


# WELSH SHEEP DIP MONITORING PROGRAMME

## 1998

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# EXECUTIVE SUMMARY

## Introduction

Sheep are prone to infestation by a number of ectoparasites which require control. Some infestations 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 in Wales. Two groups of pesticides are currently licensed for sheep dipping : organophosphates and synthetic pyrethroids.

In 1997, the Environment Agency Wales and Midland Region of the Environment Agency initiated a monitoring programme for the 1997 dipping season in response to increasing awareness of the problems associated with the use of synthetic pyrethroid dips. The results of this work were reported in the Agency report 'Welsh Sheep Dip Monitoring Programme 1997'. A key recommendation was that the monitoring programme should be continued in 1998 as a means of targeting pollution prevention activities. The monitoring programme for 1998 was set up with the following two main aims:

i. To establish whether the results of the 1997 survey were representative of a larger proportion of upland Wales
ii. To use chemical and biological monitoring to target pollution prevention activities in catchments believed to be at risk.

## Methods

Catchments from within the intensive sheep rearing areas of upland Wales were selected for inclusion in the monitoring programme. Results from the 1997 survey confirmed the peaking dipping periods were in June/July and September/October. The monitoring programme therefore extended from April until December.

A network of 107 water quality sampling points was identified. Monthly water column samples were collected from this sampling network and analysed for pesticides used as active ingredients in sheep dip formulations.

Biological surveys were undertaken in 65 of the sub-catchments in July/August and October/November. Due to high river levels and floods in October, some sampling was either delayed or could not be completed.

A programme of targeted pollution prevention farm visits was also carried out in selected catchments. This was complimented by talks to farmers groups, attendance at agricultural shows, press releases and articles, and the distribution of guidance notes.

Final effluent monitoring was carried out at twelve Sewage Treatment Works that were known to receive drainage effluents from sheep markets or fell mongers.

In response to concerns raised regarding the possibility of contamination of private drinking water supplies in upland areas, a project was set up to investigate this at 35 sites. This collaborative project was managed by the Welsh Office, and supported by the Drinking Water Inspectorate, three Local Authorities and the Environment Agency. This will be reported separately by the Welsh Office.

## Stream chemistry

Direct comparison of 1997 and 1998 data is not possible due to changes in detection levels, monitoring regimes and weather conditions. The results for synthetic pyrethroids (SPs) have been influenced by improved detection levels in 1998, as it was believed that the presence of SPs was under represented in Environment Agency Wales sites in 1997. Sampling frequencies were reduced in 1998 to enable more sites to be covered, and many of the sampling points were selected lower down the catchments, affording greater dilution. Due to a relatively wet spring, and a very wet autumn, river levels were generally higher, leading to dilution of pesticides.

The presence of sheep dip pesticides was found to be widespread, with 75 % of 107 river sites monitored giving positive (above detection level) results. Overall 52% of the 107 sites recorded positive results for the Organophosphate (OP) dip diazinon, and 34% for the OP dip propetamphos. Synthetic pyrethroid (SP) dips were also found at 33% of sites for cypermethrin and 6% for flumethrin. For 1997, the incidence of positive records for OPs was 95% for diazinon and 64% for propetamphos respectively, while that for SPs was 23% both for cypermethrin, and for flumethrin. No positive results were recorded for chlorfenvinphos at river sites suggesting that this sheep dip chemical, which is no longer authorised, was not being widely used.

The impact of weather on the timing of dipping was reflected in the monitoring results. Weather conditions may have influenced reduced dipping activity in June and July. However, dipping was then carried out right through the autumn, some as late as November and December due to the poor weather, in order to protect sheep through to lambing time. Few positive results were recorded in April, May and June, but the number increased in July and August, peaking in October, and continuing right through to December.

Thirty-one sites (29%) of the 107 monitored failed the Maximum Allowable Concentration (MAC) Environmental Quality Standards (EQS) for one or more sheep dip pesticides. Thirteen sites (12%) failed the MAC EQS for one or more of the OPs and twenty-one (20%) failed the EQS MAC for cypermethrin. In 1997, 49 % of 39 sites failed the MAC for one or more sheep dip pesticides, but the majority of these were due to OPs rather than SPs.

## Stream biology

Extensive biological surveys were carried out in 65 sub-catchments in upland areas, with a total of 1432 km covered between a network of 661 sites, more than double the length covered in the surveys in 1997. The results showed that atleast126.5km (9%) were known or suspected of being affected by sheep dip. In 1997, 679km were surveyed, and 5% was known or suspected of being impacted by sheep dip. In 1998 biological surveys were better targeted in catchments using chemical results from 1997 and 1998, which may account for some of the increase.

The 1998 survey represented approximately 10% of the high risk areas, and therefore the results suggest that up to 1200km of upland watercourses could potentially be affected by sheep dip.

In addition, a further 11% of river length surveyed in 1998 showed signs of biological impacts from other sources. Known causes included acidification, run off from abandoned metal mine sites, and organic pollution from silage and manure, in 2% of river lengths affected. At a number of sites, representing 9% of river length surveyed, the exact cause could not be determined due to high river flows preventing further investigation, or sites showing signs of recovery following an incident believed to have occurred some weeks or months before the survey.

Therefore, a significant conclusion of the 1998 survey is that 20% of the upland watercourses surveyed showed signs of impoverished biological fauna due to pollution. Of this 9% was suspected as being due to sheep dip pesticides, 2% other known causes, and an additional 9% which could not be confirmed to be due to any of these. Although high river flows may have masked the impacts in some cases due to difficulties in sampling, the results suggest that even in wet years, when dilution in watercourses is higher, sheep dip pesticides can still have a significant environmental impact.

As reported in 1997, the method of sampling and interpreting biological scores may under report the full extent of impact as it does not enable moderate impacts to be identified. The toxicological effects of sheep dip pesticides in the field under different conditions of water chemistry may also be a factor.

## Pollution prevention activities and farm visit programme

Seven hundred properties were visited as part of the 1998 pollution prevention campaign. Of these, 348 were occupied by sheep farmers using some form of treatment, such as dipping or injection, and were inspected accordingly. About half of the properties visited were found not to require a full inspection. This is nearly three times the number of farms inspected in 1997. Therefore any comparison of the results should be treated with caution. Farm visits could be targeted more effectively if better information was made available on the location of dips, or those farms known to stock sheep.

Organophosphate (OP) dips were used by 44% of farms inspected. Synthetic pyrethroid (SP) dips were used by just over a quarter of farms (28%). A new type of treatment method used by some farmers (6%) is the use of jetters or showers, which use a pumped system of spray jets to soak the sheep without immersing them fully in a dip bath. Injections and pour-ons were used at 9% of farms inspected.

Awareness amongst farmers on the risks of sheep dipping, and particularly the need for safe disposal was generally good. Fewer sites overall were found to be of high risk compared to 1997 (16 % cf 26%) and well over half (60%) were considered to be low risk. A proportion of farmers were found to dispose of used dip to land (nearly 80%), and 19% of farmers disposed of used dip to soakaway or direct discharge.

In some cases the need to dispose of pesticide containers properly, and the risks associated with allowing recently dipped sheep to have access to watercourses were not recognised. Also the greater toxicity of SP dips to aquatic life was not always known, due to the misconception that as it is safer for operators then it must be safer for the environment.

The use of jetters or showers, which use smaller volumes of chemicals, appears to be on the increase. The environmental risks of this activity, from the location of the equipment, management of sheep and disposal of spent dip are still high, and pollution prevention guidance specific to these methods of treatment is needed.

The campaign also targeted mobile dipping contractors, who were being employed more frequently by farmers. Although some contractors did discuss their operations when approached by the Agency, some operators were reluctant to do so, and greater efforts will be made to target these in future.

## Sewage Treatment Works monitoring

Positive results for sheep dip pesticides were recorded at eleven out of the twelve Sewage Treatment Works (STWs) monitored. Nine of the STWs had significant levels in the final effluent, on at least one sampling occasion, the highest being 3880 ng/l for diazinon and 244 ng/l cypermethrin. Downstream monitoring was not carried out, so it is not known what levels were present in the receiving water following dilution of the effluent. However, these results suggest that further monitoring should be carried out to assess the environmental significance of these results.

## Resurveys of 1997 impacted sites

Resurveys at sites which suffered sheep dip pollution in 1997 showed that in the majority of cases recovery of the invertebrate fauna was good. Where recovery had not occurred, this was attributed to further incidents of sheep dip pollution within the catchment, or possibly longer term impacts associated with disposal of used dip to inappropriate land or soakaway.

Only one survey included fisheries monitoring, and an assessment of salmonid distribution and growth rates was unable to detect any decreased productivity. Further fisheries investigations are recommended at those sites where biological recovery has not been complete.

## Pollution Incidents

Seventeen substantiated pollution incidents were recorded in 1998, sixteen of which were detected during biological surveys, and one was reported by a member of the public. Of these eleven were directly attributable to synthetic pyrethroid dips and dipping activities, one was due to organophosphate dip, and one was due to both types of dip. The exact cause of the sheep dip pollution in the remaining four cases could not be confirmed.

## Overview

Overall the results of the 1998 survey have confirmed that pollution by sheep dip pesticides is widespread in upland Wales. Usage as indicated by farmers suggests a downward trend in the use of OP dips, and an upward trend in the use of SP dips. Substantiated incidents confirmed to be due to sheep dip were all but one due to SP dips. As SP dips are around 100 times more toxic to aquatic life than OP dips, this may provide some explanation for the increase in the proportion of river length impacted as indicated by biological monitoring compared to 1997.

Pollution prevention visits suggest that although awareness of the risks associated with sheep dipping is increasing amongst farmers, practices have not changed sufficiently to allay concerns.

Sewage Treatment Works have been identified as potential point sources of sheep dip pesticides that also need to be minimised.

## Recommendations

1) Resources should continue to be committed to this issue in a targeted way. Those catchments identified as suffering from the impacts of sheep dip pesticides should be prioritised within the area Environment Protection teams for further biological investigations and pollution prevention visits. Water quality monitoring could also be used at selected sites, for six months from June to November to cover the peak dipping periods.

2) Background water quality monitoring for authorised sheep dip pesticides should be carried out at key sites as part of the regional pesticide monitoring programme. Analysis for chlorfenvinphos could be discontinued.

3) Monitoring should be carried out at selected Sewage Treatment Works in a prioritised way to provide data for consenting purposes and impact assessment. Policy on this issue needs to be clarified at a national level. This issue should also be brought to the attention of the relevant sewerage undertakers and site operators, in order that they can establish the source of the pesticides and take appropriate remedial action.

4) The biological data sets collected in 1997 and 1998 could be used to develop the assessment techniques to allow greater confidence in the interpretation of the biological survey results, particularly for moderately impacted sites.

5) Further investigations should be carried out in catchments suffering from the biological impacts of unknown pollution to determine the cause subject to resource availability.

6) The recovery of impacted sites or sites suffering from repeated incidents, should be further monitored, particularly where recovery has been slow, and the potential long-term impacts of reduced food sources on fish populations investigated. Sediment samples could be taken to establish whether the continued presence of sheep dip pesticides is inhibiting recovery.

7) Pollution prevention visits should be continued, and opportunities to work with other organisations, such as ADAS, the National Trust, National Parks, and HSE should be maximised. Mobile dip and shower/jetter operators should also be targeted. Better information is still required to target farms actually treating sheep.

8) The introduction of the Groundwater Regulations 1998 will provide an opportunity to identify and visit some of the sites of applications for disposal authorisations. The benefit of site visits should be maximised by assessing dipping and handling facilities, as well as disposal risk.

9) The Regulations and the provision for Prohibition Notices will provide opportunities to prevent dipping and disposal activities if the correct authorisations are not in place, or if there is a high risk of pollution. These should be used as appropriate.

