH 861 513	77	98
37	A.Merddwr at Pont Newydd	SH 861 512	71	81
38	A. Merddwr u/s trib. from STW	SH 917 500	28	-
39	A. Merddwr u/s trib. from farm	SH 921 499	48	-
40	Un-named Trib. d/s Rhydlydan	SH 878 511	75	-

Key to Symbols

? *Sheep dip suspected but not determined*

● *Unpolluted*

▲ *Pollution - cause not determined*

◆ *Moderately affected by sheep dip pesticides*

■ *Severely affected by sheep dip pesticides*

▽ *Pollution - other than sheep dip*

Table 3.9 Summary of water quality results from the Merddwr catchment.EQS failures in bold.

SITE			AA ng/l	Max ng/l	No samples	No positive	Date first sample	Date last sample
Name	SPN	Det						
Merddwr Glasfryn	25545	Diazinon	**45.2**	**217**	12	9	13/05/97	28/10/97
		Propetamphos	0	0	12	0	13/5/97	28/10/97
		Chlorvenvinphos	0	0	12	0	13/5/97	28/10/97
		Cypermethrin	**28.3**	**55**	13	1	13/5/97	28/10/97
		Flumethrin	0	0	13	0	13/5/97	28/10/97
Merddwr Rhydlydan	25544	Diazinon	**200.6**	**1490**	13	11	13/5/97	28/10/97
		Propetamphos	**35.5**	**383**	13	2	13/5/97	28/10/97
		Chlorvenvinphos	0	0	13	0	13/5/97	28/10/97
		Cypermethrin	0	0	13	0	13/5/97	28/10/97
		Flumethrin	0	0	13	0	13/5/97	28/10/97
Merddwr Pentrefoelas	25543	Diazinon	**114.3**	**692**	12	9	13/5/97	28/10/97
		Propetamphos	**29.2**	**292**	12	2	13/5/97	28/10/97
		Chlorvenvinphos	0	0	12	0	13/5/97	28/10/97
		Cypermethrin	0	0	12	0	13/5/97	28/10/97
		Flumethrin	0	0	12	0	13/5/97	28/10/97
Merddwr Pont Newydd	25013	Diazinon	**90.8**	**497**	13	9	13/5/97	28/10/97
		Propetamphos	**28.9**	**313**	13	2	13/5/97	28/10/97
		Chlorvenvinphos	0	0	13	0	13/5/97	28/10/97
		Cypermethrin	0	0	13	0	13/5/97	28/10/97
		Flumethrin	0	0	13	0	13/5/97	28/10/97

biological quality of the Afon Merddwr decreased progressively upstream, becoming poor at Site 38, with a BMWP score of 28. The site was dominated by molluscs and beetles, all at very low abundances. This suggested a toxic substance had entered the watercourse in the upper reaches of the Merddwr. It was difficult to pinpoint a clear source of the pollution as the upper reaches of the Merddwr catchment drain marsh-land and thus became difficult to sample. The chemical data indicated that there were high levels of diazinon in the Merddwr at Glasfryn, Rhydlydan and Pentrefoelas.

The survey undertaken in October again demonstrated a lower than expected biological quality on the Merddwr at Pentrefoelas with a BMWP score of 50. A second sample was taken in Pentrefoelas to assess any impact of construction work undertaken on the road bridge, the BMWP score indicated that this work had not significantly impacted the watercourse. The presence of dead invertebrates at Rhydlydan (Site 32) led to more detailed investigation of the tributaries upstream of Rhydlydan. The likely cause of the very poor biological quality at Sites 28 and 30 was sheep dip pesticide. Biological quality further upstream at site 23 had improved (BMWP score of 56, as opposed to 36 in the summer). This information was used to help target the farm inspections in the catchment. A direct discharge from a sheep dip structure was located upstream of sites 28 and 30 during the farm visit programme.

3.2.1.3 Farm visit programme

A number of visits were undertaken in the Northern Area to determine, where possible, the likely sources of sheep dip chemicals that were being identified by water quality sampling and biological surveys. This watercourse recorded concentrations of sheep dip chemicals typically an order of magnitude greater than the other study catchments in Northern Area. Three dipping structures were found to have direct discharges to the watercourse; advice on pollution prevention measures was given to these farmers. It became evident that there would need to be a concerted effort to visit every farm in the catchment to determine where the mobile dipping sites were, particularly as there has been a move towards using this method rather than the static dips. Not one mobile dipping operation was found despite the visits being undertaken during the main dipping period in October.

Treatment method

It was evident that the majority of those sites visited were still using Organophosphate (O/P) dips. Of particular note was the fact that some farmers had tried the SP treatments in 1996 but had claimed that the longevity of the protection afforded appeared, in their opinion, to be less than that provided by the OP dips. They had therefore reverted to using Ops in 1997. This was particularly evident in the upper reaches of the Afon Merddwr where there was a lot of bracken in the grazing area, which farmers consider to harbour ticks and therefore increase infestation.

Table 3.10 Treatment methods used in the Merddwr catchment

Treatment method	% sites visited
O/P dips	50
S/P dips	25
S/P & O/P dips	7
Injection	3
Pour on	14
Didn't know	0

Structures

Whilst most dips were found to be in a reasonable state of repair, there were a number of concerns with regard to location of the dips. Dipping sites were predominantly within 10 metres of a watercourse with at least 3 sites having a direct discharge to a watercourse. Soakaways were much in evidence as those dips installed in the early eighties were guided by information available at that time (former MAFF Code of Good Agricultural Practice), which recommended the use of this disposal method.

Chemical Storage

Most sites kept neat chemicals in a store of some description. In the majority of cases, however, this was not done by placing the containers in a bunded store or a secure lockable container. Advice was given where appropriate and arrangements made to review storage facilities.

Dip Disposal

There were four main disposal routes for used dip, by sub-surface soakaway, landspreading, off-site disposal by contractor and by direct discharge to the watercourse.

Table 3.11 Disposal methods in the Merddwr catchment

Disposal Method	% Sites Visited
Soakaway	39
Landspreading	50
Off-site Disposal	0
Direct Discharge	11

The **soakaway** method was favoured by most farmers. However, in a number of cases with the older dipping structures, the system had become clogged and was not operating efficiently, resulting in very slow drain-down times. Advice on alternative disposal options was given by field staff.

Landspreading was an option that those farmers with vacuum tankers were using. In most cases dilution was not being undertaken such that application rates were considerably higher than that recommended. Some farmers were found to be disposing of used dip in very small areas leading to high concentrations in the ground close to streams.

Off-site disposal was not used, the principle reason being that disposal costs were apparently excessive with charges being quoted in excess of £200/load.

Direct discharges were found at 3 of the sites inspected. Of these, one site had not been used in 1997, one dip tank was full and the other had apparently been emptied prior to the inspection taking place. The full tank was to be emptied by tankering and the farmer with the operational but empty dip was warned that any further discharges to the stream would result in formal action being taken.

Pollution Prevention Measures

All those sites visited received a follow up letter detailing any remedial works and/or precautionary measures required to minimise the risk of pollution associated with dipping activities. The Agency Pollution Prevention Guidelines for sheep dipping (PPG 12) were distributed to all the sites within the study areas.

Overall Risk Assessment

All sites were assessed using the site inspection sheet data to identify whether the site was either High,Medium or Low risk to surface and groundwaters. The results are given below:-

Risk Category	*% Sites Visited*
High	35
Medium	35
Low	30

It became evident that whilst the majority of the farmers visited were aware of the pollution risks associated with sheep dip disposal the high level of toxicity of the spent dip was still being underestimated. Guidance to minimise the risks associated with dip disposal was given with written confirmation of best practice to be adopted. It became apparent that it would be beneficial to undertake a concerted educational programme and an extended pollution prevention campaign to visit all the sites in the catchment in 1998.

3.2.2 Ystrad catchment

3.2.2.1 Stream chemistry

A total of 5 sites were sampled on the Afon Ystrad between the 13/5/97 and the 28/10/97. The tributary upstream of the Afon Lliwen exceed the annual average (AA) and MAC EQS limits for propetamphos (OP). The Ystrad upstream of the watercourse from Peniel gave one positive result for cypermethrin (SP) which caused exceedance of both the AA and MAC EQS limits.

Positive results were more sporadic in the AfonYstrad catchment with detection in early July, September and late October. Recorded concentrations were generally lower than the other two main target catchments in Northern Area.

Table 3.12 Summary of water quality results from the Ystrad catchment.EQS failures in bold.

SITE			AA ng/l	Max ng/l	No samples	No positive	Date first sample	Date last sample
Name	SPN	Det						
Lliwen d/s n.Blaenau	1793	Diazinon	5	14	13	1	13/05/97	28/10/97
		Propetamphos	0	0	13	0	13/05/97	28/10/97
		Chlorvenvinphos	0	0	13	0	13/05/97	28/10/97
		Cypermethrin	0	0	13	0	13/05/97	28/10/97
		Flumethrin	0	0	13	0	13/05/97	28/10/97
Trib. u/s A. Lliwen	1800	Diazinon	5	12	13	3	13/05/97	28/10/97
		Propetamphos	**39**	**450**	13	1	13/05/97	28/10/97
		Chlorvenvinphos	0	0	13	0	13/05/97	28/10/97
		Cypermethrin	0	0	13	0	13/05/97	28/10/97
		Flumethrin	0	0	13	0	13/05/97	28/10/97
Ystrad P.Newydd	1803	Diazinon	8	19	13	4	13/05/97	28/10/97
		Propetamphos	7	99	13	1	13/05/97	28/10/97
		Chlorvenvinphos	0	0	13	0	13/05/97	28/10/97
		Cypermethrin	0	0	13	0	13/05/97	28/10/97
		Flumethrin	0	0	13	0	13/05/97	28/10/97
Ystrad Egryn	1813	Diazinon	5	10	12	3	13/05/97	28/10/97
		Propetamphos	6	20	12	1	13/05/97	28/10/97
		Chlorvenvinphos	0	0	12	0	13/05/97	28/10/97
		Cypermethrin	0	0	12	0	13/05/97	28/10/97
		Flumethrin	0	0	12	0	13/05/97	28/10/97
Ystrad u/s Peniel	1830	Diazinon	5	10	13	1	13/05/97	28/10/97
		Propetamphos	5	11	13	1	13/05/97	28/10/97
		Chlorvenvinphos	0	0	13	0	13/05/97	28/10/97
		Cypermethrin	**3**	**40**	13	1	13/05/97	28/10/97
		Flumethrin	0	0	13	0	13/05/97	28/10/97

3.2.2.2 Stream biology

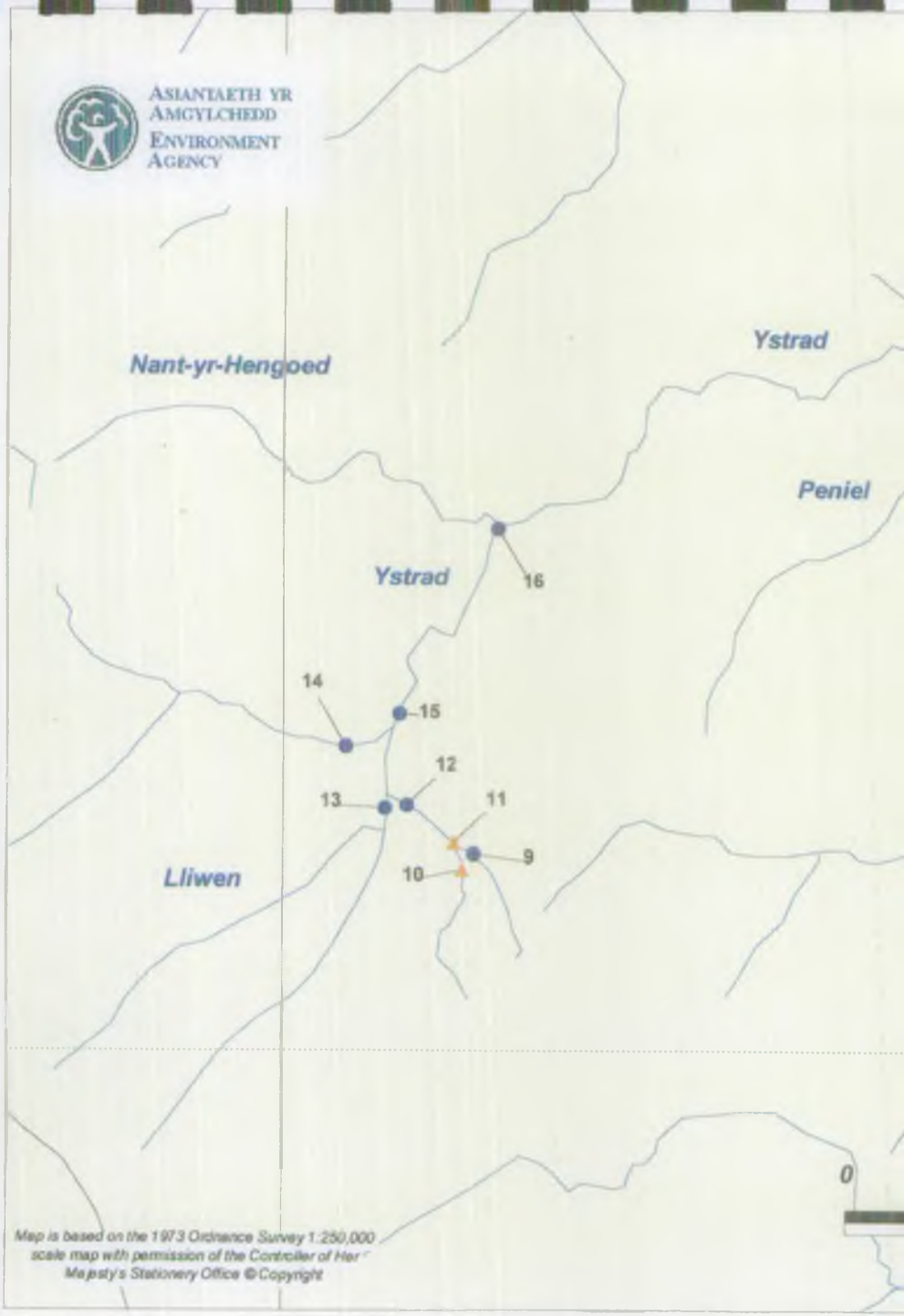
A total of 10 sites were sampled in the Ystrad catchment (Fig 3.5).

The survey undertaken in July indicated that the biological quality at all of the sites sampled was moderate to good, and there was no evidence of gross impact by sheep dip chemicals. However, site 13 only scored 53 which was to increase substantially in the October survey. The poor biological quality at Sites 10 and 11 in October, with BMWP scores of 43 and 36 respectively, may be attributable to organic pollution, as the invertebrate families present were dominated by low scoring taxa in high abundances.

3.2.2.3 Farm visit programme

This catchment was subject to a general farm pollution prevention campaign in early 1997, prior to this project being initiated. As part of the general campaign at that time the Agency guidance leaflet on sheep dipping (PPG12) was distributed to farmers.