10) Awareness campaigns at national and local level should be continued through attendance at shows, media coverage, and talks to farmers groups. Agency staff in Water Management functions who carry out field visits in sheep rearing areas routinely should also be encouraged to participate in raising awareness during visits.

11) Recommendations from the 1997 and 1998 reports of national significance should be incorporated within the Agency Strategy for Sheep Dip Action Plan.

# 1.0 INTRODUCTION

Sheep are prone to infestation by a number of ectoparasites and are dipped for economic, cosmetic and welfare reasons. Sheep Scab, caused by the ectoparasites *Psoroptes ovis* or *Sarcoptes scabiei*, is perhaps the most serious condition which can cause discomfort and even death. There is therefore a need 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 solution is currently the most widely accepted treatment method in Wales.

Two groups of chemicals are currently licensed for sheep dipping: organophosphates (OPs), which have the active ingredients diazinon or propetamphos, and the newer synthetic pyrethroids (SPs) such as flumethrin and cypermethrin. The latter were introduced in the early 1990s, partly because of concern over the potential effects of organophosphates on the health of farmers undertaking the dipping process. Although SPs were deemed to be less toxic to human health than OP dips, they are around 100 times more toxic to some elements of the aquatic environment.

Since 1995 there has been an increasing awareness of the environmental problems associated with the use of synthetic pyrethroid based sheep dips. Given the importance and prevalence of sheep farming within Wales and the Midland Region of the Environment Agency, a monitoring programme was initiated for the 1997 dipping season in order 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, which were detailed in the Environment Agency internal report entitled 'Welsh Sheep Dip Monitoring Programme 1997'(March 1998), are summarised below.

Thirty-nine water quality monitoring sites selected in 10 sub-catchments were monitored for sheep dip compounds from April to November 1997. Of these, 49% failed the maximum allowable concentration (MAC) Environmental Quality Standard (EQS) for one or more of the sheep dip pesticides. The OP pesticide diazinon was the most frequent cause of MAC EQS failures. Biological monitoring revealed that 33.8 km (5%) of 679km surveyed were known or suspected as being impacted by sheep dip. Visits at 117 farms indicated that 55% of farms were using OP dips, and 19% were using SP dips. Overall 26% of farms visited were found to be at a high risk of polluting a watercourse from sheep dipping activities. A key recommendation was that the monitoring programme should be continued in 1998 as a means of targeting pollution prevention activities.

The monitoring programme for 1998 was set up with the following aims:

i. To establish whether the results of the 1997 survey were representative of a larger proportion of Wales
ii. To use chemical and biological monitoring to target pollution prevention activities in catchments believed to be at risk.

In order to make the best use of the limited resources available whilst also expanding the programme to cover many more catchments, some changes in methodology were necessary. The results of the 1998 programme are therefore not fully comparable to those of 1997.

This report is structured such that the survey design and methodology is presented first. This is followed by sections giving the results for each of the four Agency geographical areas involved. These are summarised to provide 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

Sub-catchments were selected within upland areas of Wales categorised as high risk due to sheep densities and geographical characteristics. Some of the catchments selected were those where preliminary monitoring in 1997 had indicated that there may be environmental problems associated with sheep dip.

## 2.2 Stream chemistry

A network of 107 water quality sampling points was identified (Fig. 2.1). Monthly water column samples were collected between April and December 1998 to cover the peak dipping periods of June/July and September/October. The sites selected were routine monitoring sites, and therefore extra manpower was not required to visit them. This allowed more catchments to be sampled for sheep dip pesticides, but restricted the number of samples taken at each site to approximately eight, as the sites were only visited on a monthly basis.

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. Chlorfenvinphos, which is no longer authorised as a sheep dip was included due to the possibility of farmers using old stocks. The limit of detection (LOD) for organophosphate pesticides was 5 ng/l. The LOD for cypermethrin and flumethrin at 1 ng/l was significantly lower than that of 25 ng/l achieved during the 1997 monitoring programme at the majority of sites.

The maximum value for each determinand recorded at each site was assessed against the maximum allowable concentration (MAC) Environmental Quality Standard (EQS) for each pesticide (Table 2.1). It should be noted that these figures are currently under review, and may change in future. The MAC EQS should not be exceeded at any time and therefore an assessment of maximum recorded values against the MAC EQS is appropriate to determine exceedances. Annual Average EQS failures were not calculated as the sampling period and frequencies did not allow 12 samples to be taken over a 12 month period.

As part of follow up investigations, where sheep dip pollution was suspected, some sediment samples were analysed. The limits of detection were 1 μg/kg and 10 μg/kg for OP and SP pesticides, respectively. There are no standards (EQS) applicable to sediments.

In response to concerns raised regarding the possibility of contamination of private drinking water supplies, a project to investigate this was set up by the Welsh Office, in collaboration with the Drinking Water Inspectorate, three Local Authorities and the Environment Agency. The sampling was carried out at 35 sites, at fortnightly intervals from August 1998 to January 1999. The full results will be reported elsewhere later in the year. Results showing levels of sheep dip pesticides exceeding the MAC EQS were followed up by the Environment Agency and by Local Authority Environmental Health Officers.

**Table 2.1 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 |

## 2.3 Stream biology

Biological surveys were carried out in 65 sub-catchments in Wales. The sub-catchments were selected using the following criteria:

i. Sub-catchments upstream of chemical sampling points which registered positive for sheep dip pesticides in the 1997 monitoring exercise and which were not biologically assessed in 1997;
ii. Sub-catchments upstream of chemical sampling points which registered positive for sheep dip pesticides during sampling in 1998
iii. Sub-catchments which, from local knowledge, have a history of pollution by sheep dip or where poor practice was suspected.

Biological surveys were undertaken in sub-catchments in July/August and some in October/ November. Over 660 sites were sampled. Due to high river levels and floods in October, some sampling was delayed, or could not be completed.

The biological surveys consisted of one-minute kick samples amongst stream gravels at key locations, followed by bank-side assessment for invertebrate composition. Each site was given a score according to the standard Biological Monitoring Working Party (BMWP) methodology.

The biological quality at each site was then assigned to one of the following categories:

*1) Sites where fauna is 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 by low abundance of invertebrate groups (taxa) sensitive to sheep dip pesticides (e.g. mayflies, stoneflies, caddis flies and crustaceans).

To firmly attribute the impact to sheep dip pesticides, corroborative evidence was also required to show that the poor fauna was due to sheep dip. This either took the form of determining markedly better fauna upstream of a dipping structure than below or sheep dip chemicals being detected at in the watercourse sediments or soil.

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

*2) 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 pesticides. Impact on fauna characteristic of sheep dip pesticides but not confirmed was classified as being suspected to be due to sheep dip.

3*) 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, acidification, abandoned metal mine sites).

*4) Cause of the poor biological quality was undetermined.*

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

*5) 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 either no characteristic taxa missing or at a low abundance.

## 2.4 Pollution prevention activities and farm visit programme

A programme of farm visits was undertaken within a total of twenty sub-catchments. In order to ensure the effective deployment of the available resources, the programme was targeted as follows:

i. Some high risk sites identified in 1997 were reinspected prior to dipping in 1998, to ensure improvements had been carried out;
ii. Sub-catchments where 1997 chemical and biological monitoring had recorded an impact in 1997, but inspections had not been carried out;
iii. Sub-catchments suspected as being high risk due to local knowledge, information from fisheries staff, or those where collaborative inspections with other organisations such as the National Trust, were requested;
iv. Sub-catchments where, in 1998, biological surveys or MAC exceedences highlighted sheep dip problems.

Seven hundred properties were visited in total, of which 348 were subjected to a full inspection when it had been established that the farmers employed some sort of treatment. A common site inspection form was used to record information such as the site location details, type of dip used, structure of dipping facility, disposal method for used dip and the overall risk to watercourses from the sheep dipping operation(Appendix 1).

Mobile dip contractors were contacted and offered advice on minimising the risks of dipping. Opportunities were taken to raise awareness through press releases and articles, talks, agricultural shows and providing information at markets.

In consultation with the Agency, additional farm visits were carried out by ADAS on behalf of the Welsh Office in sheep rearing catchments.

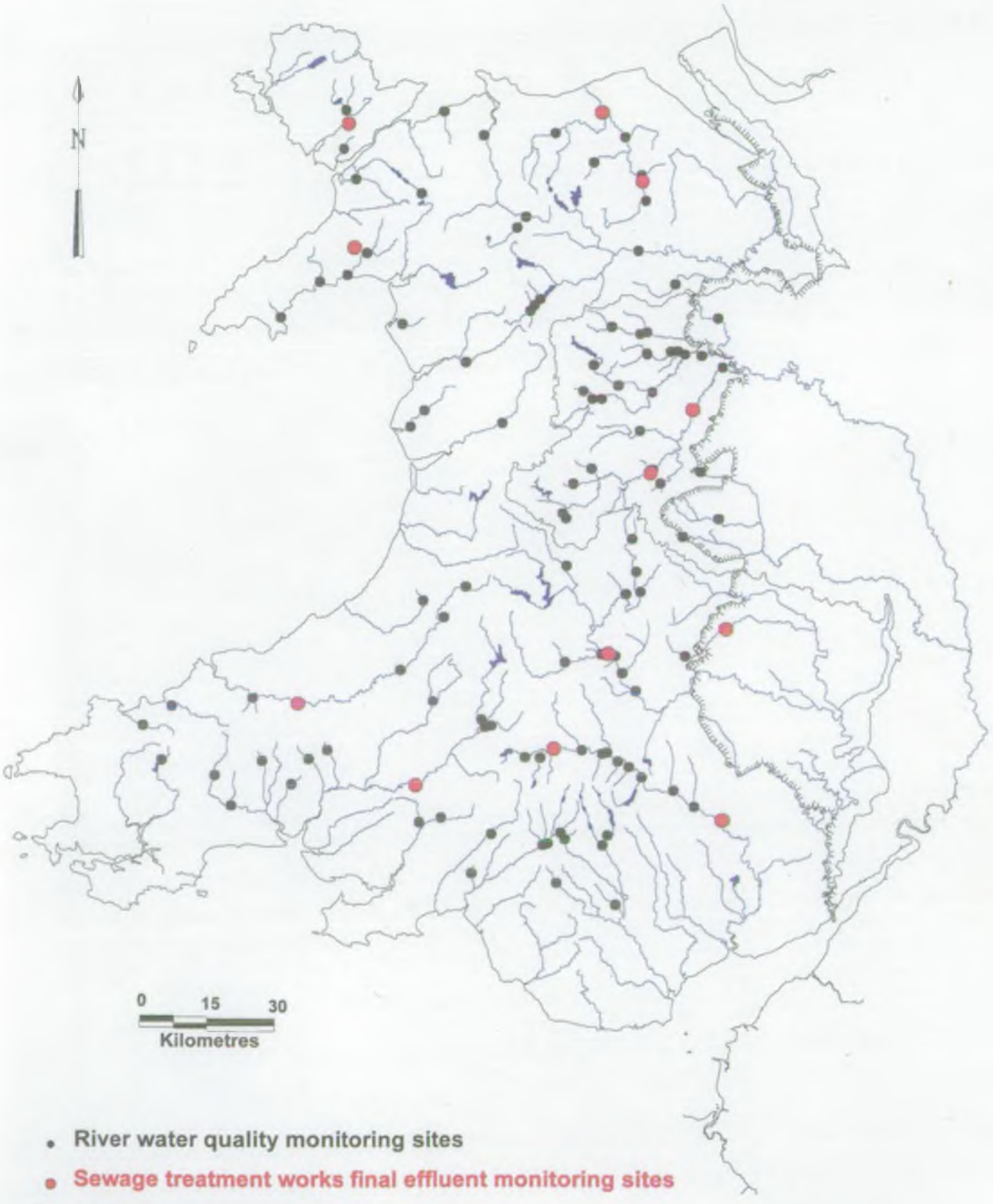
## 2.5 Sewage Treatment Works monitoring

As part of the 1997 monitoring programme two Sewage Treatment Works (STWs) effluents were monitored and found to contain sheep dip chemicals. As a results an additional six STWs were monitored during 1998, selected on the basis of their rural locations, and receiving inputs from either livestock markets or fell mongers. After initial results at these works, an additional four STWs were added to this programme in the autumn. Biological monitoring was carried out in the receiving watercourses of some of the STWs.

## 2.6 Assessment of recovery at sites impacted in 1997

Sites which had suffered severe biological impacts, due to sheep dip pollution, in 1997 were reassessed to establish how quickly the fauna recovers, and whether there was any indication of long term impacts.

# Fig 2.1 Water quality monitoring network included in the 1998 sheep dip monitoring programme



# 3.0 SURVEY RESULTS

## 3.1 UPPER SEVERN AREA

Thirteen river subcatchments within the Welsh and borders sections of the Midlands region were studied as part of this survey. They are grouped together into three larger catchments: the River Vrynwy, River Severn and the River Teme. The principal land use in these areas is sheep and beef rearing. The upland farms in these areas are at an approximate altitude of 300-400 metres above ordnance datum.

### 3.1.1 Vyrnwy catchment

#### 3.1.1.1 Stream chemistry

Water column samples were taken from a total of sixteen sites in the Vyrnwy catchment between April and November 1998 (Table 3.1.1; Figs. 3.1.1 – 3.1.5)

Exceedances of Maximum Allowable Concentration (MAC) EQS limits for cypermethrin were recorded at seven sites (map refs: P,T,U,V,W,X,Y) during the months of April and October. Only one exceedance at each site was recorded with the exception of the River Morda ( map ref: Y) on which there were three.

Only one site failed the MAC EQS for propetamphos, which was on the Afon Cownwy (map ref: N) in October.

There were no MAC EQS failures for diazinon, although the chemical was detected at several sites (map refs: M,P,R,S,T,X,Z), most commonly in the months of June and July.

There is no MAC EQS for Flumethrin, but it was recorded at two sites ( map refs :U, V).

**Table 3.1.1 A summary of positive water column sampling results for the Vyrnwy catchment. EQS failures in bold.**

| SITE (Name and Map Reference) | Site code | Determinands with positive results | Max (ng/l) | No. samples | No. positive |
|---|---|---|---|---|---|
| Afon Rhaeadr (K) | 31232040 | No positive results | - | 8 | 0 |
| Afon Tanat (L) | 30885720 | No positive results | - | 9 | 0 |
| Afon Eirth (M) | 31381030 | Diazinon | 25 | 9 | 2 |
| | | Propetamphos | 46 | 9 | 1 |
| Afon Cownwy (N) | 32515220 | Propetamphos | **101** | 9 | 2 |
| | | Cypermethrin | **2** | 8 | 1 |
| Afon Vyrnwy at Dolanog (O) | 30661480 | Propetamphos | 10 | 9 | 1 |
| Afon Gam (P) | 32069140 | Diazinon | 17 | 9 | 1 |
| | | Propetamphos | 27 | 9 | 2 |
| | | Cypermethrin | 2 | 8 | 1 |
| Afon Twrch (Q) | 32190060 | No positive results | - | 9 | 0 |
| Afon Banwy at Llanerfyl (R) | 31798790 | Diazinon | 12 | 8 | 1 |
| Afon Banwy at New Bridge (S) | 31795020 | Diazinon | 22 | 9 | 3 |
| | | Propetamphos | 12 | 9 | 1 |
| Afon Cain at Pont y Pentre (T) | 31466180 | Diazinon | 16 | 8 | 1 |
| | | Cypermethrin | **4** | 9 | 1 |
| Afon Cain at Llanfechain (U) | 31467390 | Cypermethrin | 1 | 6 | 1 |
| | | Flumethrin | 2 | 6 | 1 |
| Nant Fyllion (V) | 31468870 | Cypermethrin | **2** | 9 | 1 |
| | | Flumethrin | 2 | 9 | 1 |
| Nant Alan (W) | 31577000 | Cypermethrin | **2** | 9 | 1 |
| Afon Brogan (X) | 31484100 | Diazinon | 21 | 5 | 2 |
| | | Cypermethrin | 3 | 5 | 1 |
| Afon Vyrnwy At Llanymynch (Z) | 30654180 | Diazinon | 39 | 6 | 2 |
| River Morda (Y) | | Cypermethrin | **78** | 6 | 3 |

## 3.1.1.2 Stream biology

Due to the October floods within the Upper Severn area of the Midlands region, it was not possible to sample all the subcatchments in both of the survey periods.

A total of 78 sites were sampled in the Vrynwy catchment. The catchment is split into the Upper (42 sites) and Lower Vyrnwy (36 sites) subcatchments.

## Upper Vyrnwy

### Afon Banwy

Biological monitoring was undertaken at 24 sites on the Banwy and its tributaries upstream of Neuadd Bridge. The summer invertebrate survey indicated a number of problems within the Banwy subcatchment. The BMWP scores were generally fairly low throughout the catchment, when compared to previous routine monitoring samples. The majority of the sites sampled showed no indication that they were impacted by sheep dip pollution, as the samples contained stoneflies, mayflies and caddis in reasonable numbers. Therefore it must be assumed that these sites were unpolluted even though the BMWP score was less than 49 in some cases.

As mentioned above, a number of declines were found and investigated: -

Maes-llymystyn tributary (Site 2) had high numbers of chironomid fly larvae and sparse sensitive life present. Further investigation found an organic problem caused by silage effluent overflowing from a collection tank entering the watercourse via a drain.

An absence of sensitive invertebrate life was found at Dolgead tributary (Site 14). On further investigation, the cause of the decline was found to be due to manure effluent entering the watercourse via a land drain.

Coedtalog tributary (Site 19) also was found to have little sensitive life present. The cause of this problem is thought to be due to leakage of fuel oil into the watercourse. Chemical analysis of the sediment showed traces of Polycyclic Aromatic Hydrocarbons in the sample. No sheep dip pesticides were detected.

The Nant Menial (Site 23) was found to be affected by sheep dip chemicals. The cause of the poor biological quality was found to be due to the poor disposal of pour-on sheep dip containers.

Total length of watercourse affected in the Banwy by sheep dip was approx 3km

### Afon Twrch

Seven sites on the Afon Twrch were sampled in the summer survey. The survey indicated there was no evidence of an impact caused by sheep dip chemicals in the catchment. All the sites had low BMWP scores but sensitive life was present in all cases. The Afon Twrch has long standing problems with acidification and therefore these results were as expected for the subcatchment.

### Afon Cownwy

Eight sites were sampled on the Afon Cownwy. There was no indication of an impact caused by sheep dip chemicals. The survey indicated consistently good biological quality at all sites with the exception of Ffridd y Garnedd tributary (site 37). This site was virtually dry although some sensitive life was present.

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Banwy; Pont Twrch | SH 9870 1130 | 49 | |
| 2 | Maes-llymystyn ; Conf Banwy | SH 9730 1200 | 45 | |
| 3 | Maes-llymystyn; D/S farm | SH 9720 1160 | 44 | |
| 4 | Maes-llymystyn; U/S farm | SH 9720 1150 | 90 | |
| 5 | WernTrib.; D/S Wern Farm | SH 9660 1260 | 22 | |
| 6 | WernTrib.; U/S Wern Farm | SH 9650 1280 | 51 | |
| 7 | Llechwedd Trib.; D/S Farm | SH 9620 1270 | 44 | |
| 8 | Gesail-ddu Trib; | SH 9540 1230 | 63 | |
| 9 | Banwy; U/Sconf. Nant Ysguthan | SH 9530 1270 | 39 | |
| 10 | Trib. | SH 9470 1290 | 58 | |
| 11 | Banwy | SH 9470 1300 | 52 | |
| 12 | Banwy; D/S Dol-y-maen | SH 9440 1350 | 32 | |
| 13 | Banwy; Neudd | SJ 0840 0780 | 51 | |
| 14 | Dolgead trib.; Neudd | SJ 0850 0810 | 16 | |
| 15 | Gartheilin trib. | SJ 0790 0950 | 57 | |
| 16 | Banwy; u/s Caen y Mynydd trib. | SJ 0660 1020 | 75 | |
| 17 | Caen y Mynydd trib. | SJ 0640 1010 | 37 | |
| 18 | Berth East trib. | SJ 0660 1030 | 29 | |
| 19 | Coedtalog trib. | SJ 0520 1090 | 20 | |
| 20 | Neuadd- Wen trib. | SJ 0510 1090 | 38 | |
| 21 | Nant Wgan | SJ 0430 1070 | 60 | |
| 22 | Banwy; Llanerfyl | SJ 0320 0980 | 70 | |
| 23 | Nant Menial | SJ 0310 0960 | 56 | |
| 24 | Banwy; Llangadfan | SJ 0110 1090 | 51 | |
| 25 | Belan trib. | SJ 0090 1120 | 48 | |
| 26 | Llwydcoed trib. | SJ 0050 1140 | 45 | |
| 27 | Pont Twrch trib. | SH 9870 1130 | 47 | |
| 28 | Twrch; Pont Twrch | SH 9900 1160 | 41 | |
| 29 | Twrch; Pentre Bach | SH 9870 1330 | 48 | |
| 30 | Twrch; Pen-y-coed ford | SH 9740 1430 | 44 | |
| 31 | Twrch; Dol-y-gaseg ford | SH 9730 1460 | 50 | |
| 32 | Twrch; Moel y Tryfel | SH 9710 1510 | 41 | |
| 33 | Afon Llechog | SH 9590 1590 | 29 | |
| 34 | Twrch; Cerniau, D/S ford | SH 9550 1640 | 52 | |
| 35 | Cownwy ; U/S conf. Vyrnwy | SJ 0210 1710 | 103 | |
| 36 | Cownwy ; D/S Ddol Cownwy Brg. | SJ 0150 1740 | 74 | |
| 37 | Ffridd y Garnedd trib; U/S Ddol Cownwy | SJ 0100 1720 | 64 | |
| 38 | Cownwy ; U/S Ddol Cownwy Brg. | SJ 0140 1750 | 78 | |
| 39 | Trib;U/S Henefail caravan pk. | SJ 0140 1740 | 64 | |
| 40 | Cownwy ; D/S Penisarewn trib. | SJ 0090 1770 | 67 | |
| 41 | Cownwy ; Cownwy | SH 9990 1790 | 40 | |
| 42 | Cownwy ; Blaen Cownwy | SH 9910 1840 | 72 | |