Water quality sampling during this survey demonstrated limited contamination and biological surveys did not demonstrate an impact from sheep dipping activities in this catchment. Due to staff resource commitments and the greater need in the Merddwr and Ceirw catchments, farm visits were not undertaken in this catchment as part of this project.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SHEEP DIP SURVEY

Fig 3.5 - Ystrad Catchment

Table showing BMWP scores for 1997 Survey

Site	Description	NGR	Summer	Autumn
9	Un-named trib. d/s Ty'n -Twll	SJ 014 615		79
10	Un-named trib. at farm by B5435	SJ 0135 6140		43
11	un-named trib. at farm yard	SJ 013 615		36
12	Un-named trib at B5435 Road Bridge	SJ 009 618		59
13	A.Llwen d/s. N. Blaenau	SJ 007 618	53	95
14	Trib. A.Ystrad at Nantglyn	SJ 005 622		106
15	A.Ystrad at Bont Newydd	SJ 007 624	67	109
16	A.Ystrad at Egnyn Mill	SJ 017 638	74	84
17	A.Ystrad at U.W.C. Penrel	SJ 056 646	78	100
18	A.Penrel u/s A. Ystrad	SJ 056 645		88

Key to Symbols

? *Sheep dip suspected but not determined*

● *Unpolluted*

▲ *Pollution - cause not determined*

◆ *Moderately affected by sheep dip pesticides*

■ *Severely affected by sheep dip pesticides*

▽ *Pollution - other than sheep dip*

3.2.3 Ceirw catchment

3.2.3.1 Stream chemistry

Four sites were sampled on the Ceirw catchment. All of the sites except the uppermost site in the catchment, the Afon Bach at Ty Mawr, exceeded the annual average (AA) and maximum allowable concentration (MAC) EQSs for diazinon. Whilst there were a number of positive results for propetamphos throughout the catchment, these results were below the AA and MAC EQS limits. No positive results were recorded for synthetic pyrethroid based sheep dips during the monitoring period.

Table 3.13 Summary of water quality results for the Ceirw catchment. EQS failures in bold.

SITE			AA ng/l	Max ng/l	No samples	No positive	Date first sample	Date last sample
Name	SPN	Det						
AfonBach Ty Mawr	3845	Diazinon	5	13	12	1	13/05/97	28/10/97
		Propetamphos	6	18	12	1	13/05/97	28/10/97
		Chlorvenvinphos	0	0	12	0	13/05/97	28/10/97
		Cypermethrin	0	0	13	0	13/05/97	28/10/97
		Flumethrin	0	0	13	0	13/05/97	28/10/97
Ceirw Tai'n Rhos	343	Diazinon	**32**	**290**	13	6	13/05/97	28/10/97
		Propetamphos	8	44	13	1	13/05/97	28/10/97
		Chlorvenvinphos	0	0	13	0	13/05/97	28/10/97
		Cypermethrin	0	0	13	0	13/05/97	28/10/97
		Flumethrin	0	0	13	0	13/05/97	28/10/97
Ceirw Ty Gwyn	353	Diazinon	**35.4**	**336**	13	7	13/05/97	28/10/97
		Propetamphos	2	28	13	1	13/05/97	28/10/97
		Chlorvenvinphos	0	0	13	0	13/05/97	28/10/97
		Cypermethrin	0	0	13	0	13/05/97	28/10/97
		Flumethrin	0	0	13	0	13/05/97	28/10/97
Ceirw Maesmor	372	Diazinon	**25.9**	**250**	13	7	13/05/97	28/10/97
		Propetamphos	5	15	13	2	13/05/97	28/10/97
		Chlorvenvinphos	0	0	13	0	13/05/97	28/10/97
		Cypermethrin	0	0	13	0	13/05/97	28/10/97
		Flumethrin	0	0	13	0	13/05/97	28/10/97

The Afon Ceirw demonstrated positive results in late June with the highest concentrations being recorded in September. This may be accounted for by the use/availability of mobile dipping contractors who tend to undertake "block" contracts in an area.

3.2.3.2 Stream biology

A total of 8 sites were sampled in the Ceirw catchment (Fig 3.6).

The survey undertaken in the summer indicated that the biological quality at all sites was moderate to good and there was no evidence of gross impact by sheep dip chemicals. This was despite the organophosphate, diazinon, being detected in the water column at all four water quality monitoring points. The poor biological quality recorded at Site 5, with a BMWP score of 48, during the October survey is likely to be attributable to organic pollution. The invertebrate families present were dominated by low scoring taxa including arthropods, molluscs and annelids, all in high abundances.

3.2.3.3 Farm visit programme

A blanket inspection process was used for the farms in the upper reaches of the catchment. A number of pollution prevention visits had been undertaken in the Llangwm area by ADAS in the catchment in 1995 and 1996, as part of a rolling programme determined with input from the Agency. Only one potential high risk site was found with a discharge to a soakaway from a dip that needed some work as it was in a poor state of repair. It appeared that most of the farmers spoken to were aware of the pollution risks associated with sheep dip disposal. Despite this, there were still a large number of positive detections of sheep dip chemicals in water samples.

3.2.4 Additional catchments

Eight additional sites were monitored on 1-3 occasion(s) between September and October, during the second main dipping period. Of these, four sites proved to have positive results for sheep dip chemicals (Table 3.14). On two occasions the results exceeded the MAC limits. The first was the Afon Twrch with an exceedance for cypermethrin, and the second was the Dwr Ial which exceeded the diazinon MAC EQS. Of particular note is the result for cypermethrin from the Afon Twrch, since this was the location of a chronic pollution incident in April 1997, which resulted in a total mortality of invertebrates over a distance of some 8 km (see section 4.2).

SHEEP DIP SURVEY

Fig 3.6 - Ceirw Catchment

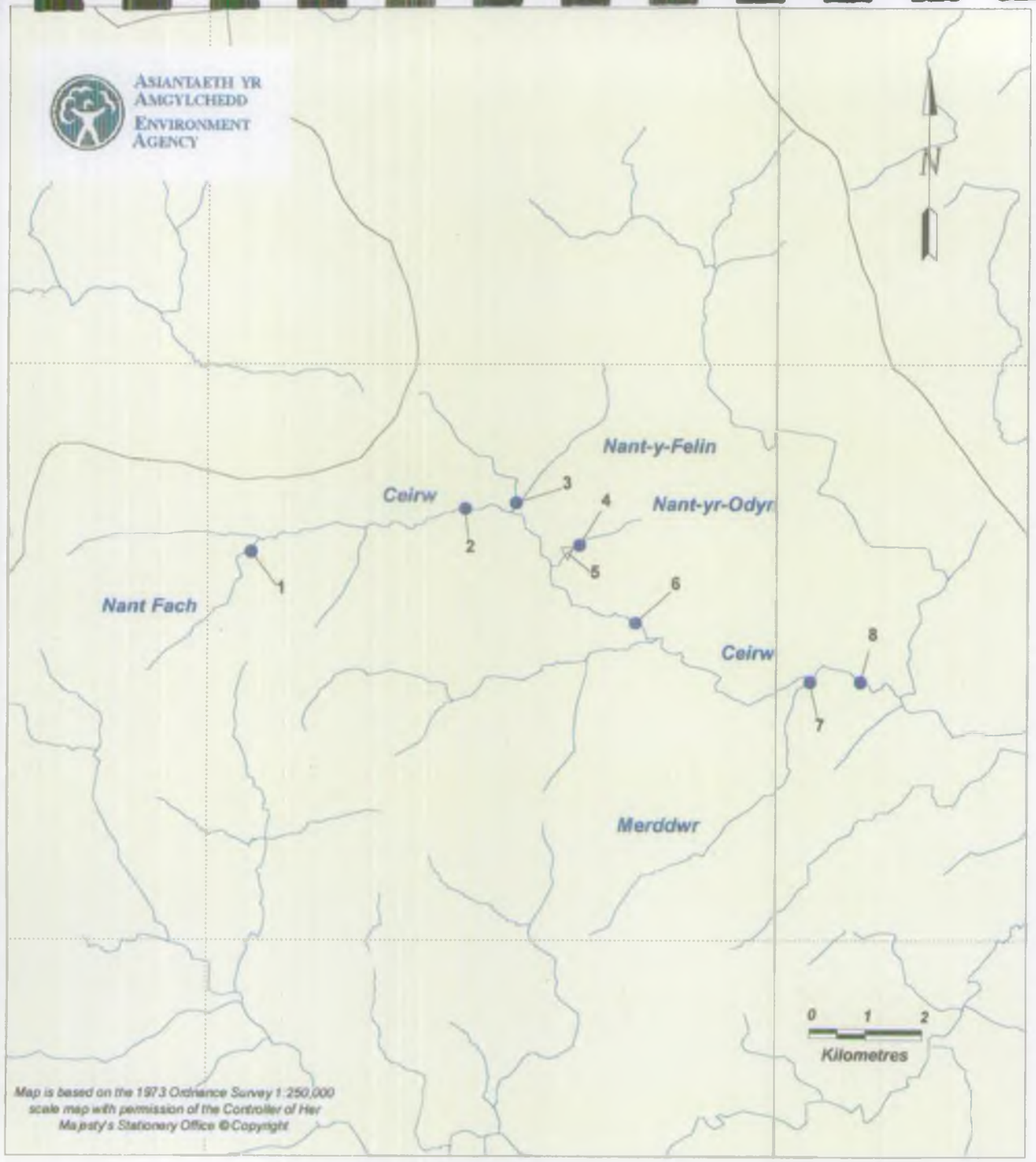


Table showing BMWP scores for 1997 Survey

Site	Description	NGR	Summer	Autumn
1	A.Nant Fach at Ty Mawr	SH 908 468	77	107
2	A.Ceirw at Tai'n y Rhos	SH 945 475		101
3	Nant y Felin u/s A. Ceirw	SH 954 476		88
4	Nant yr Odyn at Hendre Arddwyfaen u/s yard	SH 964 468		88
5	Nant yr Odyn at Hendre Arddwyfaen d/s yard	SH 964 467		48
6	A.Ceirw at Pont Ty Gwyn	SH 975 455		98
7	A.Merddwr u/s A. Ceirw	SJ 006 445		106
8	A.Ceirw at Maesmor	SJ 015 445	80	76

Key to Symbols

? *Sheep dip suspected but not determined*

● *Unpolluted*

▲ *Pollution - cause not determined*

◆ *Moderately affected by sheep dip pesticides*

■ *Severely affected by sheep dip pesticides*

▽ *Pollution - other than sheep dip*

Table 3.14. **Results from additional catchments in Northern Area. Blank record represents no detectable presence of the sheep dip chemical.**

River	Sampling Date	Diazinon ng/l	Propetamphos ng/l	Cypermethrin ng/l	Flumethrin ng/l
R.Wheeler	31/10/97				
R.Clwyd	31/10/97				
A.Eglwys	15/10/97 29/10/97				
A.Morwy	15/10/97 29/10/97				
Dwr Ial (R.Clwyd)	31/10/97	195			
Afon Clywedog	31/10/97	16			
River Elwy (R.Clwyd)	31/10/97	21			
Afon Twrch (Dee)	3/10/97 9/10/97 5/11/97			136	

3.3 SOUTH WEST AREA

3.3.1 Nevern catchment

3.3.1.1 Stream Chemistry

Six sites were sampled within the Nevern catchment, between the 13 May 1997 and 13 October 1997 (Table 3.15). One site (Road bridge near Pontfaen, 39600) failed the annual average (AA) EQS for cypermethrin, with a mean of 20 ng/l. The mean concentration of diazinon on the River Nevern at Pont Cyrion (spt 84501) was equal to the AA EQS and therefore caused a failure for this site.

Only one site failed its maximum allowable concentration (MAC) EQS for cypermethrin, and again that was the roadbridge at Pontfaen, with a maximum recorded concentration of 130 ng/l (Table 3.15).

Diazinon was found at every site, although usually at low concentrations. Chlorovenvinphos was also recorded at Pont Cyrion. Flumethrin was not recorded at any site, and cypermethrin and propetamphos were only found at Pontfaen.

All the positive results for sheep dip chemicals were recorded between 11th June and 13th August.

3.3.1.2 Stream biology

A total of 23 sites were sampled in the Nevern catchment (Fig 3.7).

Surveys undertaken in both July and October indicated that the biological quality at all sites was good and there was no evidence of adverse impact by sheep dip chemicals (Fig 3.7). This is despite the fact that the OP, diazinon, was detected in the water column at all six water quality monitoring points and the SP, cypermethrin, was detected twice in the water column at site 1 and in the sediment at Site 8. It would appear that the pesticide concentrations experienced were not sufficient to have a detectable impact upon the stream fauna. At some sites the BMWP scores were relatively low (50-60) but high abundances of taxa sensitive to sheep dip pesticides suggested that there was no confirmed impact at these site.

Table 3.15 Summary water quality results for the Nevern Catchment

SITE			AA ng/l	Max ng/l	No sample	No positive	Date first sample	Date last sample
Name	SPN	Det						
Trib of Brynberian	39597	Diazinon	1	10	10	1	13/5/97	13/10/97
		Propetamphos	0	0	10	0	13/5/97	13/10/97
		Chlorfenvinphos	0	0	10	0	13/5/97	13/10/97
		Cypermethrin	0	0	9	0	13/5/97	13/10/97
		Flumethrin	0	0	9	0	13/5/97	13/10/97
Nevern us road bridge Pontyglasier	39599	Diazinon	2	20	9	1	13/5/97	13/10/97
		Propetamphos	0	0	9	0	13/5/97	13/10/97
		Chlorfenvinphos	0	0	9	0	13/5/97	13/10/97
		Cypermethrin	0	0	9	0	13/5/97	13/10/97
		Flumethrin	0	0	9	0	13/5/97	13/10/97
River Nevern at Pont Cyrion	84501	Diazinon	10	80	10	3	13/5/97	13/10/97
		Propetamphos	8	80	10	1	13/5/97	13/10/97
		Chlorfenvinphos	1	10	10	1	13/5/97	13/10/97
		Cypermethrin	0	0	9	0	13/5/97	13/10/97
		Flumethrin	0	0	9	0	13/5/97	13/10/97
Brynberian above lower Brynberian	84506	Diazinon	3	30	9	1	13/5/97	13/10/97
		Propetamphos	0	0	9	0	13/5/97	13/10/97
		Chlorfenvinphos	0	0	9	0	13/5/97	13/10/97
		Cypermethrin	0	0	9	0	13/5/97	13/10/97
		Flumethrin	0	0	9	0	13/5/97	13/10/97
Nevern d/s road bridge at Preswylfa	39598	Diazinon	7	30	9	2	13/5/97	13/10/97
		Propetamphos	0	0	9	0	13/5/97	13/10/97
		Chlorfenvinphos	0	0	9	0	13/5/97	13/10/97
		Cypermethrin	0	0	7	0	13/5/97	13/10/97
		Flumethrin	0	0	7	0	13/5/97	13/10/97
Nevern at RB near Pontfaen	39600	Diazinon	6	30	9	2	13/5/97	13/10/97
		Propetamphos	8	70	9	1	13/5/97	13/10/97
		Chlorfenvinphos	0	0	9	0	13/5/97	13/10/97
		Cypermethrin	20	130	9	2	13/5/97	13/10/97
		Flumethrin	0	0	9	0	13/5/97	13/10/97

3.3.1.3 Farm visit programme

A total of 24 farms were visited in October 1997 in the upper Nevern catchment area, which has the highest sheep density in Pembrokeshire. The larger flocks were found in the northern part of Mynydd Preseli with two flocks of 6000 sheep, two flocks of 4000 sheep and four flocks with around 1000 sheep. There were other farms with flocks of varying sizes which were often part of mixed livestock enterprises comprising beef and sheep, dairy and sheep or dairy, beef and sheep. There were also numerous small flocks of less than 100 sheep which were not included in the inspection programme.