**Table 3.1.2 Biological results for the Upper Vyrnwy catchment for summer 1998 sheep dip surveys**

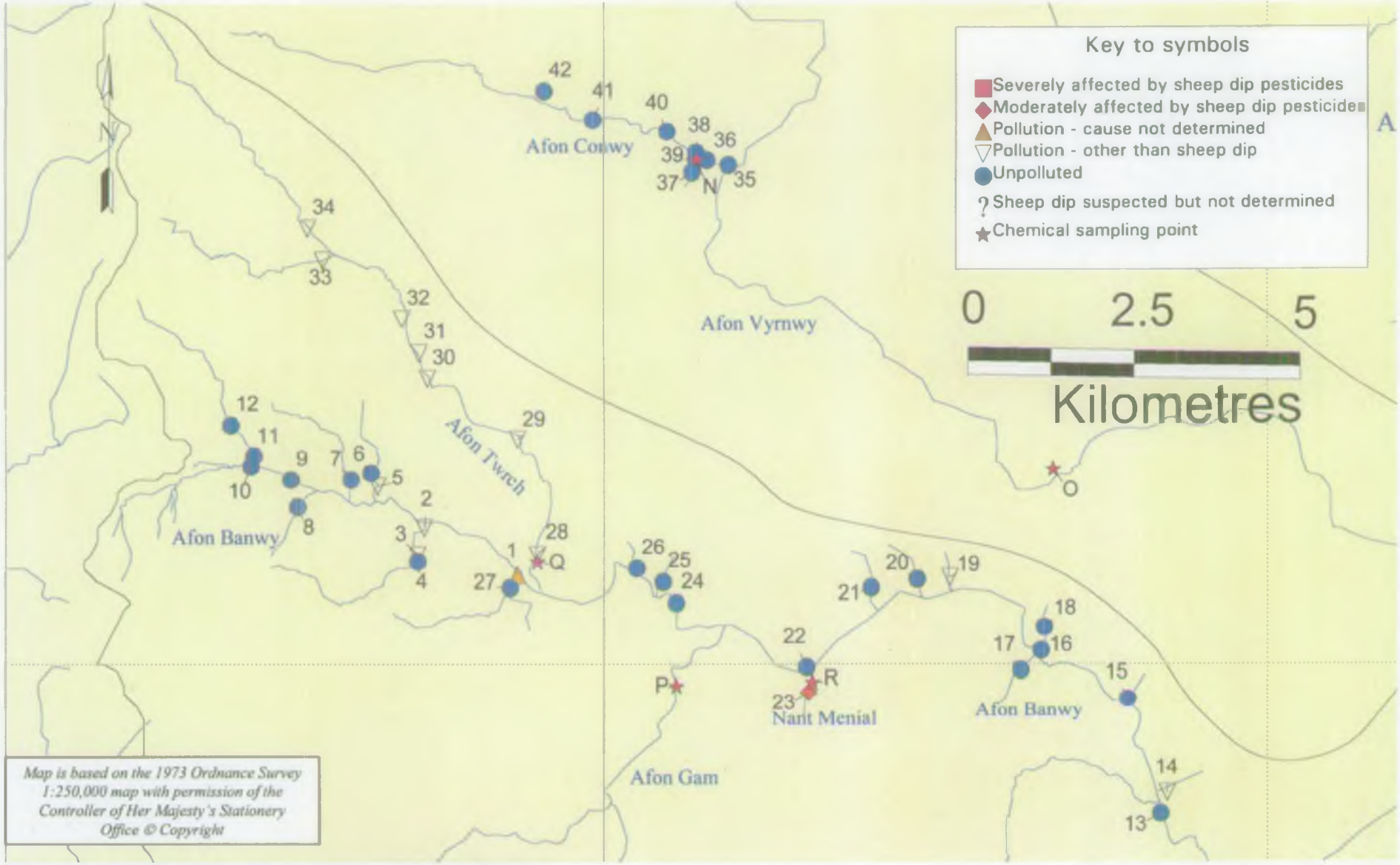



**Fig. 3.1.1 Map of the Upper Vrynwy catchment**

## Lower Vyrnwy

### Afon Tanat

Four sites were surveyed on the Tanat (upstream of Llangynog) in summer and autumn. The summer survey indicated that the biological quality of all the sites was good and had not been affected by sheep dip chemicals. The autumn survey revealed a decline in score on the Tanat at Pennant (site 3). Further investigation was undertaken and the decline was traced to a small tributary. However no point source of the decline was found and it is suspected that acidification may be the cause. The results from the other three sites were similar to those in the summer.

### Afon Brogan

Six sites were sampled on the Afon Brogan subcatchment in the summer survey. There was no evidence that any of the sites had been adversely affected by sheep dip pesticides on the Afon Brogan. However the two lower sites in the catchment at u/s Cain and Waterloo (sites 5 and 6) had very low BMWP scores and a fauna that was consistent with organic pollution.

### Afon Rhaeadr

Six sites were sampled on the Afon Rhaeadr in the summer and in the autumn. One decline in biological quality was detected on the Afon Rhaeadr. Limited sensitive life was found on the Rhaeadr at u/s Ffynon (site 15). It is suspected that the decline was due to sheep dip chemicals, however the source of the problem could not be pinpointed as the watercourse had partially recovered. Visits to farms in the area found a suspect dipping bath, which is the likely cause of the decline. The other samples were of a consistently good biological quality with plenty of sensitive life present. The autumn survey showed that there was plenty of sensitive life present at all sites on the Afon Rhaeadr. It can be taken that the Afon Rhaeadr was unpolluted by sheep dip chemicals in the autumn.

### Afon Hirnant

Biological monitoring was undertaken in July at six sites on the Afon Hirnant. Very little invertebrate life was found at Bwlch y Main tributary (site 19). This was in contrast to all the other samples taken on the Afon Hirnant catchment on the same day, which contained plenty of sensitive life. A biological investigation was undertaken to investigate the cause of the poor biological quality on Bwlch y Main tributary, which was found to be due to a sheep dip located immediately adjacent to the watercourse.

The total length of watercourse affected in the Hirnant by sheep dip in July 1998 was approx 1km.

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Tanat ; Llangynog | SJ 0540 2580 | 94 | 97 |
| 2 | Trib ; Rhyd-y-felin | SJ 0340 2540 | 82 | 103 |
| 3 | Tanat ; Pennant | SJ 0330 2580 | 99 | 41 |
| 4 | Tanat ; Pennant Melange | SJ 0250 2640 | 66 | 53 |
| 5 | Brogan; u/s Cain | SJ 2040 2070 | 24 | |
| 6 | Brogan; Waterloo | SJ 1970 2030 | 20 | |
| 7 | Brogan;Tyn Y Rhos | SJ 1870 1920 | 61 | |
| 8 | Brogan; A490 | SJ 1730 1790 | 86 | |
| 9 | Brogan; Gwaelod | SJ 1430 1670 | 108 | |
| 10 | Brogan; Cwm Nant | SJ 1260 1530 | 59 | |
| 11 | Rhaeadr; Celynog | SJ 1320 2500 | 92 | 76 |
| 12 | Rhaeadr; d/s Gwern Sebon trib. | SJ 1180 2670 | 79 | 77 |
| 13 | Rhaeadr; Commins | SJ 1020 2760 | 58 | 68 |
| 14 | Ffynon trib.; U/s Rhaeadr | SJ 0960 2830 | 86 | 83 |
| 15 | Rhaeadr; u/s Ffynon | SJ 0950 2830 | 50 | 72 |
| 16 | Rhaeadr; d/s Cwm yr Ast | SJ 0780 2910 | 83 | 63 |
| 17 | Hirnant; Penybontfawr | SJ 0860 2450 | 106 | |
| 18 | Fawnog; u/s Hirnant | SJ 0820 2390 | 86 | |
| 19 | Bwlch y main; confl. | SJ 0710 2410 | 33 | |
| 20 | Hirnant; Gelli | SJ 0670 2380 | 87 | |
| 21 | Hirnant; Minffrwd | SJ 0530 2320 | 85 | |
| 22 | Hirnant; Blaen Hirnant | SJ 0420 2230 | 62 | |
| 23 | Cain; Llanfechain | SJ 1870 2060 | 46 | |
| 24 | Cain; D/S Pentre trib. | SJ 1760 1970 | 54 | |
| 25 | Cain; Talwrn | SJ 1750 1920 | 57 | |
| 26 | Cain; Green Hall | SJ 1640 1880 | 73 | |
| 27 | Cain; Minor Road Brg. | SJ 1490 1910 | 47 | |
| 28 | R.Abel; Llanfyllin | SJ 1380 1910 | 32 | |
| 29 | Cain; Llanfyllin | SJ 1440 1940 | 64 | |
| 30 | Nant Alan; New Mills | SJ 1260 1960 | 68 | |
| 31 | Nant Alan; Coed Siencyn | SJ 1070 1840 | 72 | |
| 32 | Nant Alan; | SJ 0970 1780 | 103 | |
| 33 | Nant Alan; Tanllan | SJ 0790 1740 | 59 | |
| 34 | Nant Fylon | SJ 1310 2010 | 65 | |
| 35 | Nant Fylon; Ledfron | SJ 1240 2070 | 118 | |
| 36 | Nant Fylon; Bodyddon | SJ 1230 2130 | 101 | |

**Table 3.1.3 Biological results for the Lower Vyrnwy catchment for summer 1998 sheep dip surveys**

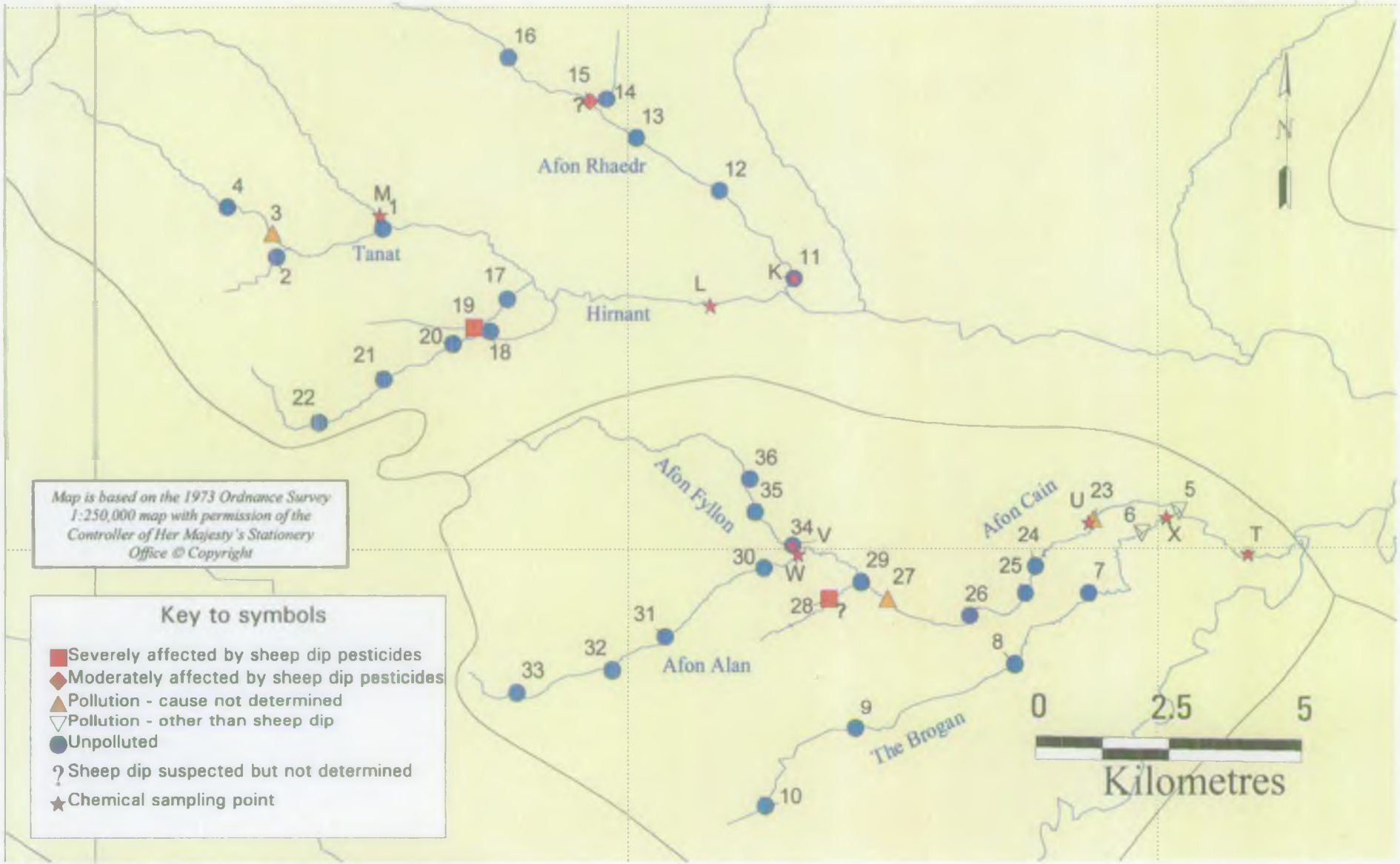



**Fig. 3.1.2 Map of the Lower Vyrnwy catchment**

**Afon Cain**

Fourteen sites on the Afon Cain were sampled in the summer survey. The results indicated two problems within the subcatchment.

There was evidence of pollution caused by sheep dip pesticides on the River Abel (Site 28), a tributary of the Cain. Invertebrate life was sparse with very little sensitive life present. The problem was traced to a spring entering the River Abel, which is thought to have become contaminated by sheep dip disposed of to soakaway. Chemical analysis of the sediment showed traces of the SP dips cypermethrin and flumethrin.

Total length of watercourse affected approx. 3.5 km of the River Abel and 1km of the Afon Cain.

The Afon Cain at Llanfechain (site 23) had a lower BMWP score than expected. This site has had problems in the past but even after extensive investigation, the source of the decline has not been identified. There was no evidence of any decline in 1996/1997, and this is thought to be a recurrence of this past problem. All other sites indicated consistently good biological quality with a good selection of sensitive invertebrate life being present.

## 3.1.1.3 Farm visit programme

One hundred and thirty three properties within the Vyrnwy catchment were visited, eighty nine of which were occupied by sheep farmers using some form of treatment.

**Type of treatment**

Organophosphate based sheep dips were the most commonly used treatment, followed by synthetic pyrethroid based dips. The use of pour-ons and injections rather than dipping seemed to be a popular alternative to dipping, with many farmers stating they had recently changed to using these types of treatment.

**Table 3.1.4 Treatment methods used in the Vyrnwy catchment**

| Treatment method | % sites visited |
|---|---|
| OP dips | 40 |
| SP dips | 24 |
| SP & OP dips | 7 |
| Injection | 10 |
| Pour on | 15 |
| Don't know | 4 |

### Sheep dipping structures

Generally, the dipping facilities were in a good state of repair and well away from watercourses. The main problem with a large proportion, however, was the presence of a drain hole in the bath. In all cases these were temporarily bunged, normally with a piece of wood. Discharge was either to soakaway or to an adjacent piece of land. No direct discharges to watercourses were found. Most drain holes to soakaways were for the disposal of spent dip, whereas other drain holes were for the release of rainwater entering baths following dipping. The disposal of rainwater subsequently entering dipping baths seemed to cause concern in the majority of cases, with the need to find a practical solution for either the disposal or the prevention of unnecessary collection by providing a safe cover for the bath.

Eight of the farmers visited have recently started to use mobile dipping facilities.

### Chemical stores

Storage of dip on most sites was very short term. Most farmers buy dip one or two days before they need it. A few had lockable stores but generally dip was stored in unlocked sheds.

### Disposal

Landspreading was the most common practice for disposing of used dip, followed by the fairly widespread use of soakaways. Most spreading sites were on poor quality grazing land on higher ground. Some farmers claimed to dilute used dip with slurry or water, but the majority did not. Most farmers were willing to spread used dip rather than use soakaways once they were aware of the risks posed by the use of soakaways. However some did not have access to spreaders or tankers and in these circumstances disposal posed a problem.

**Table 3.1.5 Disposal methods in the Vyrnwy catchment**

| Disposal Method | % Sites Visited |
|---|---|
| Soakaway | 24 |
| Landspreading | 76 |
| Off-site Disposal | 0 |
| Direct Discharge | 0 |

### Pollution Prevention Measures

Farmers were encouraged to permanently block drain holes from dipping baths and to spread used dip rather than release it to soakaway – the risks of having temporary bungs was highlighted. Management of flocks after dipping was also highlighted with the need to keep freshly dipped sheep well away from watercourses. Careful disposal of used chemical containers was also an issue that was raised. On one property, pour-on and injection solution containers were found in a stream, resulting in a significant decline in biological life in a very small tributary of the Afon Banwy.

Pollution prevention guidelines were distributed to all sheep farmers and delivered (with informative letters) to properties where the occupier could not be located. Letters requesting remedial measures or changes in practices were sent when necessary.

One mobile dipping contractor was visited and procedures discussed. Pollution prevention guidelines and informative letters were sent to an agricultural contractors's association for distribution to mobile dipping contractors.

A display trailer was taken to the Llanfair Caereinion agricultural show and a talk held for Agricultural Training Board groups at Llanrhaeadr to raise awareness of pollution potential arising from sheep dipping.

**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 | 34 |
| Medium | 40 |
| Low | 26 |

Overall risk generally increased due to poor management rather than the condition and siting of facilities. In particular, lack of awareness of the toxicity of synthetic pyrethroid based dips, release of contaminated rainwater, careless container disposal, and the release of sheep to high risk areas immediately following dipping increased the risk from individual operations.

## 3.1.2 Severn catchment

### 3.1.2.1 Stream chemistry

Water column samples were taken from a total of ten sites in the Severn catchment between April and December 1998 (Table 3.1.6; Figs 3.1.3 – 3.1.4)

Exceedances of MAC EQS limits for cypermethrin were recorded at 4 sites (map refs:B,D,F,G) with a particularly high level of concentration found on the Afon Trannon (map ref: D) in September. A high result was also recorded on the Afon Garno (map ref: B) during September, from which a positive link was established with the biological impact on this watercourse. Most cypermethrin failures occurred in samples taken during August and September.

Flumethrin was detected at three sites (map refs:D,E,G). All detections occurred in samples taken during October.

Exceedences of MAC EQS limits for both diazinon and propetamphos were recorded at only one site - on the Afon Rhiw (map ref: C) during August.

**Table 3.1.6 A summary of positive water column sampling results for the Severn catchment. EQS failures in bold.**

| SITE (Name and map Reference) | Site code | Determinands with positive samples | Max (ng/l) | No. samples | No. positive |
|---|---|---|---|---|---|
| Bechan Brook (A) | 34371050 | Diazinon | 16 | 7 | 2 |
| | | Propetamphos | 18 | 7 | 1 |
| Afon Garno (B) | 34941320 | Cypermethrin | **37** | 7 | 1 |
| Afon Rhiw (C) | 33670440 | Diazinon | **130** | 9 | 3 |
| | | Propetamphos | **359** | 9 | 2 |
| Afon Trannon (D) | 35303700 | Cypermethrin | **101** | 6 | 3 |
| | | Flumethrin | 4 | 6 | 1 |
| Afon Dulas (E) | 36097760 | Flumethrin | 1 | 6 | 1 |
| Afon Brochan (F) | 36108040 | Cypermethrin | 3 | 4 | 3 |
| Afon Mule (G) | 34180020 | Propetamphos | 81 | 6 | 1 |
| | | Cypermethrin | **21** | 6 | 1 |
| | | Flumethrin | 2 | 6 | 1 |
| Caebitra Brook (H) | 33422430 | No positive results | - | 6 | 0 |
| Severn at Aberbechan (I) | 00065870 | Propetamphos | 40 | 15 | 3 |
| Severn at Llandrinio (J) | 00060200 | No positive results | - | 9 | 0 |

### 3.1.2.2 Stream biology

A total of 40 sites were sampled in the Severn catchment.

**Afon Garno**

Sixteen sites were surveyed on the Afon Garno (upstream of Clatter) in the summer period (Fig. 3.1.3). The survey undertaken in July revealed that sites 1 to 10 and 14 to 16 were of good biological quality, with plenty of sensitive life being present in the samples. There was no indication that these sites had been affected by sheep dip chemicals. Caeauduon tributary (Site 13) had a very low BMWP score, with just worms and fly larvae being present. Further investigation was inconclusive but it is suspected that the decline in biological quality was due to freshly dipped sheep walking through the watercourse.

**The Mule**

Ten sites were surveyed on the Mule in the summer (Fig. 3.1.4). There was no evidence of an impact caused by sheep dip chemicals in the subcatchment. The survey indicated good biological quality of all the sites on the Mule with a good selection of sensitive life being present.

**Caebitra Brook**

Twelve sites on the Caebitra Brook were surveyed in the summer and autumn (Fig 3.1.4). There was evidence in the summer samples of pollution caused by sheep dip chemicals at New House tributary (site 35), as there was limited sensitive life present. The majority of other sites (29-34 and 36-40) contained some sensitive life in reasonable numbers. The poor habitat at a number of sites accounted for some low scores. However Bacheldre tributary (site 33) had a low BMWP score. Bacheldre tributary had a reduced fauna that was consistent with organic pollution. The flows were very high when the Caebitra was resurveyed in the autumn and therefore the results are not wholly reliable. However freshwater shrimps were found in good numbers in all the samples and therefore it is assumed that none of the sites had been affected by sheep dip chemicals.

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Carno ; D/S Maesypandy | SN 9950 9560 | 90 | |
| 2 | Carno ; U/S Maesypandy | SN 9920 9570 | 81 | |
| 3 | Carno ; Plaesnewydd | SN 9750 9620 | 72 | |
| 4 | Carno ; Carno | SN 9670 9640 | 72 | |
| 5 | Carno; u/s Railway Brg. | SN 9650 9660 | 72 | |
| 6 | Afon Gerniog; Pentre | SN 9560 9610 | 67 | |
| 7 | Afon Cledan ; Carno | SN 9560 9740 | 81 | |
| 8 | Afon Cledan; Wylfa | SN 9420 9700 | 74 | |
| 9 | Left Trib. D/S Railway; Sarn | SN 9530 9770 | 38 | |
| 10 | Left Trib; Pikins | SN 9440 9860 | 64 | |
| 11 | Left Trib; Ralt | SN 9390 9890 | 46 | |
| 12 | Left Trib; U/S Caeauduon Trib | SN 9380 9890 | 72 | |
| 13 | Caeauduon Trib; U/S conf. | SN 9380 9920 | 11 | |
| 14 | Caeauduon Trib; D/S A470 | SN 9380 9950 | 11 | |
| 15 | Caeauduon Trib.; U/S A470 | SN 9410 9970 | 40 | |
| 16 | Right Trib; U/S Carno | SN 9620 9760 | 58 | |
| 17 | Right Trib ; Plasau | SN 9640 9840 | 65 | |
| 18 | Right Trib.;Rhyd | SH 9750 0060 | 45 | |
| 19 | Mule; Glanmule | SO 1620 9040 | 88 | |
| 20 | Nant Meheli; Glanmeheli | SO 1610 9010 | 96 | |
| 21 | Nant Meheli; Pentre | SO 1550 8910 | 124 | |
| 22 | Nant Meheli; Cwmvdalfa | SO 1410 8810 | 91 | |
| 23 | Nant Meheli; KerryHill | SO 1360 8690 | 106 | |
| 24 | Mule; Kerry | SO 1410 9000 | 97 | |
| 25 | Mule; The Forest | SO 1320 8950 | 102 | |
| 26 | Mule; Wig | SO 1200 8760 | 103 | |
| 27 | Dolfortrib; Wig | SO 1180 8760 | 117 | |
| 28 | Mule; Ceulanau | SO 1180 8640 | 108 | |
| 29 | Rockley trib; u/s Caebitra | SO 2660 9410 | 48 | |
| 30 | Caebitra Brook; u/s Rockley | SO 2670 9390 | 78 | |
| 31 | Rockley trib.; d/s Offa Farm | SO 2360 9460 | 6 | 69 |
| 32 | Caebitra Brook ; Bacheldre | SO 2430 9280 | 61 | 22 |
| 33 | Bacheldre trib.; u/s Caebitra | SO 2440 9270 | 23 | 54 |
| 34 | Cwm Bromley trib. | SO 2330 9270 | 59 | 49 |
| 35 | New House trib. | SO 2330 9260 | 33 | 21 |
| 36 | Hopton trib. | SO 2290 9210 | 11 | 22 |
| 37 | Caebitra Brook; Sarn | SO 2060 9050 | 65 | 56 |
| 38 | Bachaethlon trib. | SO 2070 9050 | 73 | 31 |
| 39 | Pant y Falog trib. | SO 1950 8980 | 63 | 89 |
| 40 | Lower Hill trib. | SO 1970 8950 | 78 | 99 |