Treatment method

It was evident that organophosphate pesticides were the most commonly used in the catchment (Table 3.16). Two farms used SP pesticides at the same dipping location and another used a mobile dip. There was an apparent lack of confidence in the reliability of SP dips for complete protection against sheep scab infections in the catchment and SP dips were used where operator safety considerations prevailed.

Table 3.16 **Treatment methods used in the Nevern catchment**

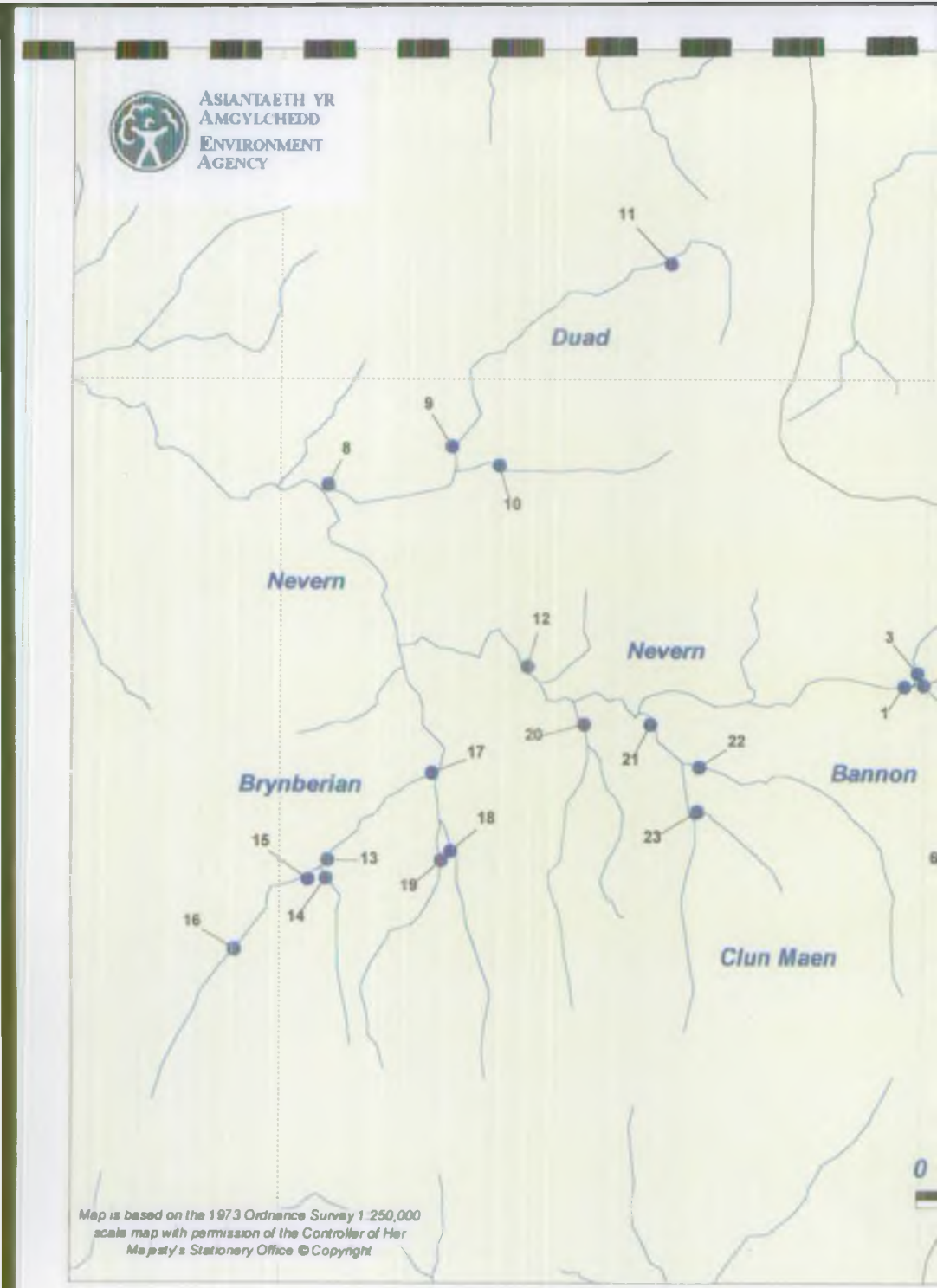
Treatment method	% sites visited
O/P dips	83
S/P dips	13
S/P & O/P dips	0
Injection	4
Pour on	0
Didn't know	0

Chemical storage

A number of farms stored chemicals in a store but the majority purchased products at the time of dipping.

Dip disposal

There were three disposal routes for waste dip, sub-surface soak away (4%), drainage to a storage tank or pit and subsequent land disposal (13%), and land spreading (83%). Where mobile dips had been used it could not be ascertained that landspreading at the correct dilution rates was conducted on all sites. The soakaway disposal site employed a deep excavated pit which allowed slow ground dispersal and thus a groundwater pollution risk.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SHEEP DIP SURVEY

Fig 3.7 - Nevern Catchment

Table showing BMWP scores for 1997 Survey

Sit	Description	NGR	Summer	Autumn
1	Nevern Road Bridge near Pontfaen	SN 1880 3880	93	74
2	Nevern u/s confluence with trib at Pontfaen	SN 1870 3870	103	89
3	Trib of Nevern u/s confluence at Pontfaen	SN 1870 3880	122	73
4	Nevern trib at 'The Gnoll'	SN 1800 3740	87	80
5	Nevern trib at 'The Gnoll'	SN 1810 3770	88	108
6	Nevern u/s conf. near Dyfrynn Manor	SN 1740 3540	83	75
7	Trib of Nevern u/s conf. near Dyfrynn Manor	SN 1750 3540	119	85
8	Duad u/s conf with Nevern	SN 1060 3890	84	68
9	Duad u/s ford	SN 1180 3930	74	112
10	Nant Hafren d/s conf. with small trib	SN 1230 3910	75	83
11	Duad 30m d/s road bridge	SN 1410 4120	99	113
12	Nevern @ bridge north of Crosswell	SN 1280 3700	80	88
13	Brynberian 30m d/s of road bridge	SN 1040 3510	83	107
14	Trib of Brynberian - right hand trib	SN 1040 3500	59	80
15	Trib of Brynberian - u/s conf. with right hand trib	SN 1030 3480	96	106
16	Trib of Brynberian 0.5km d/s Penanty	SN 0980 3400	84	57
17	Trib of Brynberian. 1km above Crosswell	SN 1180 3590	123.	80
18	Trib of Brynberian nr. Glan-yr-lsaf	SN 1180 3510	93	90
19	Trib of Brynberian. u/s footbridge	SN 1170 3500	109	57
20	Trib of Nevern nr Temple Gate	SN 1320 3840	82	74
21	Bennon d/s bridge @ Pontyglasiar	SN 1390 3640	87	103
22	Bennon d/s road bridge	SN 1440 3590	79	68
23	Afon Clun Maen d/s road bridge	SN 1440 3550	86	97

Key to Symbols

? *Sheep dip suspected but not determined*

● *Unpolluted*

▲ *Pollution - cause not determined*

◆ *Moderately affected by sheep dip pesticides*

■ *Severely affected by sheep dip pesticides*

▽ *Pollution - other than sheep dip*

Structures

Most dips were in a reasonable state of repair but some of rendered concrete construction were in need of maintenance to prevent risk of seepages. The use of mobile dips was increasing in the catchment. One farm has purchased a mobile dip for use at that farm only. A pollution incident was attributed to the farm three years ago but the farmer has provided an effluent storage tank for storing draining pen liquors. Another farmer was about to purchase a mobile dip for future use.

Risk assessment

The proportion of farms categorised as high, medium and low risk were 29%,42% and 29%, respectively. It was encouraging to find that most farmers were aware of pollution risks and also prepared to consider guidance given. It was however apparent that there is a need to continue a concerted educational programme in the catchment in 1998.

3.3.2 Sawdde catchment

3.3.2.1 Stream chemistry

Four sites were sampled as part of the monitoring programme, between 15th June and 4th November. None of the four sites failed either annual average (AA) or MAC EQS limits (Table 3.17).

Low concentrations of diazinon were found at three of the sample points, but there was only one incidence per site (over differing days). Chlorfenvinphos and propetamphos were absent throughout the sampling period, whilst cypermethrin and flumethrin were only found on the River Sawdde at Llangadog (sampling point 88003) at low concentrations. The Afon Sawdde at Hen Bont (sampling point 34206) had no positive results for any of the five determinands.

3.3.2.2 Stream biology

A total of 19 sites were sampled in the Sawdde catchment (Fig 3.8).

The survey undertaken in July indicated good biological quality on the Afon Sawdde upstream of the confluence with the Clydach (Sites 1-7), and there was no evidence of pollution by sheep dip pesticides. The Afon Clydach upstream of the confluence with the Sawdde (Site 9), however, had a very limited invertebrate fauna. Only five invertebrate families were present (BMWP score 23) and abundances of these were very low. Biological quality improved upstream of the Nant Maesadda tributary (Site 11). Investigation of the Nant Maesadda itself indicated very poor quality (BMWP score 1-19) at three locations in its lower reaches. Biological quality was much improved at the head of this tributary (BMWP score of 111 with 17 families present) and it was therefore inferred that a toxic substance had entered the watercourse between sites 17 and 18. Pinpointing a clear source of the problem proved difficult as the stream appeared to be in the process of recolonisation. This information was conveyed to the Environment Protection Officers who were undertaking farm inspections in the catchment. Interviewing the farmers who owned

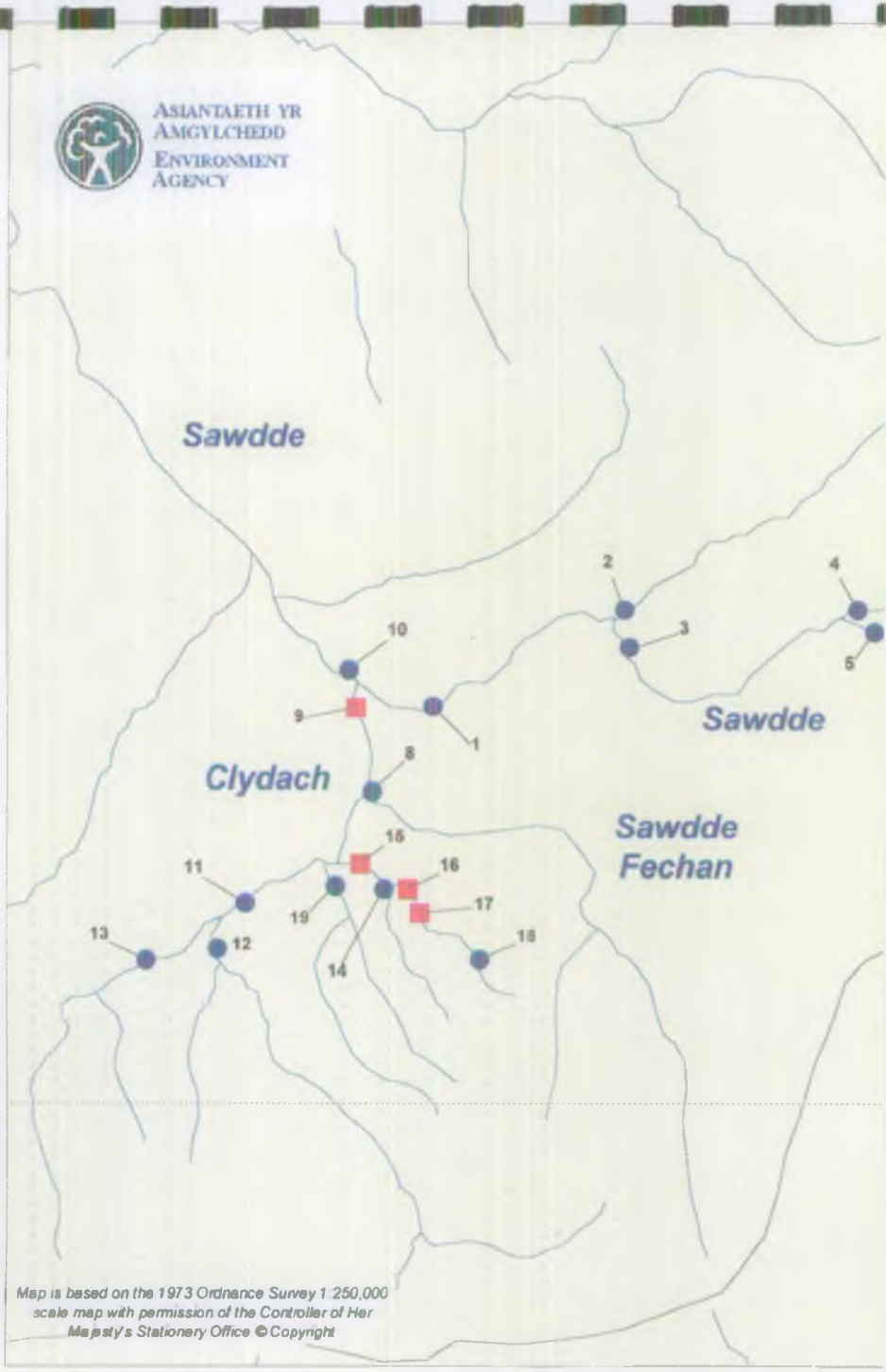
the adjoining land did not enable the cause to be determined since they stated that they either did not dip or used injection.