**Table 3.1.7 Biological results for the Severn catchment for summer and autumn 1998 sheep dip survey.**

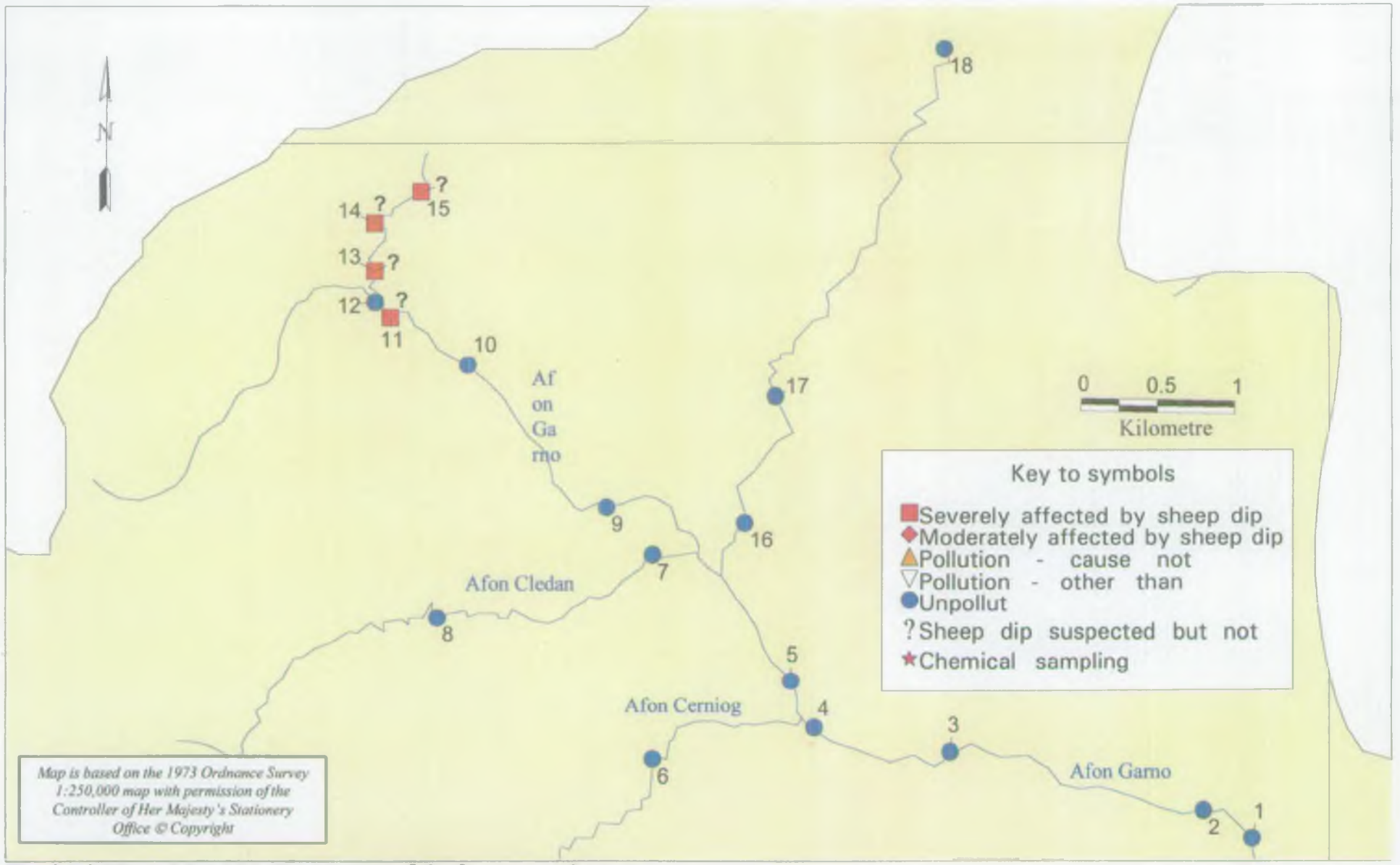



**Fig. 3.1.3 Map of the Afon Carno, part of the Severn catchment**

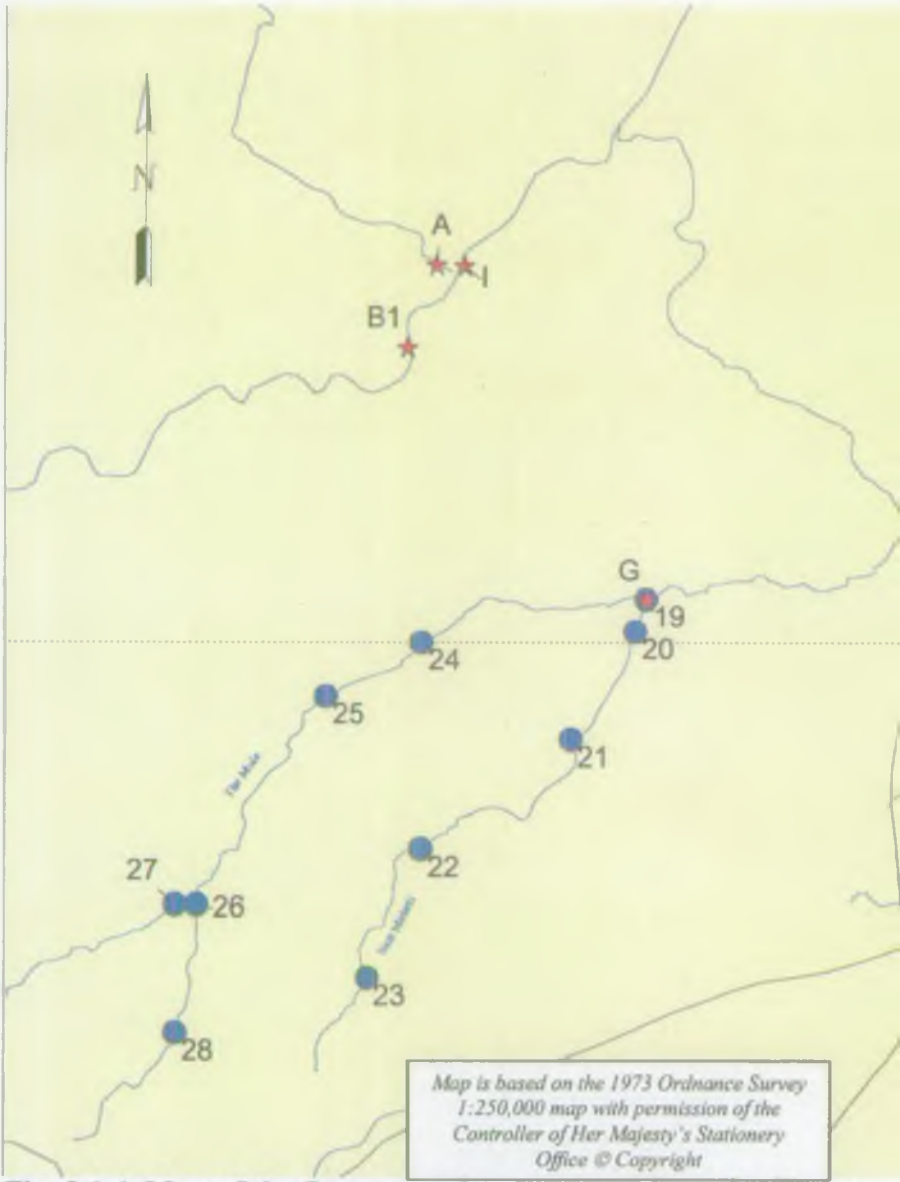
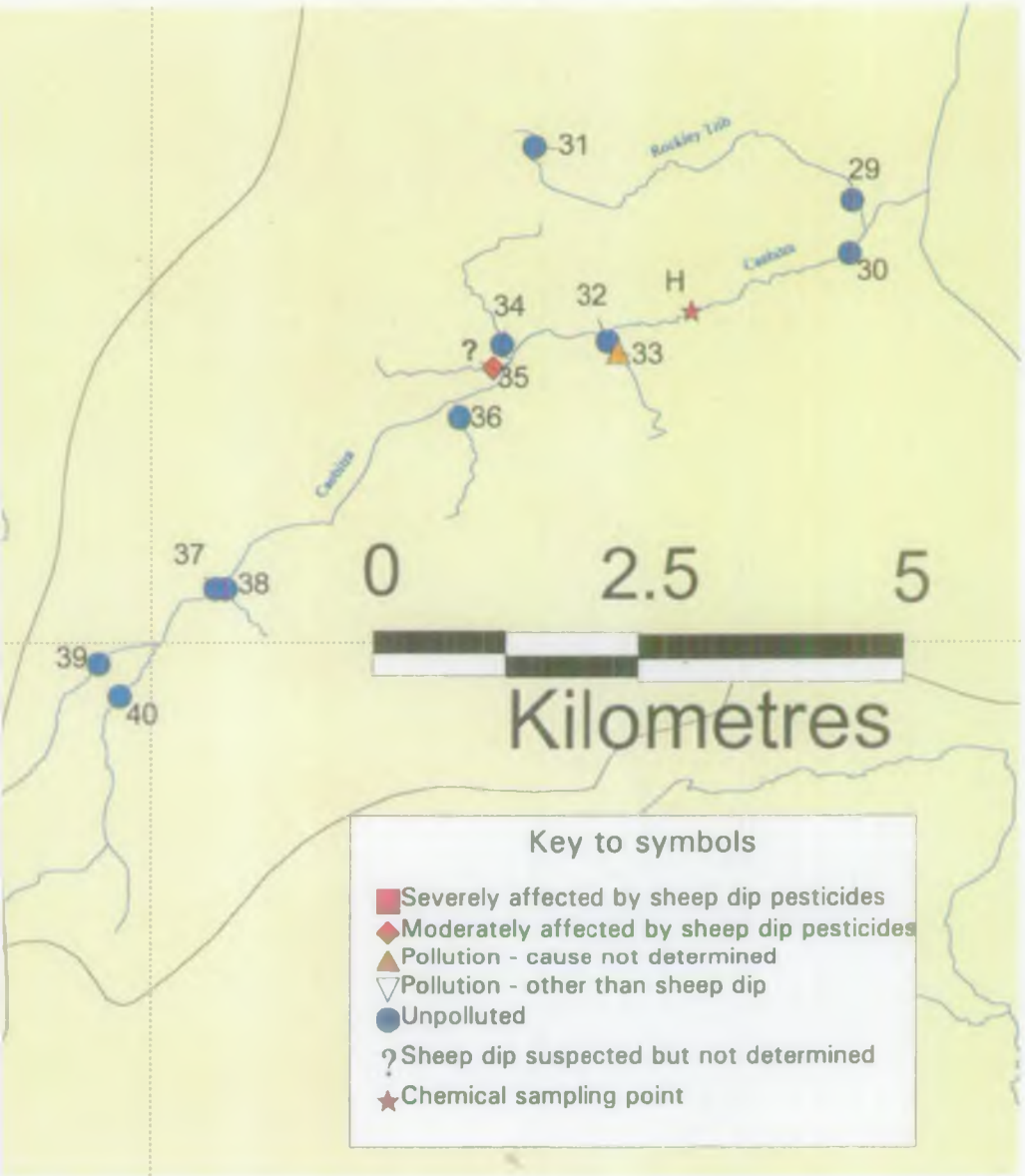



**Fig. 3.1.4 Map of the Severn catchment, apart from the Carno**


31
29
30
H
32
34
33
?
35
36
37
38
39
40
0
2.5
5
Kilometres
Key to symbols
Severely affected by sheep dip pesticides
Moderately affected by sheep dip pesticides
Pollution - cause not determined
Pollution - other than sheep dip
Unpolluted
? Sheep dip suspected but not determined
Chemical sampling point

### 3.1.2.3 Farm visit programme

Forty eight properties within the Severn catchment were visited, forty of which were occupied by sheep farmers using some type of treatment

**Type of treatment**

Organophosphate based sheep dips were the most commonly used treatment, followed very closely by the use of synthetic pyrethroid based dips and pour-on treatments. The use of injections was also recorded at several sites but to a much lesser extent than the other treatments.