The survey undertaken in October again demonstrated poor biological quality in the lower Clydach (BMWP score 21), and the bottom of the Nant Maesadda was also very poor (BMWP score 16). There had been

Table 3.17. Summary of water quality results from the Sawdde Catchment

SITE			AA ng/l	Max ng/l	No sample	No positive	Date first sample	Date last sample
Name	SPN	Det						
River Sawdde at Llangadog	88003	Diazinon	1	9	12	1	15/5/97	23/10/97
		Propetamphos	0	0	12	0	15/5/97	23/10/97
		Chlorfenvinphos	0	0	12	0	15/5/97	23/10/97
		Cypermethrin	2	25	12	1	15/5/97	23/10/97
		Flumethrin	2	25	12	1	15/5/97	23/10/97
River Sawdde at Henbont	34206	Diazinon	0	0	12	0	15/5/97	4/11/97
		Propetamphos	0	0	12	0	15/5/97	4/11/97
		Chlorfenvinphos	0	0	12	0	15/5/97	4/11/97
		Cypermethrin	0	0	12	0	15/5/97	4/11/97
		Flumethrin	0	0	12	0	15/5/97	4/11/97
A.Clydach at Pont Newydd	39596	Diazinon	1	7	12	1	15/5/97	4/11/97
		Propetamphos	0	0	12	0	15/5/97	4/11/97
		Chlorfenvinphos	0	0	12	0	15/5/97	4/11/97
		Cypermethrin	0	0	12	0	15/5/97	4/11/97
		Flumethrin	0	0	12	0	15/5/97	4/11/97
Sawdde Fechan at Pont Aber	39595	Diazinon	1	12	12	1	15/5/97	4/11/97
		Propetamphos	0	0	12	0	15/5/97	4/11/97
		Chlorfenvinphos	0	0	12	0	15/5/97	4/11/97
		Cypermethrin	0	0	13	0	15/5/97	4/11/97
		Flumethrin	0	0	13	0	15/5/97	4/11/97

some improvement at site 16 to a BMWP score of 42 but all families identified were present at low abundance. More detailed sampling of the Nant Maesadda identified that the cause of the poor quality was leaching of the SP, cypermethrin, from ground adjacent to a sheep dip structure.


Asiantaeth yr Amgylchedd
Environment Agency
Sawdde
Clydach
Sawdde
Fechan
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1
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Map is based on the 1973 Ordnance Survey 1 250,000 scale map with permission of the Controller of Her Majesty's Stationery Office © Copyright

SHEEP DIP SURVEY

Fig 3.8 - Sawdde Catchment

Table showing BMWP scores for 1997 Survey

Sit	Description	NGR	Summer	Autumn
1	Sawdde @ Henbont	SN 7420 233	89	91
2	Afon Llechach u/s road bridge nr Twynllanan	SN 7580 241	92	69
3	Sawdde nr Llwyntron	SN 7570 237	94	69
4	Sawdde u/s conf with Mihartach	SN 7770 242	102	97
5	Mihartach u/s conf with Sawdde	SN 7770 241	88	76
6	Sawdde nr Blaennau (u/s trib)	SN 7930 242	95	90
7	Trib of Sawdde u/s Sawdde nr Blaennau	SN 7930 243	130	
8	Sawdde Fechan u/s conf with Clydach	SN 7370 226	82	60
9	Clydach at Pont Newydd (u/s Sawdde confluence)	SN 7360 234	23	21
10	Afon Sawdde 250m d/s conf. with Clydach	SN 7350 236	73	68
11	Afon Clydach u/s Pontbren	SN 7270 217	73	78
12	Trib of Clydach d/s Glan Toddeb	SN 7240 213	90	110
13	Western trib of Afon Clydach	SN 7180 212	83	60
14	Western trib of Clydach nr Maesadda Farm	SN 7380 218	82	77
15	Nant Maesadda immediately u/s conf @ road bridge	SN 7360 220	17	16
16	Nant Maesadda d/s Maesadda Farm	SN 7400 218	19	42
17	Nant Maesadda @ Maesadda Farm	SN 7410 216	1	
18	Nant Maesadda u/s Maesadda Farm	SN 7460 212	111	105
19	Trib of Clydach from Hirlwyn Isaf	SN 7350 220	87	97

Key to Symbols

? *Sheep dip suspected but not determined*

● *Unpolluted*

▲ *Pollution - cause not determined*

◆ *Moderately affected by sheep dip pesticides*

■ *Severely affected by sheep dip pesticides*

▽ *Pollution - other than sheep dip*

Legal action may now follow. There was no evidence from biology of an impact from sheep dip chemicals elsewhere in the catchment.

The total length of watercourse found to be severely affected by sheep dip pesticides was 2.3 km (1.6 km of the Afon Clydach and 0.7 km of the Nant Maesadda). The main River Sawdde was not markedly affected.

3.3.2.3 Farm visit programme

Nineteen farms were visited in the catchment between the 15 September and the 30 September 1997.

Type of treatment

Of the 19 farms visited, five stated that they did not use any treatment at all and another three stated that they did not dip on their farms but did so elsewhere(Table 3.18). At several of the farms where dipping was no longer undertaken or they had changed to injections, the farmers had done so due to health problems, allegedly associated with OP dips.

Table 3.18 Treatment methods used in the Sawdde catchment

Treatment method	% sites visited
O/P dips	26
S/P dips	10
S/P & O/P dips	0
Injection	5
Pour on	5
Unknown	10
No treatment or dipped elsewhere	42

Dip structures

In general the dipping structures appeared to be in average to good condition. The structures were constructed of various materials including brick (18%), concrete (64%), fibre-glass (9%) and steel (9%). All the dips inspected in this survey were found to be at least 30 m from any watercourse.

Chemical storage

Little information was gained concerning chemical storage, but of the information obtained farmers did not appear to store chemicals.

Dip disposal

Of the farms that used dips, 22% used soakaways, 22% disposed of the dip off-site using a contractor, 22% disposed of the dip to land, and the mode of disposal was not confirmed for 34%. Of the farmers who disposed of the dip to land, half of these first put the used dip into their slurry lagoon for spreading at a later date.

Risk assessment

Not all the dips were in use but for the purpose of risk assessment all were deemed usable and therefore included as if they were in operation. As a consequence 0% were considered high risk, 33% were considered medium risk and 67% were considered low risk.

One of the farmers who stated that his dip was not in use was later found to be the cause of the pollution incident in the Nant Maesadda tributary. This dip was not categorised as a high risk site since the structure was >10 m from a watercourse. However, the incident confirms the need to know exact disposal routes for used dip.

3.3.3 Additional catchments

An additional six catchments were sampled on two occasions between September and November. Low concentrations of the sheep dip chemical, diazinon, were detected in three of the six catchments (Table 3.19).

Table 3.19. Results from additional catchments. Blank record represents no detectable presence of the sheep dip chemical.

River	Sampling Date	Diazinon ng/l	Propetamphos ng/l	Cypermethrin ng/l	Flumethrin ng/l
Afon Brennig 89118	25/9/97 20/10/97				
River Teifi 83001	25/9/97 20/10/97	6			
River Aeron 89114	29/9/97 31/10/97	15			
R. Twrch (Cothi)88241	01/10/97 23/10/97				
R. Gwydderig 88001	03/10/97 24/10/97	15			
River Ystwyth 82001	06/10/97 04/11/97 02/12/97				

3.4 SOUTH EAST AREA

3.4.1 Wye catchment

3.4.1.1 Stream Chemistry

Four sites were sampled as part of the main monitoring programme, between the 30 May and the 5 November 1997.

The only site which failed its annual average (AA) EQS for a sheep dip pesticide was the Nant yr Offeiriad (R. Clettwr), with propetamphos being the pesticide exceeded. No exceedances of maximum allowable concentration (MAC) EQS limits were recorded at any of the four sites.

The site on the main river Edw recorded three positive results for both diazinon and propetamphos, and one for chlorfenvinphos. The river Camnant, a tributary of the Edw, recorded a single positive result for diazinon. All detections were at relatively low concentrations and therefore the biological results in the Edw, where marked reductions in fauna occurred (see below), suggests that water quality monitoring may have missed a particular event.

As well as failing its AA EQS for propetamphos, a single detection of diazinon was also recorded in the Nant yr Offeiriad (Clettwr).

No sheep dip pesticide was recorded in the smaller Black Brook sub-catchment. No synthetic pyrethroid was detected in the catchment.

3.4.1.2 Stream Biology

A total of 40 sites were sampled in the Wye catchment. Sampling was undertaken in the Black Brook, Edw and Nant-yr-Offeiriad (Clettwr) sub-catchments (Fig 3.9).

Black Brook sub-catchment

One site was sampled on the Black Brook just upstream of its confluence with the Summergil Brook, in both July and October (Fig 3.9).

The BMWP score was good in both seasons (BMWP 83-85) and since it is only a small catchment it was not deemed necessary to sample further upstream.

Table 3.20 **Summary results from the Wye catchment**

SITE			AA ng/l	Max ng/l	No sample	No positive	Date first sample	Date last sample
Name	SPN	Det						
River Edw	50013	Diazinon	4	29	12	3	30/5/97	5/11/97
		Propetamphos	2.5	14	12	3	30/5/97	5/11/97
		Chlorfenvinphos	0.6	7	12	1	30/5/97	5/11/97
		Cypermethrin	0	0	12	0	30/5/97	5/11/97
		Flumethrin	0	0	12	0	30/5/97	5/11/97
Black Brook	50878	Diazinon	0	0	12	0	30/5/97	5/11/97
		Propetamphos	0	0	12	0	30/5/97	5/11/97
		Chlorfenvinphos	0	0	12	0	30/5/97	5/11/97
		Cypermethrin	0	0	12	0	30/5/97	5/11/97
		Flumethrin	0	0	12	0	30/5/97	5/11/97
Nant yr Offeiriad (R.Clettwr)	50015	Diazinon	1	13	12	1	30/5/97	5/11/97
		Propetamphos	12	92	12	2	30/5/97	5/11/97
		Chlorfenvinphos	0	0	12	0	30/5/97	5/11/97
		Cypermethrin	0	0	12	0	30/5/97	5/11/97
		Flumethrin	0	0	12	0	30/5/97	5/11/97
R.Camnant	50822	Diazinon	1	11	11	1	30/5/97	5/11/97
		Propetamphos	0	0	11	0	30/5/97	5/11/97
		Chlorfenvinphos	0	0	11	0	30/5/97	5/11/97
		Cypermethrin	0	0	11	0	30/5/97	5/11/97
		Flumethrin	0	0	11	0	30/5/97	5/11/97

Edw sub-catchment

Nine sites were sampled in the Edw catchment in the summer. These sites were all re-sampled in the autumn, along with an additional nine sites (Fig 3.9). The Camnant, which is also a tributary of the Edw, was treated as a separate catchment due to the locations of the water quality sampling points, and has been reported separately below.

The survey undertaken in the summer did not indicate that there were any particular problems in the catchment, with the exception of Site 22 on the Clas Brook which scored just 41. At the time this was not further investigated due to the abundances of two groups of mayflies being quite high. However, when compared with autumn score of 84, it appears that the summer fauna had been impoverished and that in the past had been affected by a contaminant of some sort.

In the autumn, the sites in the upper reaches of the Edw (Sites 29-33) had BMWP scores in the range of 71 to 93, indicating that the biological quality was good. In the middle reaches of the Edw a reduction in faunal diversity was recorded over a distance of some 2-3 kilometres. This poor quality occurred from just upstream of the Llaneon tributary (Site 28), to approximately a kilometre below the Camnant Brook (Site 24). It is likely that the low scores of 26 and 40 downstream of the Camnant were a result of the problems identified on the Camnant itself (see below). However, upstream of the Camnant the Edw scored between 33 and 49. No obvious cause for the decline in scores could be detected.

Camnant Brook (sub-catchment of the Edw)

Three sites were sampled in the Camnant catchment in July and fourteen in October (Fig 3.9).

The results of the survey undertaken in July indicated that the biological quality of all three sites was good and that there appeared to be no problems in the catchment. In October, however, BMWP scores on the Camnant upstream of the Edw (Site 2) and upstream of the Colwyn Brook (Site 8) had decreased from 68 and 80 to 30 and 46, respectively. In addition, the BMWP score on the Colwyn Brook upstream of the Camnant (Site 3) had decreased from 95 to 33. Further sites were therefore investigated on both brooks.

On the Camnant, the low scores were traced upstream to a dead sheep in the river. Upstream of the sheep (Sites 11-15) the BMWP scores ranged from 60 to 95, whereas downstream of it (Sites 8-10) the BMWP range was 32 to 46. This implies that the sheep was impacting upon the biological quality, although it is not clear whether this would have been through organic means, via its decomposition, or whether traces of sheep dip washed off the fleece into the watercourse. However, no signs of organic input were observed as the sheep was not in a very advanced state of decomposition and no sewage fungus was present on the river bed. No other obvious causes for the decline in quality were apparent.

Upstream of its confluence with the Camnant Brook, the Colwyn Brook (Site 3) scored 33. Just over 1km upstream of this the Cwm-berwyn Farm tributary, which enters the Colwyn Brook on the right hand bank, scored 87 (Site 5). This indicated good biological quality and ruled out the Cwm-berwyn farm tributary as a possible source of contamination. Further confirmation of this

was obtained by BMWP scores of 15 and 16 on the Colwyn Brook, upstream (Site 6) and downstream (Site 4) of the tributary, respectively. Approximately 0.5 km further upstream (Site 7), the BMWP score was 3. It was not possible to take a sample upstream of this as the stream became extremely small and the surrounding land very marshy.

It is clear that a pollution incident of some sort occurred on the Colwyn Brook between July and October 1997, and due to the remoteness of the catchment it is likely to have been the result of a farming activity. There was no indication that other pollutants, such as slurry or silage effluent, had caused this severe impact and therefore sheep dip is strongly suspected.

The low score on the Camnant below its confluence with the Colwyn Brook (Site 2), is most likely to have been caused by the contaminant that passed down the Colwyn Brook, as the Colwyn Brook appeared to be the most severely affected of the two streams. It is also likely that it was the pollutant that passed down the Colwyn Brook that caused the decrease in score on the Edw (Site 25) downstream of its confluence with the Camnant.

Nant yr Offeiriad (Clettwr) sub-catchment

A total of six sites were sampled in the Nant yr Offeiriad catchment in July and seven in October (Fig 3.9).

The biological quality was good at all sites in both seasons and there was no evidence of any effects of sheep dip pesticides on the invertebrate communities.

3.4.1.3 Farm visit programme

Due to conflicting priorities in SE area, resource commitments did not allow for farm visits to be undertaken as part of the monitoring programme.