**Table 3.1.8 Treatment methods used in the Severn catchment**

| Treatment method | % sites visited |
|---|---|
| OP dips | 28 |
| SP dips | 20 |
| SP & OP dips | 0 |
| Injection | 9 |
| Pour on | 20 |
| Don't know | 23 |

**Sheep dipping structures**

Most dipping facilities were tidy and in a good state of repair. A few had draining pens which did not drain back to the dipping bath and a large number of facilities had a drain hole within the bath. On most occasions these holes were bunged and used for the disposal of rainwater rather than used dip, but a number did drain to soakaway with this being used on a few occasions as the disposal route for used dip.

**Chemical stores**

It seemed common practice on many of the properties to store chemicals beside the dipping facility. In the majority of these cases, this was undercover and although the sites were not secure, there was not a high risk of pollution from storage in this way. Storage of dip on most sites was very short term.

**Disposal**

Landspreading was the most common practice for disposing of used dip. A small proportion of the properties used soakaways as the disposal method. Most spreading sites were on waste ground and posed minimal risk of pollution, but a few were using stony ground with shallow soils and on one occasion a field containing land drains was used.

**Table 3.1.9 Disposal methods in the Severn catchment**

| Disposal Method | % Sites Visited |
|---|---|
| Soakaway | 11 |
| Landspreading | 89 |
| Off-site Disposal | 0 |
| Direct Discharge | 0 |

**Pollution Prevention Measures**

Farmers were encouraged to permanently block drain holes from dipping baths - the risks of having temporary bungs was highlighted. Management of flocks after dipping was also discussed with the need to keep freshly dipped sheep well away from watercourses. Careful disposal of used chemical containers was also an issue that was raised as several properties had stores of used chemical containers in an area that posed an unacceptable risk of pollution.

Although general awareness of the pollution potential of dipping operations was high, a large number of farmers were under the impression that synthetic pyrethroid dips were safer for the environment as well as being safer for the operator – so the toxicity of these dips was stressed.

Pollution prevention guidelines were distributed to all sheep farmers and delivered (with informative letters) to properties where the occupier could not be located. Letters requesting remedial measures or changes in practices were sent when necessary.

Information highlighting the pollution risks posed by sheep dipping operations was displayed at the West Midlands Show and Science in the Square in Shrewsbury. A display trailer was also taken to an Agricultural Training Board (ATB) mobile dipping demonstration day at Adfa. A twenty-five minute interview specifically dealing with the sheep dip issue was given on a local radio agricultural programme.

A talk was held for ATB groups at Cefn Coch and a discussion evening for the Powys Grassland Association held at Forden, during both of which, the potential for pollution arising from sheep dipping activities was emphasised.

**Overall Risk Assessment**

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

| *Risk Category* | *% Sites Visited* |
|---|---|
| High | 12 |
| Medium | 38 |
| Low | 50 |

## 3.1.3 Teme catchment

### 3.1.3.1 Stream chemistry

Water column samples were taken from two sites in the Teme catchment between May and November 1998 (Table 3.1.10; Fig. 3.1.5).

Exceedances of MAC EQS limits for cypermethrin were recorded at both sites. One failure was recorded on the Teme (map ref: C1) in October and three were recorded on the Unk (map ref: D1), in the months of October, June and August.

Only one of the sites failed the MAC EQS for propetamphos, which was on the River Unk in June.

Flumethrin was recorded at both sites during October.

**Table 3.1.10 A summary of positive water column sampling results for the Teme catchment. EQS failures in bold.**

| SITE (Name And Map Reference) | Site code | Determinands with positi results | Max (ng/l) | No. samples | No. positive |
|---|---|---|---|---|---|
| Teme (C1) | 13631540 | Diazinon | 17 | 7 | 1 |
| | | Cypermethrin | **2** | 7 | 1 |
| | | Flumethrin | 4 | 7 | 1 |
| Unk (D1) | 20912455 | Propetamphos | **104** | 7 | 1 |
| | | Cypermethrin | **24** | 7 | 3 |
| | | Flumethrin | 2 | 7 | 1 |

### 3.1.3.2 Stream biology

A total of 25 sites were surveyed in the Teme catchment (Fig. 3.1.5).

**River Teme**

Seventeen sites were sampled on the Teme (upstream of Dutlas) in the July survey. The survey indicated there was no evidence of an impact caused by sheep dip chemicals in the catchment. With the exception of Cwm Bugail (site 5), all samples were of good biological quality with plenty of sensitive life being present. Cwm Bugail was found to be affected by a small organic problem from an upstream farm.

**River Unk**

Eight sites were sampled on the River Unk in the summer and autumn survey. In the summer survey, the Unk at Clun and Bicton (Sites 18 and 19) was of poor biological quality with very little sensitive life being present in the samples. Further investigation failed to pinpoint the source of the decline (due to partial recovery), although it is suspected that sheep dip chemicals were the cause. In the autumn survey the Unk at Clun (site 18) continued to be of poor biological quality, which also could not be traced, despite further bankside sampling. The rest of

the samples were of good biological quality in both the summer and autumn survey and there was no evidence of sheep dip chemicals having affected these sites.

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Teme; Dutlas | SO 2120 7820 | 104 | |
| 2 | Dutlas trib; Dutlas | SO 2100 7780 | 102 | |
| 3 | Warren Brook; B4355 | SO 2020 7930 | 113 | |
| 4 | Warren Brook; Carregyfran | SO 1830 7890 | 112 | |
| 5 | Cwm Bugail; Radnorshire Arms | SO 1960 7970 | 54 | |
| 6 | Teme; Beguildy | SO 1910 8020 | 77 | |
| 7 | Deuddwr Brook; Felindre | SO 1690 8110 | 72 | |
| 8 | Teme; Felindre | SO 1700 8150 | 85 | |
| 9 | Llanllwyd; The Moat | SO 1880 8050 | 60 | |
| 10 | Cil Owen Brook; confl. | SO 1620 8060 | 84 | |
| 11 | Deuddwr Brook; Tansomalia | SO 1600 8010 | 77 | |
| 12 | Deuddwr Brook; Llanrhys | SO 1560 7860 | 89 | |
| 13 | Rheuddwr Brook; confl. | SO 1640 8220 | 86 | |
| 14 | Medwaledd trib; Confl. | SO 1590 8380 | 81 | |
| 15 | Nant Rhydyfedwr; Anchor | SO 1640 8490 | 96 | |
| 16 | Rheuddwr Brook; u/s lake | SO 1660 8460 | 84 | |
| 17 | Teme; Cwmgwyn Hall | SO 1380 8270 | 104 | |
| 18 | Unk; Clun | SO 2980 8120 | 36 | 38 |
| 19 | Unk; Bicton | SO 2890 8260 | 52 | 68 |
| 20 | Unk; Birches Mill | SO 2850 8440 | 114 | 64 |
| 21 | Unk; Cefn Einion | SO 2820 8600 | 92 | 77 |
| 22 | Knuck Trib.; confl. | SO 2770 8650 | 64 | 54 |
| 23 | Churchtown trib; confl. | SO 2750 8740 | 86 | 64 |
| 24 | Unk; Lower Edenhope | SO 2720 8890 | | 22 |
| 25 | Unk; Lower Dolfawr | SO 2510 8870 | 80 | 58 |

**Table 3.1.11 Biological results for the Teme catchment for summer and autumn sheep dip survey**

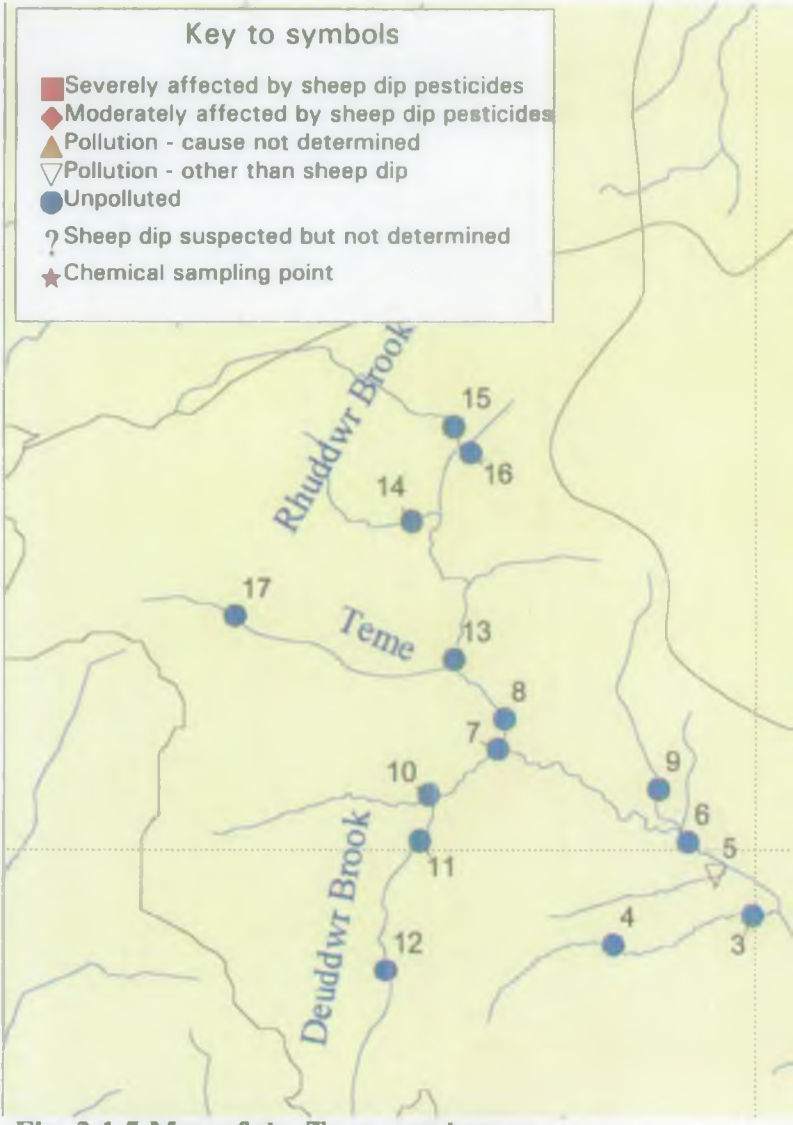
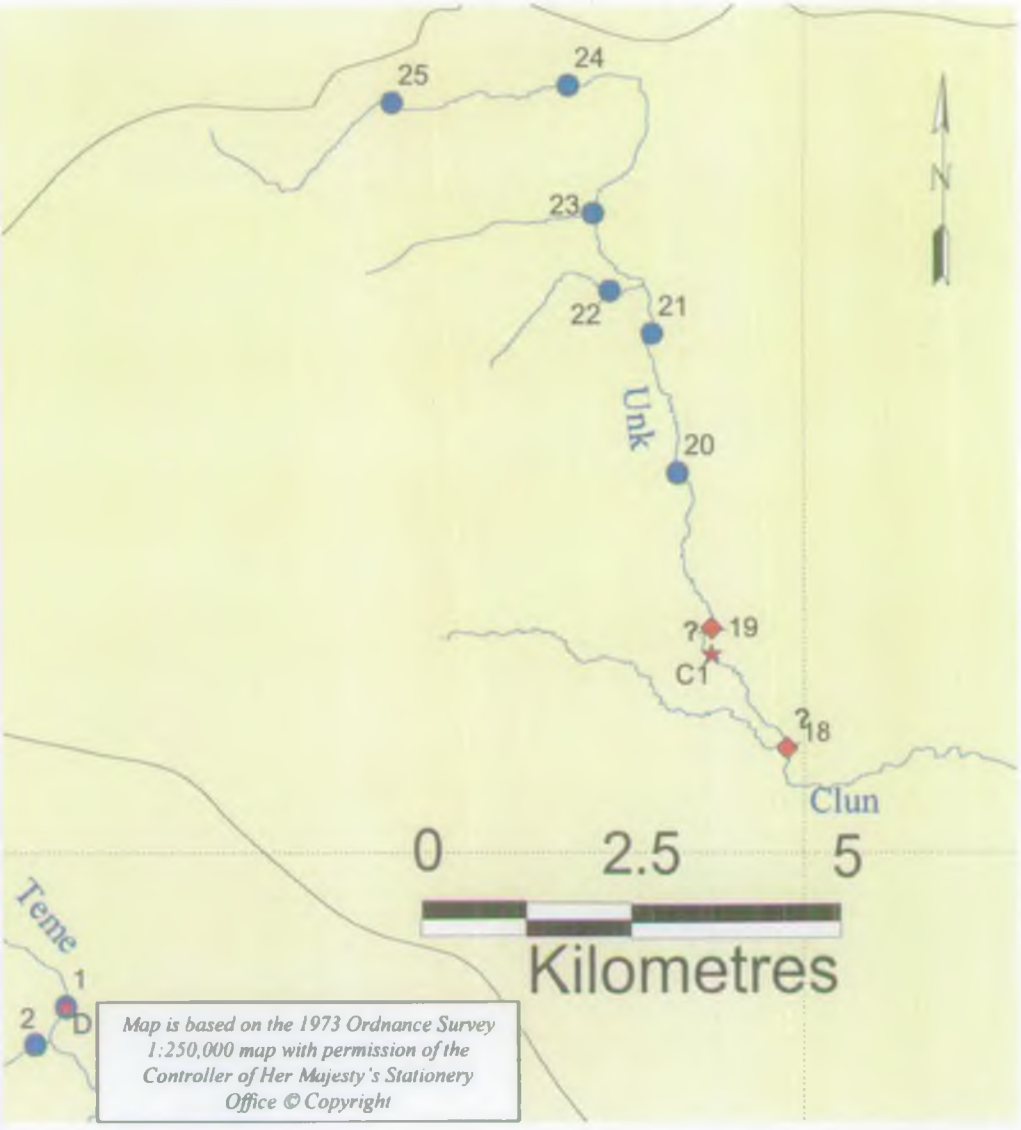