SHEEP DIP SURVEY

Fig 3.9 - Upper Wye Catchments

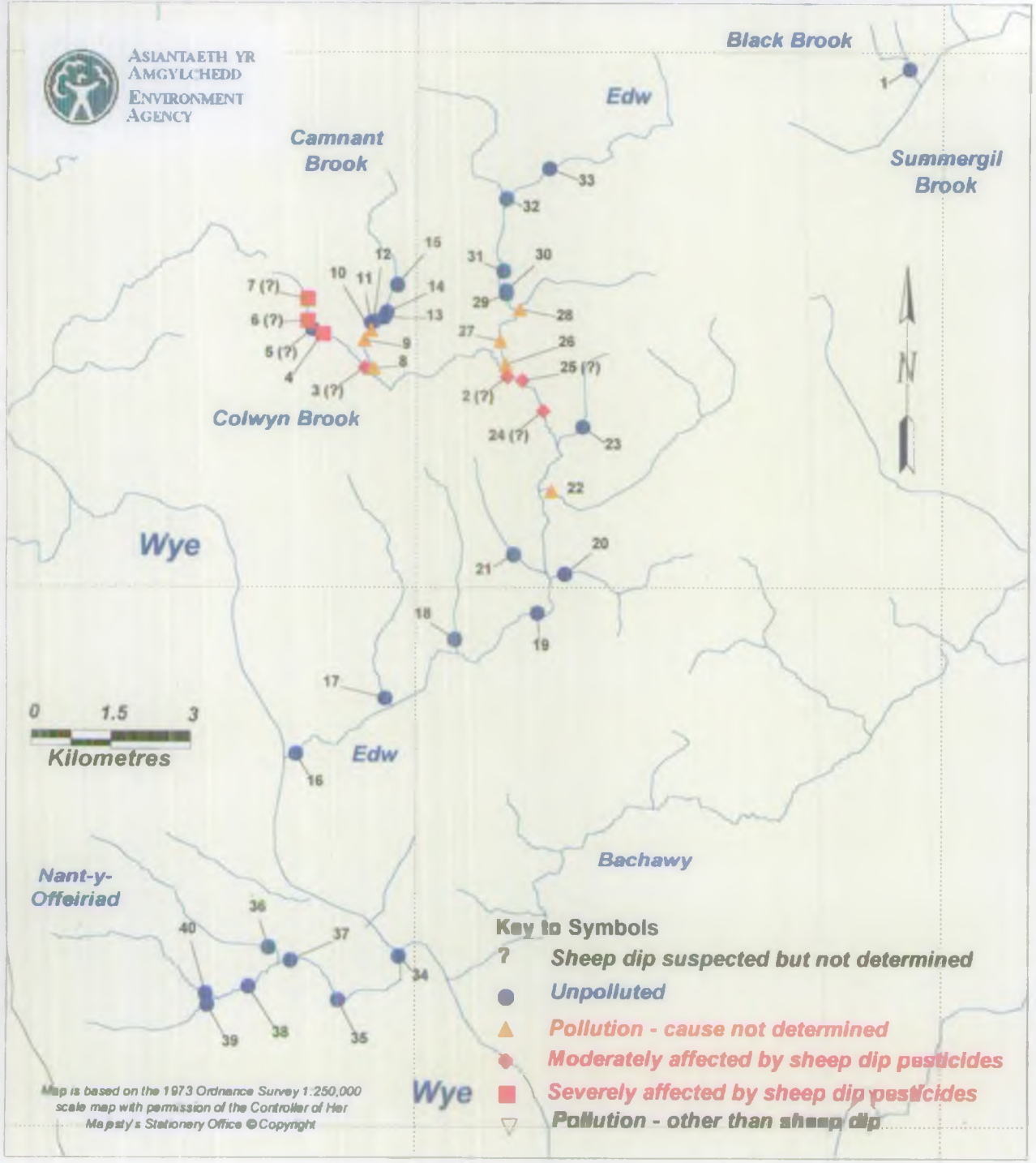


Table showing BMWP scores for 1997 Survey

Site	Description	NGR	Summer	Autumn
1	Black Brook @ A44	SO 1947 5945	83	85
2	Camnant Brook @ conf. Edw	SO 1165 5395	68	30
3	Colwyn Brook u/s Camnant	SO 0918 5390	95	33
4	Colwyn Brook d/s Cwm-berwyn Fm trib.	SO 0800 5485		15
5	Cwm-berwyn Fm trib. u/s Colwyn Brook	SO 0795 5485		87
6	Colwyn Brook u/s Cwm-berwyn Fm trib	SO 0795 5490		16
7	Colwyn Brook 0.5km u/s of 6	SO 0795 5540		3
8	Camnant u/s Colwyn Brook	SO 0920 5395	80	46
9	Camnant near Bryntwppa	SO 0900 5475		33
10	Camnant approx. 300m u/s Bryntwppa	SO 0910 5485		32
11	Camnant d/s trib.	SO 0915 5495		60
12	Camnant u/s trib.	SO 0920 5497		61
13	Camnant d/s small imput	SO 0940 5505		73
14	Camnant u/s small input	SO 0940 5506		83
15	Camnant d/s road bridge	SO 0965 5585		95
16	Edw @ Aberedw	SO 0770 4697	85	75
17	Milo Brook u/s Edw	SO 0970 4785	62	94
18	Cwmblaenerw Brook u/s Edw	SO 1080 4880	105	103
19	Edw @ Lower House bridge	SO 1230 4960		62
20	Edw trib. near Dan y Bryn	SO 1275 5035	103	102
21	Edw trib. near The Park	SO 1185 5060	118	121
22	Clas brook u/s Edw	SO 1255 5180	41	84
23	Edw trib. near Box Farm	SO 1315 5299	52	58
24	Edw near Crossway	SO 1240 5330		40
25	Edw d/s cf Camnant	SO 1170 5385		26
26	Edw u/s cf Camnant	SO 1165 5395		33
27	Edw @ Hundred House	SO 1145 5460		49
28	Edw u/s Llaneon trib.	SO 1195 5520		43
29	Edw d/s small trib	SO 1170 5550		93
30	Edw u/s small trib.	SO 1170 5555		71
31	Edw @ Franks Bridge	SO 1165 5590		86
32	Edw trib near Glanoer	SO 1170 5725	66	80
33	Edw u/s bridge	SO 1251 5780	76	85
34	Nant-yr-Offeiriad u/s Wye	SO 0970 4310	70	95
35	Trib. @ Crickadarn	SO 0855 4230	90	80
36	Erw-hir trib. u/s Nant- yr-Offeiriad	SO 0750 4330	93	84
37	Nant-yr-Offeiriad d/s Erw-hir trib.	SO 0775 4325		91
38	Trib. @ Cwm Crickadarn	SO 0680 4270	111	79
39	Trib @ Cilian-uchaf	SO 0610 4240	97	73
40	Nant-yr-Offeiriad u/s Cilian-uchaf trib.	SO 0620 4250	73	88

3.4.2 Usk catchment

3.4.2.1 Stream Chemistry

Two sites were sampled as part of the main monitoring programme, between the 20 May and the 6 November 1997.

Both the Cilienni and Senni failed their annual average (AA) EQS and maximum allowable concentration (MAC) EQS for the SP, cypermethrin.

The Cilienni also recorded four positive results for diazinon, spread through June, July, August and October. Two positive results for propetamphos were recorded, once in August and again in October.

The Senni also recorded four positive results for diazinon but these were concentrated in June/July and once in August. The four detections of propetamphos were spread through July, August and October.

Table 3.21 Summary water quality results from the Usk Catchment

SITE			AA ng/l	Max ng/l	No sample	No positive	Date first sample	Date last sample
Name	SPN	Det						
River Cilienni	40885	Diazinon	5	35	13	4	20/5/97	6/11/97
		Propetamphos	8.5	83	13	2	20/5/97	6/11/97
		Chlorfenvinphos	0	0	13	0	20/5/97	6/11/97
		Cypermethrin	2.6	34	13	1	20/5/97	6/11/97
		Flumethrin	0	0	13	0	20/5/97	6/11/97
River Senni	40879	Diazinon	5.6	41	13	4	20/5/97	6/11/97
		Propetamphos	7.7	55	13	4	20/5/97	6/11/97
		Chlorfenvinphos	0	0	13	0	20/5/97	6/11/97
		Cypermethrin	33	43	13	1	20/5/97	6/11/97
		Flumethrin	0	0	13	0	20/5/97	6/11/97

3.4.2.2 Stream Biology

Senni sub-catchment

Six sites were sampled in the Senni catchment in the summer and thirteen in the autumn (Fig 3.10).

Biological quality in the bottom half of the catchment did not appear to be affected in either season. More sites were sampled on the main river in autumn, leading to the discovery of a length of river with an impoverished fauna. This was first detected at Heol Senni (Site 45) where the BMWP score of 25 was much lower than expected. Approximately one and a half kilometres further upstream (Site 46), just below the confluence with the Nant Cwm-du, the score was 30. Habitat conditions were good, though it is possible that cattle may enter this part of the river from a cattle drink just upstream and may therefore be affecting the quality. The Nant Cwm-du (Site 47) which joins the Senni just upstream, was of good biological quality containing numerous pollution sensitive families.

Between the Nant Cwm-du and site 49, the Senni consisted mainly of pools and deep runs. Only site 48 had a suitable habitat for sampling but this was a cattle ford and scored only 36. Opposite site 49 a small tributary entered the Senni on the left hand bank which passed through a marshy area containing ferruginous deposits and fungal growths. The site was not really comparable with others on the survey due to it being a slow run with a silty substrate. Only tipulids were present. The score of 74 at site 49 indicated that the quality here was good, however, the tributary had not wholly mixed with the Senni so no conclusions can be drawn as to whether or not the tributary was having an effect on the Senni.

Upstream of this the four sites on the Senni and one on the Nant Ystwyth were of good biological quality. A small percentage cover of the sewage fungus *Leptomitus lacteus* was present at the uppermost site on the Senni. A survey carried out in 1992 at this site recorded a high coverage of *Leptomitus lacteus*, the cause of which was never discovered.

Despite the lack of more suitable sampling sites with no access for cattle, it is clear that some sort of incident had occurred on the Senni, as indicated by the quality at Heol Senni, which was unaffected by cattle. No obvious reason for the decline in quality could be detected.

Cilieni sub-catchment

Seven sites were sampled on the Cilieni catchment in July and nine in October (Fig 3.10).

With the exception of sites 56, 57 and 58, the scores at all sites indicated good biological quality and there was no evidence of impact from sheep dip pesticides. The three tributaries on which sites 56, 57 and 58 were situated, all scored higher in autumn than summer. Low flows were originally suspected as having caused the low scores in summer, but judging by the large increase in scores between the summer and autumn, it is possible that another factor was involved. Pollution sensitive taxa were absent from these sites in summer, but present in autumn, so it is possible that sheep dip pesticides may have been present in the tributaries in the summer.

SHEEP DIP SURVEY

Fig 3.10 - Senni & Cilieni Catchments

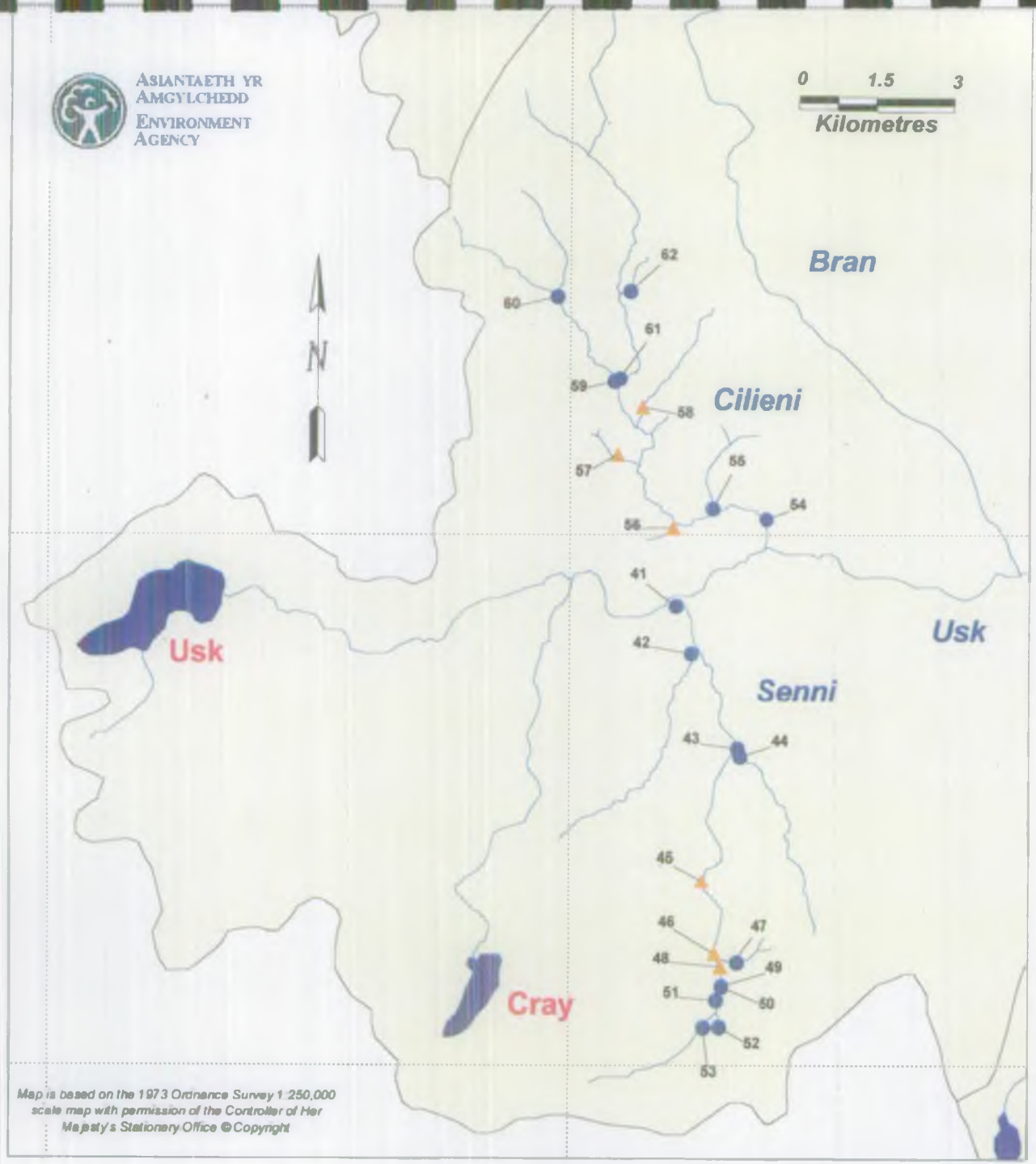


Table showing BMWP scores for 1997 Survey

Site	Description	NGR	Summer	Autumn
41	Senni @ Sennybridge	SN 9206 2865	74	95
42	Nant Robert u/s Senni	SN 9236 2775	73	97
43	Senni u/s Aberseinni uchaf	SN 9325 2695		68
44	Trib @ Pont ar Frynych	SN 9330 2580	55	80
45	Senni @ Heol Senni	SN 9265 2345		28
46	Senni d/s Cwm-du	SN 9280 2207		30
47	Nant Cwm-du @ Pont Cwm-du	SN 9325 2190	76	70
48	Senni u/s Nant Cwm-du	SN 9275 2190		36
49	Senni d/s Garnhwyd trib	SN 9295 2146		74
50	Senni u/s Garnhwyd trib	SN 9295 2145		87
51	Senni @ Tyleglas	SN 9285 2120		104
52	Nant Ystwyth u/s Senni	SN 9290 2090	104	106
53	Senni near Tyle-garw	SN 9260 2070	80	85
54	Cilieni @ confl Usk	SN 9380 3030	60	66
55	Cwm Dan trib. u/s Cilieni	SN 9275 3060	62	67
56	Trib. @ Pantre'r-felin	SN 9210 3025	19	51
57	Cwm Pyllan trib.	SN 9090 3150	20	75
58	Cwmllech trib	SN 9130 3240	43	90
59	Nant Eithnm u/s Cilieni	SN 9085 3280	87	53
60	Nant Eithnm @ Llandeilo'r-Fan	SN 8975 3450		128
61	Cilieni u/s cf Eithnm	SN 9095 3295		62
62	Cwm Nant-yr-hen trib	SN 9115 3460	88	96

Key to Symbols

? *Sheep dip suspected but not determined*

● *Unpolluted*

▲ *Pollution - cause not determined*

◆ *Moderately affected by sheep dip pesticides*

■ *Severely affected by sheep dip pesticides*

▽ *Pollution - other than sheep dip*

3.4.2.3 Farm visit programme

Due to conflicting priorities in SE area, resource commitments did not allow for farm visits to be undertaken as part of the monitoring programme.

3.4.3 Additional catchments

An additional six catchments were sampled on 2-3 occasions between September and October. The OP pesticide, propetamphos, was detected in the Afon Marteg. The SP pesticide, cypermethrin, was detected in the Nant Bran at a level exceeding the MAC EQS (Table 3.22).

Table 3.22. Results from additional catchments. Blank record represents no detectable presence of the sheep dip chemical.

River	Sampling Date	Diazinon ng/l	Propetamphos ng/l	Cypermethrin ng/l	Flumethrin ng/l
River Bidno	30/9/97 9/10/97 30/10/97				
Nant y Dernol	30/9/97 9/10/97 30/10/97				
Llanwrthwl Dulas	30/9/97 9/10/97 30/10/97				
Afon Marteg	30/9/97 9/10/97 30/10/97	11			
Nant Bran	10/10/97 6/11/97			29	
Afon Yscir	10/10/97 6/11/97				

3.5 A WELSH SYNOPSIS

3.5.1 Stream chemistry and quality

3.5.1.1 Temporal nature of contamination

A monthly assessment of the proportion of samples that were positive for each sheep dip pesticide demonstrated clear temporal patterns (Fig 3.11). This was particularly the case for the most frequently detected pesticide, diazinon, which demonstrated a peak in July and again in October. This is in accordance with the expected pattern from the usage of sheep dips by farmers (see Table 2.1 page 4). Diazinon in particular, was detected frequently right up until the end of the monitoring period. There was some evidence from the farm visits that farmers were delaying the autumn dip in 1997 due to weather conditions. It is highly likely therefore that contamination would have continued later into November and possibly into December/January.

3.5.1.2 Spatial nature of contamination

An examination of the proportion of sites where each sheep dip pesticide was detected (Fig 3.12), demonstrated differences amongst the pesticides and four geographical areas involved.

Diazinon was detected at 95% of sites across Wales and no marked difference could be determined between the Areas (83-100%; Fig 3.12).

Propetamphos was detected at 64% of sites across Wales (Fig 3.12). SW Area recorded propetamphos at only 20% of sites and were therefore lower than the North (54%), SE (67%) and upper Severn (80%).

Chlorfenvinphos is no longer licenced as an active ingredient in sheep dip formulations but farmers may still store some limited supplies. This determinand was only analysed for in the Welsh region and therefore there are no results for upper Severn. Overall, chlorfenvinphos was detected at 5% of sites. Only SW (10% sites) and SE (17% sites) detected this pesticide.

Cypermethrin was detected at 23% of the sites across Wales (Fig 3.12). The 30% recorded in upper Severn is higher than the overall average, probably due to the lower limit of detection used in that area (LOD =0.1 ng/l). Many of the results from the upper Severn sites recorded concentrations in the range 0.1-0.6 ng/l, and it is therefore likely that the Welsh region, with a LOD of 25 ng/l, under represented the presence of cypermethrin in its samples.

Overall, flumethrin was detected at 23% of sites (Fig 3.12). However, all of these were in the upper Severn Area (detected at 90% sites) and this was again attributable to the lower LOD used in upper Severn area. It is therefore likely that the Welsh Region sampling under represented the true level of contamination from flumethrin.

FIGURE 3.11 - SAMPLES RECORDED POSITIVE FOR SHEEP DIP PESTICIDES

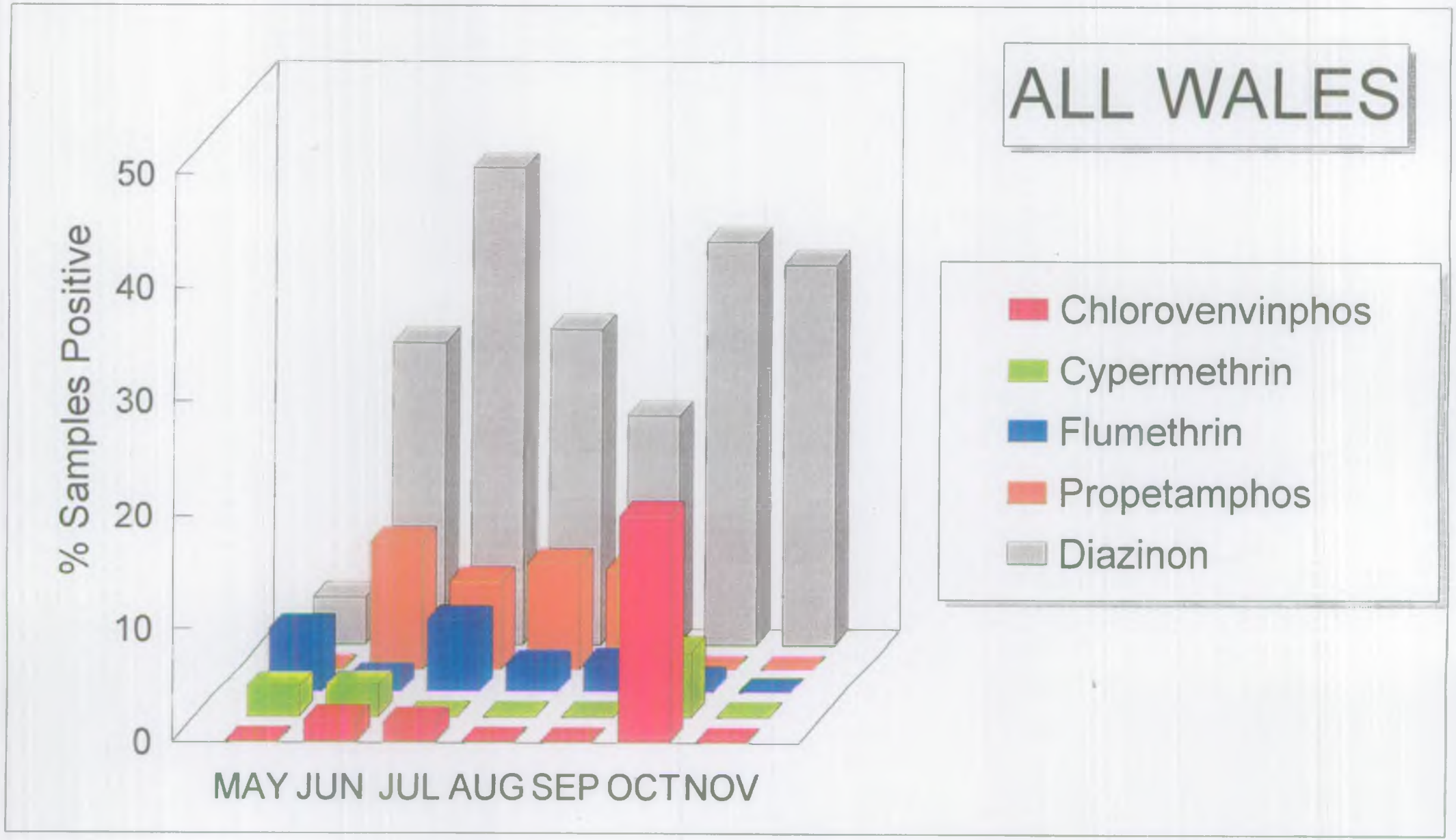
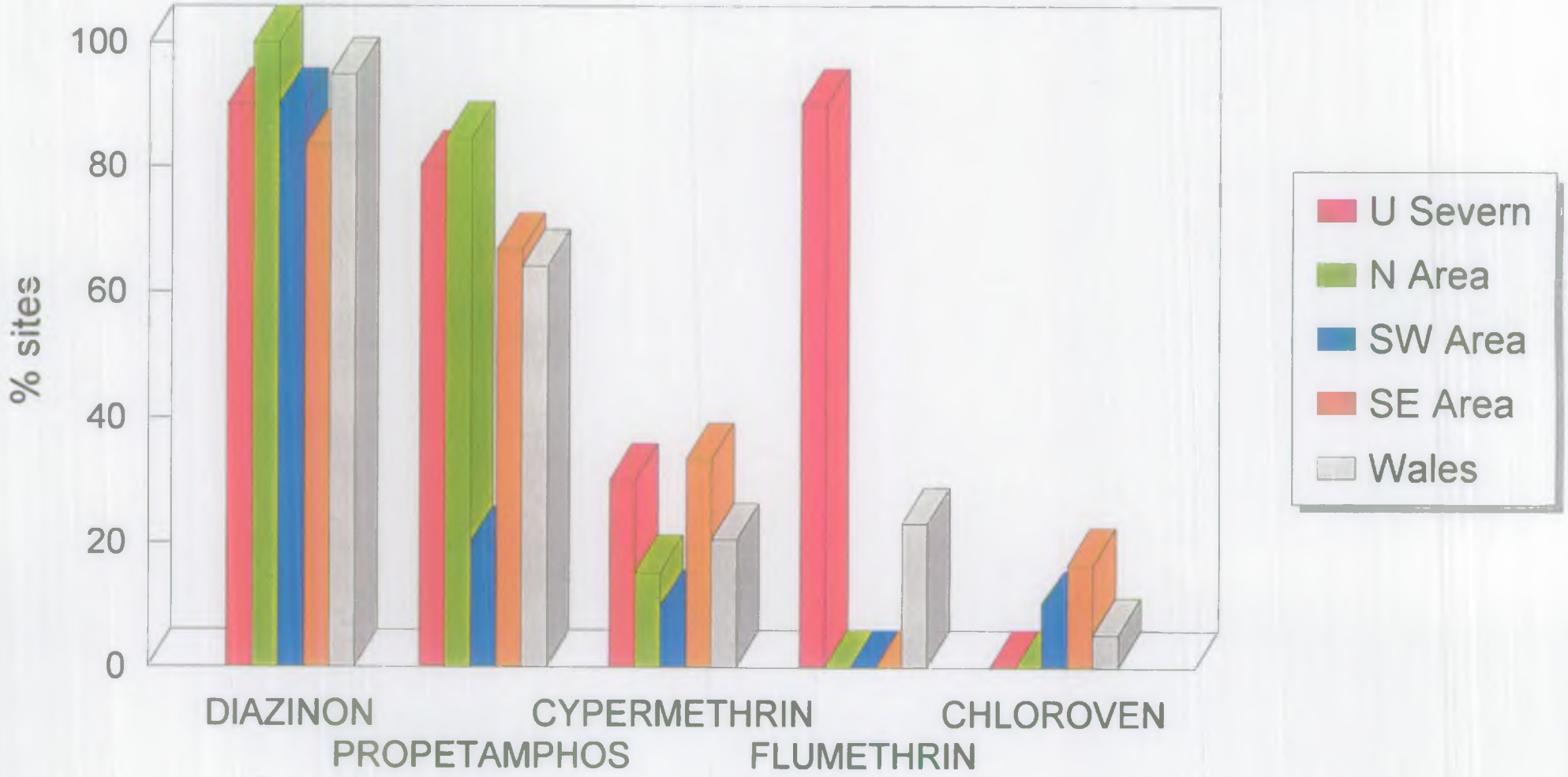


Fig. 3.12 Detections of sheep dip chemicals



The sampling undertaken in the additional catchments demonstrated the presence of one or more of the sheep dip pesticides at 14 of the 27 sampling sites. This is despite only 1-3 samples being taken from these sites and many of the samples being taken during elevated river flows in November. This additional network of sampling points consolidates the argument that contamination of water courses by sheep dip chemicals was widespread in 1997.

The results of monitoring Newtown and Welshpool STW effluents demonstrated that these were also sources of introducing sheep dip chemicals to watercourses. Effluents from a sheep market in Welshpool and a fellmongery in Newtown are discharged as trade effluents to the public sewer under discharge consents with the water company, Severn Trent Water.

3.5.1.3 Assessment against EQS and MAC limits

Nineteen of the monitored sites (49%) failed the maximum allowable concentration (MAC) EQS for one or more of the sheep dip pesticides. 12 (31%) of the sites failed the MAC EQS for one or more of the organophosphate pesticides and 8 (21%) sites failed the draft MAC EQS for cypermethrin. Again. no assessment was made against flumethrin results.

Diazinon was again the OP pesticide which caused the most frequent MAC failures, with 28% of sites failing for this chemical (Fig. 3.13).

Of the 39 water quality monitoring sites, 22 (56%) failed the Annual Average (AA) Environmental Quality Standard (EQS) for one or more of the sheep dip pesticides. 16 (41%) of the sites failed the AA EQS for one or more of the organophosphate (OP) pesticides and 9 (23%) sites failed the draft EQS for cypermethrin (SP). No assessment was undertaken against flumethrin (SP) results since there is no current agreed AA EQS for this pesticide. There was some variation across Wales in AA EQS compliance with a considerably lower percentage of sites failing the standards in SE and SW Area (Fig 3.14).

Diazinon was the OP pesticide which caused the most frequent AA EQS failures, with 33% of sites failing for this chemical (Fig 3.14).

3.5.2 Stream biology

The distribution of biological sampling sites enabled 679 km of streams to be surveyed in the monitored catchments (Table 3.23). The proportion of stream length impacted within each catchment varied but overall, 33.8 km (5 %) of stream length was known or suspected to be impacted by sheep dip. The invertebrate fauna in a further 6.5 km of streams was deemed impacted but the cause could not be determined. The invertebrate fauna was impacted in 1.5 km of streams by organic pollution.

Upper Severn Area recorded the highest proportion of stream length impacted by sheep dip (9%) followed by SE (6%), North (4%) and SW (2%).

Table 3.23 Summary of biological surveys undertaken in 1997

Area	km surveyed	km impacted by sheep dip	% stream length surveyed	km impacted but cause not determined	km impacted, cause other than sheep dip
Upper Severn	161.0	14.5	9%	3.4	3.0
North	254.3	10.0	4%	0.5	0.1
South West	144.0	2.3	2%	0	0
South East	120.5	7.0	6%	6.5	0
Total	679.8	33.8	5%	10.4	3.1

3.5.3 Farm visit programme

A total of 117 farms were visited in the monitored catchments.

3.5.3.1 Type of treatment

A total of 117 farms were visited in the catchments surveyed. Upper Severn Area, Northern Area and South West Area accounted for 46, 28 and 43 of these visits, respectively. South East Area were unable to resource site visits due to conflicting priorities.

The frequency of use of OP compounds was relatively similar in each Area, with an overall frequency for of 55% (Table 3.24). The use of SP dips was remarkably similar in Upper Severn and Northern Area (25-26%) but markedly lower in South West Area (7%). Farmers in SW area and Northern Area indicated that the frequency of use had changed between 1996 and 1997. Many farmers stated that they used SP dips in 1996 but changed back to OP dips for 1997. Purchase of usage data for 1997 from MAFF would allow an objective assessment of any change in usage patterns. This change was because of a perceived lack of efficacy with the SP dips, particularly in providing lasting protection. In Northern area, this may be due to the inherent geography of many of the northern farms being at higher altitude (many >500 m AOD) and with increased bracken cover. Farmers viewed this as harbouring ticks and increasing infestation. In SW area it may be a facet of the large size of flocks, which tend to dipped by mobile contractors.

Those farmers using both SP & OP dips were usually using the SP in the earlier part of the dipping season, and the OP later on to try to maximise protection through to the lambing period.

Fig. 3.13 Sites failing maximum allowable concentration (MAC) EQS limits

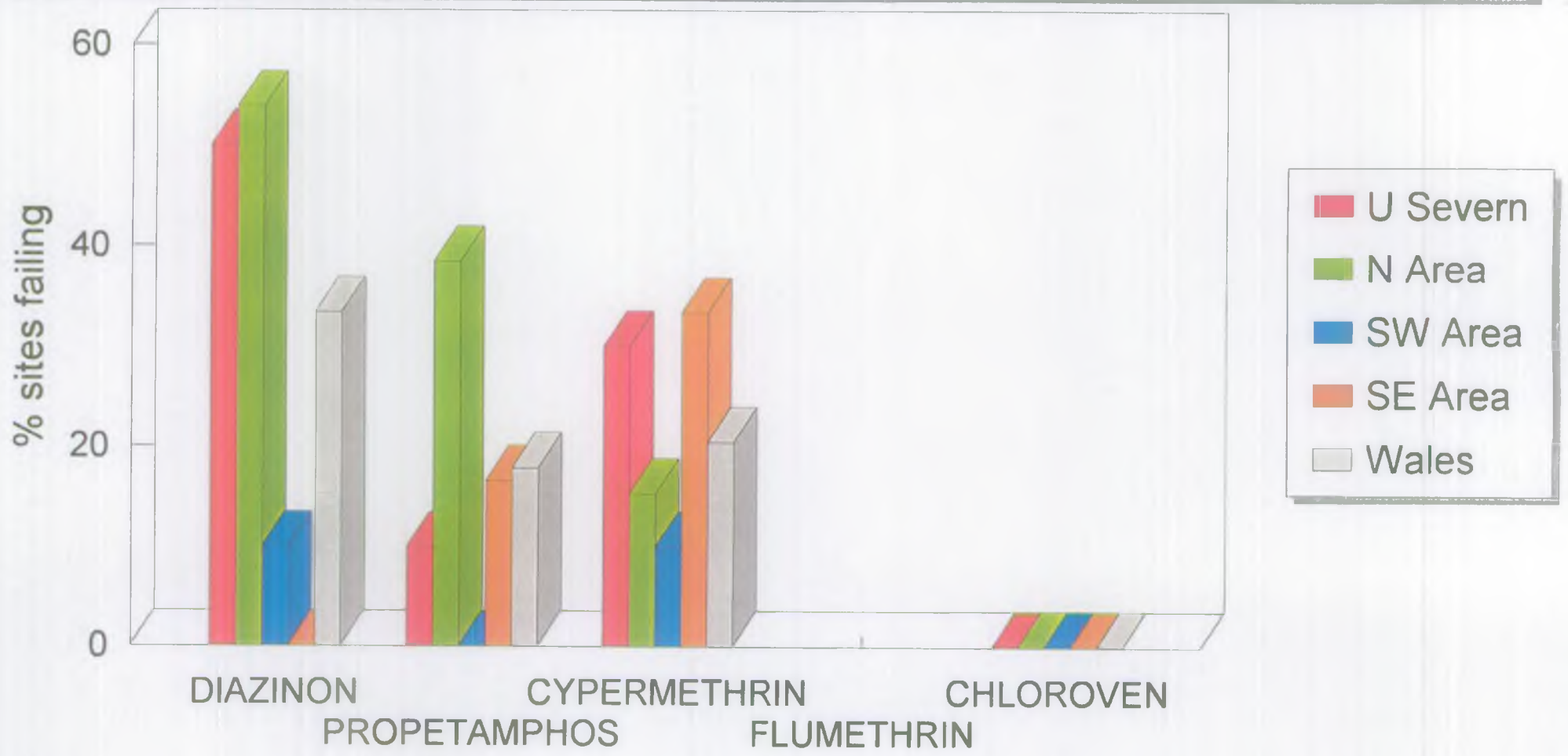


Fig. 3.14 Sites failing annual average EQS limits

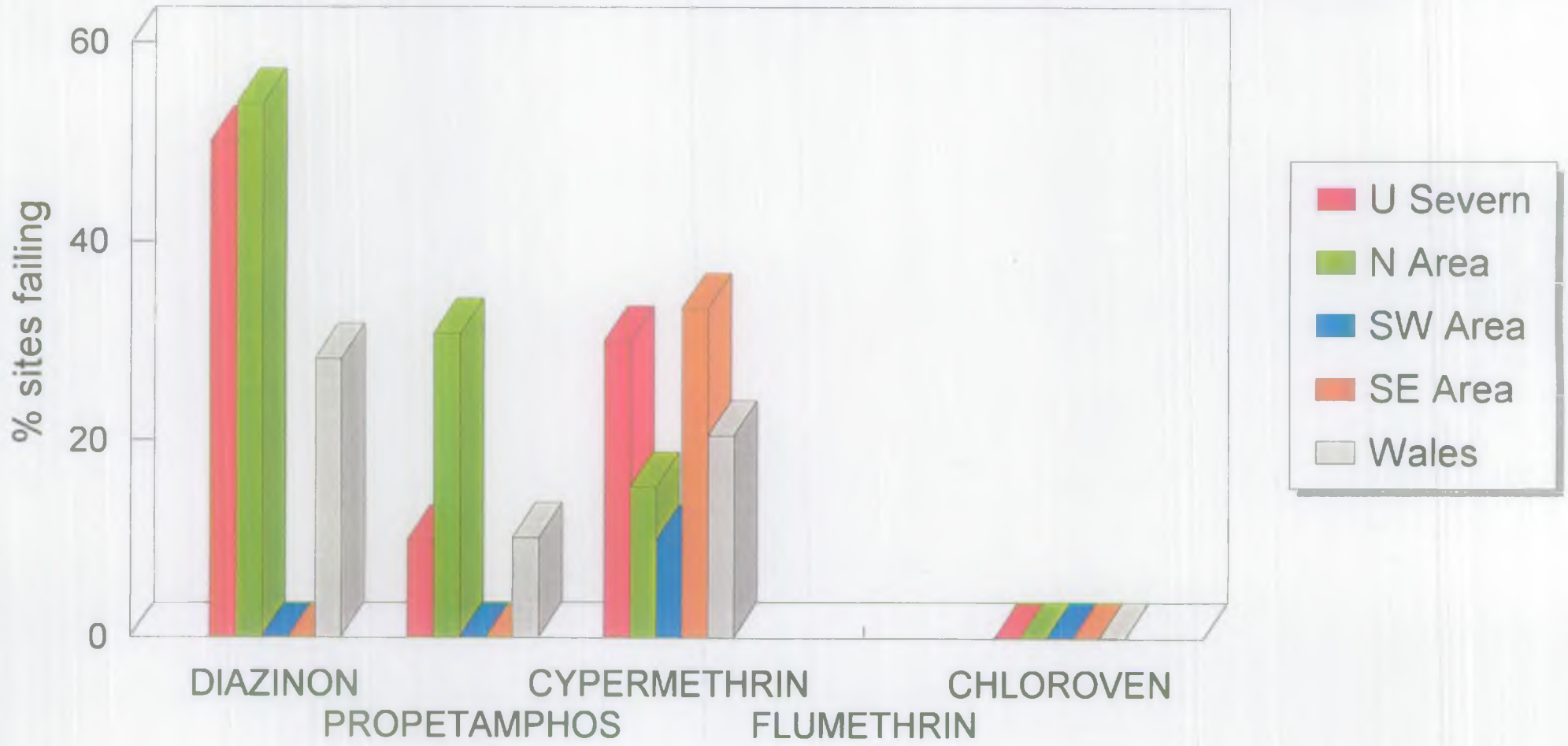


Table 3.24 **A summary of the use (% frequency), determined by farm visits, of different sheep dipping chemicals across Wales in 1997.**

Type of Treatment	Northern Area (%)	South West Area (%)	Upper Severn Area (%)	Wales Average (%)
O/P	50	61	55	55
S/P	25	7	26	19
S/P & O/P	7	0	2	3
Injection	3	13	0	5
Pour On	14	2	12	9
Didn't Know	0	10	4	5
Unknown	0	6	0	2

There was some variation between the frequency of use of non-plunge-dipping treatment methods across the Areas, with SW area recording particularly high usage of injections (Table 3.24). The reason for the difference in use of pour-on and injection methods between areas was not clearly established. Operator safety may be of particular relevance in that there is reduced exposure with non-plunge-dipping methods to dipping chemicals.

3.5.3.2 Structures

The location of sheep dipping structures was a major area of concern, many were located within 10 m of a watercourse. Most of the permanent dipping structures were in a reasonable state of repair but many of the older structures (>10 years) either had a direct discharge to the watercourse or discharged to a soakaway. There was evidence of an increasing tendency towards using mobile dipping facilities and contractors.

The dipping practice undertaken by farmers also caused concern in a number of cases. The main problems were with spillages occurring during dipping and the access of freshly dipped sheep to a watercourse.

3.5.3.3 Storage

The storage and security of sheep dip containers caused concern in some cases. Containers were sometimes left near the vicinity of the dipping structure and not locked away securely. A number of farmers, however, stated that they did not store containers but purchased supplies as necessary.

3.5.3.4 Disposal of used dip

A soakaway was the disposal route used by 25% of farmers, a method which is contrary to current advice. Most (70%) farmers disposed of their used dip by land spreading, although the dilution rates used were found to be variable. Of concern was the finding that 5% of the dipping structures had a direct discharge to a watercourse.

3.5.3.5 Overall risk assessment

Overall, 26% of the farms visited were found to be at a high risk of polluting a watercourse (Table 3.25).

Table 3.25 Risk assessment of 117 farm visited in Wales in 1997.

Area	Farms visited	Number high risk	% high risk	Number medium risk	% medium risk	Number low risk	% low risk
SW	43	7	16%	14	33%	22	51%
N	28	10	36%	10	35%	8	30%
U. Severn	46	12	26%	12	26%	22	48%
Overall	117	29	26%	36	30%	52	44%

Northern area had the highest recorded proportion of high risk sites (36%) and SW area the lowest (16%).

4.0 POLLUTION INCIDENTS 1997

4.1 UPPER SEVERN AREA

Ten substantiated pollution incidents were recorded in upper Severn area in 1997.

Incident number 2501958
EPO John Bateman
Date detected 22 July 1997
Location Afon Gwestyn, a tributary of the Afon Clywedog. SN 894 864
Initial reason for investigation Problem found by Agency biologist whilst undertaking a study into the impact of metal mines in the area.
Nature of impact A dramatic decline in the invertebrate life of the watercourse until its confluence with the Afon Clywedog
Category 2
River distance affected 4 km
Recovery Not yet assessed
Pollution source It appears that several farmers use the dip bath which was the source of this problem, using both organophosphate and synthetic pyrethroid dips. The bath was sited immediately adjacent to the watercourse, some dip may have entered the water from a bung hole in the side of the bath. After dipping the sheep were held on a lane which also drained to the stream. Legal action possible.

Incident number 2501985
PCO John Bateman
Date detected 6 August 1997
Location Mochdre Brook, tributary of River Severn, near Newtown. SO 087 855
Initial reason for investigation 1997 sheep dip survey
Nature of impact Poor quality of invertebrate life in watercourse. Shrimps absent
Category 2
River distance affected At least 4.8 km
Recovery The upper section of the brook was recovering by October 1997 but the lower section had been severely affected by a further sheep dip incident.
Pollution source This was traced to a farm on the eastern half of the catchment. A diazinon dip had been used. This had been allowed to drain from the bath into a marshy area of ground and in to the brook. Legal action possible.

Incident number 2502585
EPO John Fraser
Date detected 23 October 1997
Location Mochdre Brook, tributary of River Severn, Newtown. SO 048 837
Initial reason for investigation Sheep dip survey and investigations into recovery after previous sheep dip pollution incident.
Nature of impact Virtually all invertebrate life was wiped out in the top sections of the brook. The lower few miles were also severely impacted
Category 2
River distance affected 8 km
Recovery None yet
Pollution source This was traced to a dip bath situated away from any farm buildings. it is used by at least five different farmers. High cis cypermethrin was detected in a land drain near to the bath.

Incident number 2502417
EPO Karen Pearce
Date detected 14 July 1997
Location River Clun, Clun, South Shropshire. SO 208 837
Initial reason for investigation Routine annual GQA biology survey
Nature of impact Severely depleted invertebrate life and dead crayfish.
Category 2
River distance affected At least 16 km
Recovery Not assessed yet
Pollution source A dip bath very close to the river. This was found to be full of holes and had overflowed during dipping. A high cis cypermethrin dip had been used. Legal action possible.

Incident number 2502416
EPO Karen Pearce
Date detected 20 March 1997 (although samples preserved since survey in December 1996)
Location River Redlake, a tributary of the River Teme, South Shropshire. SO 314 765
Initial reason for investigation Routine annual biology GQA survey
Nature of impact Moderate decline in invertebrate score of watercourse.
Category 2
River distance affected 6.4 km
Recovery Good invertebrate scores on this stretch by October 1997
Pollution source A dip bath on the bankside had overflowed into the river. A diazinon dip had been used in December 1996.

Incident number 2502586
EPO John Bateman
Date detected 8 October 1997
Location Llwydiarth Brook, tributary of the River Vyrnwy. SJ 042 150
Initial reason for investigation Sheep dip survey.
Nature of impact Local decline in abundance of invertebrate life
Category 3
River distance affected 0.8 km
Recovery Not yet
Pollution source A dip bath situated in cattle buildings approximately one mile from the watercourse. A bung is placed in the bath during dipping but is removed during the rest of the year. Water flushes through the bath and associated drains after heavy rainfall. High cis cypermethrin detected in culvert the below the farm.

Incident number 2502520
EPO Paul Hayward
Date detected Early November 1997
Location Afon Eirth, tributary of the Afon Tanat, Llangynog
Initial reason for investigation Sheep dip survey
Nature of impact Moderate decline in invertebrate life in watercourse
Category 3
River distance affected 3.2 km
Recovery Unsure if invertebrate life is recovering from a problem last year, or has been moderately affected this year.
Pollution source It appears that the sheep walked through the Eirth after dipping. High cis cypermethrin was used.

Incident number 2502291
EPO Michelle Bannister
Date detected Early August 1997
Location Afon Trannon, a tributary of the River Severn. SN 955 905
Initial reason for investigation Complaint by member of the public of loss of fish and foaming.
Nature of impact Very little sensitive life downstream.
Category 2
River distance affected 6.4 km
Recovery Unable to re-assess due to further sheep dip pollution incident further upstream.
Pollution source Traced to a farm at the head of the catchment. The dip bath had been filled over night and found to be leaking. Approximately half a bath of Young's Robust (cypermethrin) had been lost. The leak had come from a sealed pipe at the bottom of the bath. The chemical entered the watercourse via a soakaway and land drain.

Incident number 2500127
EPO Michelle Bannister
Date detected Early August
Location Afon Trannon, a tributary of the River Severn. SN 940 905
Initial reason for investigation Follow up of complaint that no fish were present and foaming in the Afon Trannon at Trefeglwys.
Nature of impact Minor invertebrate kill.
Category 3
River distance affected Very localised, less than 0.8 km
Recovery Not reassessed but no affect on Afon Trannon
Pollution source Dip bath at farm overflowed to surface water drain, into soakaway and land drain. The farmer had used a cypermethrin dip.

Incident number 2502245
EPO Michelle Bannister
Date detected October 1997
Location Afon Trannon, a tributary of the River Severn. SN 910 902
Initial reason for investigation Follow up sampling after incident 2502291
Nature of impact Complete invertebrate wipe out.
Category 2
River distance affected 9.6 km
Recovery Not reassessed
Pollution source Unclear. Dipping occurred in wet weather, bath may have overflowed or leaked from a bunged drain hole. Cypermethrin used. Legal action possible.

4.2 NORTHERN AREA

One substantiated pollution incident was recorded in the Northern Area in 1997.

Incident number
EPO David Lee
Date detected April 1997
Location Afon Twrch, tributary of the River Dee.
Initial reason for investigation Biological sampling as part of the Llyn Tegid project.
Nature of impact Complete invertebrate wipe out.
Category 2
River distance affected 8 km
Recovery Not reassessed
Pollution source . Farmer replaced old dipping bath and contents of old bath discharged to a small stream.

4.3 SOUTH WEST AREA

One substantiated pollution incident was recorded in the SW Area in 1997.

Incident number 34149
EPO Hannah Wilkinson
Date detected 20 November 1997
Location Nant Maesadda, tributary of the River Sawdde.
Initial reason for investigation The 1997 Welsh Monitoring programme.
Nature of impact Severe depletion of fauna.
Category 2
River distance affected 2.3 km (0.7 km Nant Maesadda and 1.6 km River Clydach).
Recovery Not reassessed.
Pollution source . Cypermethrin sheep dip discharged to the watercourse via a soakaway.

4.4 SOUTH EAST AREA

No substantiated pollution incidents were recorded in 1997, but the impact of the following pollution incident , which occurred in October 1996 was reassessed as part of this study.

Incident number
EPO
Date detected October 1996
Location River Sgithwen, tributary of the River Wye at Erwood.
Initial reason for investigation Notification of dead and dying crayfish from a member of the public.
Nature of impact Complete invertebrate and crayfish wipe out.
Category 2
River distance affected 5 km
Recovery Sampling undertaken in October 1997, one year following the incident, demonstrated almost a full recovery in invertebrate populations but crayfish were still absent.
Pollution source . Cypermethrin sheep dip discharged to a soakaway and then via a ditch into the Sgithwen.

4.5 Summary statistics for sheep dip pollution incidents

Permanent sheep dip structures were the main source of problems, with 12 of the 13 pollution incidents arising from such structures (Table 4.1). Cypermethrin (SP) was the most common pesticide responsible for impacting upon fauna, with 10 of the 12 cases, where the pesticide was determined, being attributable to it.

Table 4.1 **A summary of statistics from pollution incidents in Wales .**

Category		Total	Percentage
Method of detection	Public complaint	4	31%
	1997 Monitoring programme	5	38%
	Routine biological sampling	4	31%
Type of dipper	Permanent	12	92%
	Mobile	0	0%
	Unknown	1	8%
Sheep dip Chemical	Synthetic pyrethroid	10	92%
	Organophosphate	2	15%
	unknown	1	8%
Cause	Structural failure	0	0%
	Overflow following dipping	3	23%
	Splashing during dipping	1	8%
	Direct discharge to a watercourse	1	8%
	Soakaway	5	38%
	Run-off from sheep holding area	1	8%
	Sheep entering a watercourse	1	8%
	Run-off following landspreading	0	0%
	Unknown	1	8%
Length of river affected	>1 km	2	15%
	1-1.99 km	0	0%
	2-4.99 km	4	30%
	5-9.99 km	6	47%
	10-19.99 km	1	8%
	>20 km	0	0%

5.0 CONCLUSIONS

Stream chemistry

The contamination of watercourses by sheep dip chemicals was found to be widespread throughout the sheep rearing areas of Wales. The temporal pattern of detection was in accordance with that expected from known peak dipping periods. Organophosphate concentrations were typically in the range 5-20 ng/l, and current limits of detection are therefore adequate. The concentration of synthetic pyrethroid based pesticides recorded in Upper Severn area was typically 0.1-1.0 ng/l, and therefore a limit of detection of at least 0.1 ng/l is required to adequately monitor for these chemicals.

Only two sediment samples proved positive for any sheep dip chemical. The current limit of detection for sediment SP samples (>10 ug/kg) is therefore inadequate to be used as a routine monitoring tool to detect contamination. This method of sampling should, however, be continued as part of pollution incident investigations where concentrations are markedly higher (400-4000 ug/kg).

Nineteen of the monitored sites (49%) failed the maximum allowable concentration (MAC) EQS for one or more of the sheep dip pesticides. 12 (31%) of the sites failed the MAC EQS for one or more of the organophosphate pesticides and 8 (21%) sites failed the MAC EQS for cypermethrin (SP).

Diazinon was again the OP pesticide which caused the most frequent MAC EQS failures.

Of the 39 water quality monitoring sites, 24 (62%) failed the AA EQS for one or more of the sheep dip pesticides. 16 (41%) of the sites failed the AA EQS for one or more of the organophosphate (OP) pesticides and 14 (36%) sites failed the draft AA EQS for cypermethrin (SP). There was, however, some variation across Wales with a lower percentage of sites failing EQS in SE and SW Area.

Diazinon was the OP pesticide which caused the most frequent AA EQS failures, with 33% of sites failing for this chemical.

Stream biology

The distribution of biological sampling sites enabled 679 km of streams to be surveyed in the monitored catchments. Some 33.8 km of streams within these monitored catchments were found to be impacted by sheep dip. In addition, biology in a further 75.3 km of streams outside the monitored catchments is known or suspected to have been impacted due to recorded pollution incidents. In total, therefore, there is some 109.5 km of stream length in Wales where biology is known to have been impacted by sheep dip. Given that the catchments monitored in 1997 covered 4.9% of the high/very high risk areas across Wales, it is possible that some 700 km of stream length may have been impacted in 1997.

The method of sampling and interpreting biological scores in 1997 only allowed sites with marked reductions in biological fauna to be categorised as impacted. It is likely that other sites with intermediatory biological fauna may have been impacted to a lesser degree. This may partly explain the discrepancy in some catchments where no biological impact could be determined despite sheep dip chemicals being detected.

Understanding of toxic concentrations of sheep dip chemicals to field base situations needs to be improved. Background water chemistry may be an influencing factor in modifying toxicity and this may also partly explain the discrepancy in some catchments where no biological impact could be determined despite sheep dip chemicals being detected.

Farm visits

Organophosphate based sheep dips were the most commonly used treatment method (55% of farms) with synthetic pyrethroid dips being used by 19% of farms. Many farmers indicated that they had used SP dips in 1996 but reverted back to OP dips in 1997 due to a perceived lack of efficacy with SP dips for treating sheep scab. It is likely therefore that had monitoring been undertaken in 1996, the results may have been worse in terms of the greater potential for impact from SP dips.

It was evident that as the year progressed the awareness of farmers to the potential problems with sheep dip chemicals improved. earlier in the season, 'safer to the operator' was being interpreted as 'safer to the environment' for SP based dips.

There was an indication in most areas that the use of mobile sheep dips and contractors was increasing. This is, however, heresay and would require a more objective assessment to confirm any such changes.

The location of sheep dipping structures was a major area of concern, many being located within 10 m of a watercourse. Most of the permanent dipping structures were in a reasonable state of repair but many of the older structures (>10 years) either had a direct discharge to the watercourse or discharged to a soakaway.

The dipping practice undertaken by farmers also caused concern in a number of cases. The main problems were with spillages occurring during dipping and the access of freshly dipped sheep to a watercourse.

A soakaway was the disposal route used by 25% of farmers, a method which is contrary to current advice. Most (70%) farmers disposed of their used dip by land spreading, although the dilution rates used were found to be variable. Of concern was the finding that 5% of the dipping structures had a direct discharge to a watercourse. There was little evidence of treatment of used dip being undertaken by farmers, despite the manufacturers promoting on-farm treatment from June 1997 onwards.

Overall, 26% of the farms visited were found to be at a high risk of polluting a watercourse.

Pollution Incidents

Thirteen pollution incidents were recorded across Wales. Static dipping structures were the main source of pollution incidents (92%) and the synthetic pyrethroid, cypermethrin, was the most common pesticide identified as causing the impact (77% of cases). The majority of pollution incidents were recorded from the Upper Severn Area. Whilst sheep farming is particularly intensive in this Area, the main reason why more pollution incidents were recorded is believed to be the greater level of routine biological sampling undertaken in this Area in 1997.

6.0 RECOMMENDATIONS

1. Resources should be committed to continuing the monitoring programme in 1998. This should primarily be targeted at biological investigations in high risk catchments and water chemistry sampling at appropriate locations in these catchments. The catchments where positive samples of sheep dip chemicals were recorded as part of the 'additional catchments' programme should be prioritised for inclusion in the 1998 full programme.

2. The rapid bankside assessment of biological fauna used in the 1997 survey should continue to be used in 1998 since it allows greater coverage of individual catchments. There is, however, a need to develop this method to allow greater confidence in interpreting sites with potentially impacted biological fauna.

3. The understanding of the influence of stream chemistry on toxicity needs to be improved, in particular the possible variations in toxicity of pesticides between poorly and highly buffered waters.

4. There is currently very limited information upon which to determine the impact of pollution incidents on fish populations. Fish are seldom killed as part of the pollution incident but possible effects such as starvation should be examined. This should be a priority at locations where pollution incidents occured in 1997 and any that may occur in 1998. In addition, knowledge of sub-lethal impacts to fish reproductive potential from exposure to sheep dip chemicals should be examined.

5. The sheep dip awareness campaign launched in 1997 should also be continued and expanded in 1998. This will require a Nationally consistent approach and continued working with the farming industry and other relevant organisations.

6. The Agency should deploy resources to undertake pollution prevention and enforcement visits to farms within the catchments where biology was identified as impacted in 1997.

7. Given the limited resources currently experienced by the Agency, the Region should seek additional resources through the corporate planning process.

8. Given the current concern within the Fisheries and Conservation functions, the deployment of fisheries staff to this issue should be considered.

9. There is currently considerable need to influence legislative change.

(a) The Agency should use the results of this monitoring programme as part of its response to the current DETR consultation on the Groundwater Regulations.

(b) The Agency should recommend that a statutory Code of Good Environmental Practice be introduced for sheep dipping.

(c) The Agency should seek to obtain details of the location of sheep dipping structures from the government.

(d) The Agency should consider pressing for Works Notice Powers, provision for which is made within the Water Resources Act (1991) and the Environment Act (1995).

ENVIRONMENT AGENCY
POLLUTION PREVENTION VISIT - SHEEP DIPPING OPERATIONS

ASIANTAETH YR AMGYLCHEDD
ENVIRONMENT AGENCY

11. Mobile Dips

Mobile Dip Used Yes ☐ No ☐ (If NO go to 12)

Dedicated Area? Yes ☐ No ☐

Permeable Base? Yes ☐ No ☐

Distance from watercourse? _____ m

Distance from surface water drains? _____ m

Could dip enter surface water drain system? Yes ☐ No ☐

Contractor Details

Name: _____

Address: _____

_____

Tel: _____

Pesticide Usage

Supplied by Contractor ☐

Type of dip O/P ☐ S/P ☐

Product Names(s) _____

_____

Risk status: High ☐ Medium ☐ Low ☐

Need to relocate to dedicated area? Yes ☐ No ☐

12. Access to Pasture

Direct from holding area Yes ☐ No ☐

Does access cross w/course Yes ☐ No ☐

Drinking water supply - from stream Yes ☐ No ☐

- from trough(s) Yes ☐ No ☐

Time held in pasture prior to release _____ hrs

13. Disposal of spent dip

Discharge to watercourse Yes ☐ No ☐

discharge to soakaway Yes ☐ No ☐

Diluted with water Yes ☐ No ☐

Diluted with slurry Yes ☐ No ☐

Drain to slurry lagoon Yes ☐ No ☐

Drain to tank Yes ☐ No ☐

Spread on land Yes ☐ No ☐

Area used for spreading _____ (Ha)

Land type (e.g. soil/ slope/ geology) _____

_____

_____

Proximity to w/course _____ metres

On-Farm disposal Yes ☐ No ☐

Off-Farm disposal Yes ☐ No ☐

Removed by waste contractor Yes ☐ No ☐

Removed by mobile dipping contractor Yes ☐ No ☐

Treatment prior to spreading Yes ☐ No ☐
(eg Addition of lime)

Please specify _____

_____

_____

_____

Risk status High ☐ Medium ☐ Low ☐

14. Disposal of unused dip

Returned to supplier Yes ☐ No ☐

Returned to manufacturer Yes ☐ No ☐

Stored for future use Yes ☐ No ☐

Dilute in bath & spread Yes ☐ No ☐

* onto/ * into land (delete as necessary)

Suitability of land Yes ☐ No ☐

Used by > 1 farmer Yes ☐ No ☐

Total No. sheep dipped _____

15. Comments and remedial works identified/ agreed with timescale for completion.

_____

_____

_____

_____

_____

_____

_____

16. Overall risk

High ☐ Medium ☐ Low ☐