**Fig. 3.1.5 Map of the Teme catchment**




*Map is based on the 1973 Ordnance Survey 1:250,000 map with permission of the Controller of Her Majesty's Stationery Office © Copyright*

### 3.1.3.3 Farm visit programme

Fifteen properties within the Teme catchment were visited, all of which were occupied by sheep farmers using some type of treatment.

**Type of treatment**

Organophosphate based sheep dips were the most commonly used treatment, followed by the use of pour-ons. Synthetic pyrethroid based dips were also used but by a smaller number of farmers. None of the farmers werereported to have used injection treatments.

**Table 3.1.12 Treatment methods used in the Teme catchment**

| Treatment method | % sites visited |
|---|---|
| OP dips | 53 |
| SP dips | 14 |
| SP & OP dips | 0 |
| Injection | 0 |
| Pour on | 19 |
| Don't know | 14 |

**Sheep dipping structures**

Generally, the dipping facilities were in a good state of repair and none of the baths were found to have drain holes. The structures were all in close proximity to a watercourse, although not within 10 metres.

**Chemical stores**

On all sites, treatments were bought when needed – there was no long term storage.

**Disposal**

All farmers reported to spread used dip. Generally the dip is diluted with either water or slurry and spread on high ground.

**Table 3.1.13 Disposal methods in the Teme catchment**

| Disposal Method | % Sites Visited |
|---|---|
| Soakaway | 0 |
| Landspreading | 100 |
| Off-site Disposal | 0 |
| Direct Discharge | 0 |

**Pollution Prevention Measures**

Due to the close proximity of most dipping facilities to watercourses, the importance of finding a safe route to return sheep to pastures was stressed.

Pollution prevention guidelines were distributed to all sheep farmers and delivered (with informative letters) to properties where the occupier could not be located.

A display trailer was taken to the Bishops Castle livestock market to raise awareness of pollution potential arising from sheep dipping.

**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 | 0 |
| Medium | 21 |
| Low | 79 |

## 3.1.4 Sewage Treatment Works monitoring

Due to the detection of sheep dip pesticides in ad-hoc samples of effluent from Welshpool and Newtown Sewage Treatment Works during the 1997 survey, regular samples were programmed as part of this year's survey.

Seven samples were taken at Welshpool STW between June and November. Diazinon was detected in all samples from Welshpool taken during September to November, with a maximum concentration of 206 ng/l. Propetamphos was detected in two samples (max 162 ng/l) and low levels of cypermethrin in three samples. Welshpool has a frequent large sheep market, which is the anticipated source of these pesticides.

Sheep dip pesticides were not detected in any of the fifteen samples taken from Newtown between April and December. This was expected, as a former sheep pelt fellmongery business in the town has changed to a cattle hide tanning operation during 1998.

Severn Trent Water Ltd. have undertaken a limited assessment of sheep dip chemicals in the crude sewage influent at all of its treatment works in Upper Severn area which receive abattoir

or livestock market trade effluent. This survey produced little positive information, consequently the company is to focus on the specific trade effluents, in particular Welshpool livestock market in 1999.

**Table 3.1.14 Positive Results from sampling Welshpool sewage treatment works. Blank records represent no detectable presence of a sheep dip chemical.**

| Site | Date | Diazinon ng/l | Propetamphos ng/l | Cypermethrin ng/l | Flumethrin ng/l |
|---|---|---|---|---|---|
| Welshpool STW | 11/9/98 | 140 | 17 | | |
| | 01/10/98 | 88 | | 2 | |
| | 09/10/98 | 68 | | 4 | |
| | 11/11/98 | 206 | 162 | 1 | |

## 3.1.5 Assessment of recovery of previously impacted sites

Biological sampling to assess recovery from the 1997 declines was carried out in May/June 1998, and took two forms. Any problems that were detected from routine monitoring relied on the routine monitoring sites to assess recovery, whereas declines found by the sheep dip survey relied upon upstream and downstream resamples of the pollution source.

It was found that all but four of the declines had completely recovered, namely the Afon Llwydiarth, the Mochdre Brook at Bryn Daddlau, the Afon Eirth and the Afon Garno. (The Afon Garno was not included in the 1997 report because the problem was detected after the 1997 report was completed. It was included in the 1998 recovery survey). The lack of recovery in the majority of these watercourses was usually limited to the minor tributary first impacted by the dip. The main watercourses were generally found to have recovered. The Afon Eirth and Afon Garno were impacted by sheep disposed of to soakaway or spread to land respectively. It is believed that these disposal methods are the likely reason why these watercourses have not recovered.

## 3.1.6 Upper Severn area recommendations

1. Future work should focus on the specific needs of Upper Severn area rather than being driven by another all Wales or Agency wide survey. The widespread evidence of sheep dip chemicals in Upper Severn watercourses with associated biological impact has been clearly demonstrated.

2. Resources should be committed to reassess and investigate as necessary those catchments where either a positive chemical detection of sheep dip was made or biological impact detected during 1998 but the source was not identified.

3. Biological surveys of impacted sites, both survey and pollution incidents should be undertaken to assess recovery. Sites with poor biological recovery from impacts in 1997 and 1998 should have further chemical analysis of sediments to assess recovery inhibition.

4. Sites with repeated incidence of biological impact should be surveyed for fish population to assess if starvation effects may be taking place.

5. The opportunity afforded by the introduction of the Groundwater Regulations must be taken to visit all applications for disposal authorisations to assess not only the disposal risk to both groundwaters and surface waters, but also the dipping and handling facilities. Sufficient resources must be made available to undertake such inspections.

6. There is a need to develop a safe and practical solution to the problem of rainwater collecting in baths when not in use, such as the provision of 'pig arc' style covers.

7. The extent, reason for and impact on sewage treatment of sheep dip chemicals in trade effluents from livestock markets should be assessed in collaboration with Severn Trent Water Ltd.

8. The local awareness campaign using agricultural shows, livestock markets, local radio and farmer group meetings should continue, with specific response to the requirements of the new regulations.

All departments in routine contact with farmers and landowners in sheep rearing areas should participate in the awareness campaign (e.g the distribution of leaflets) i.e Fisheries, Flood Defence client and contract, Development Control and Abstraction Control.

# 3.2 NORTHERN AREA

Twenty-eight river subcatchments were monitored for sheep dip pesticides from April 1998. A number of positive results were recorded at the river sites with 21 of the 28 sites recording at least one positive result for organsphosphate (OP) chemicals and with 12 of the 28 giving at least one positive synthetic pyrethoid (SP) result.

Whilst in the majority of cases the positive results were well below the Maximum Allowable Concentration (MAC) EQS for OP chemicals, two sites, the Dwr Ial (Clwyd) and the Afon Merddwr (Conwy) had peak results of 198 and 436 ng/l respectively.

In the case of the Dwr Ial, a subsequent biological investigation identified a discharge from a dip site that ultimately resulted in formal action being taken. A report has been prepared and was, at the time of writing under consideration by the Environment Agency Wales Legal Department.

A number of site inspections were undertaken in the Afon Merddwr which included a re-visit of the high risk sites identified in 1997 to determine if the remedial works agreed with the farmers had, in fact, been undertaken.

Details on a catchment by catchment basis are given below.

## 3.2.1 Gwyrfai catchment

### 3.2.1.1 Stream chemistry

One site was sampled at the A487, Bontnewydd (Table 3.2.1). This gave two positive results for both diazinon and propetamphos. The maximum concentration recorded was 42 ng/l of propetamphos.

### 3.2.12 Stream biology

A total of eight sites were sampled during August (Table 3.2.2, Fig. 3.2.1). All of these sites were reassessed in November. During the August survey, seven out of the eight sites were considered to be unpolluted and were of good to excellent biological quality. The biological quality at site 6, on a tributary immediately adjacent to a farmyard, had been reduced by the impact of organic pollution.

In November, six of the eight sites surveyed were found to be unpolluted. This included site 6, where recovery had taken place. The remaining two sites (1 and 3) had been affected by pollution, but the cause was not determined.

**Table 3.2.1 A summary of water column sampling results for the Northern Area catchments EQS failures in bold**

| Site name and description | Site Code | Determinands with positive results | Max (ng/l) | No. samples | No. positive |
|---|---|---|---|---|---|
| R Gwyrfai A487 Bontnewydd | 22504 | Diazinon | 8 | 7 | 2 |
| A Hesbin @ Pont Eyarth Uchaf | 1328 | No positive results | - | 9 | 0 |
| Dwr Ial @ Pont Telpyn | 1453 | Diazinon | 198 | 9 | 5 |
| AClywedog (Clwyd)@Rhwng y Ddwy Afon | | Diazinon | 6 | 9 | 1 |
| Afon Twrch u/s Afon Dyfyrdwy | 202 | Cypermethrin | 2 | 11 | 1 |
| A Llafar Pont Y Llafar | 209 | Diazinon | 24 | 9 | 2 |
| | | Flumethrin | 1 | 9 | 1 |
| R Dwyfawr Old Dolbenmaen Bridge | 22501 | Diazinon | 8 | 9 | 1 |
| | | Cypermethrin | 6 | 9 | 2 |
| | | Flumethrin | 2 | 9 | 1 |
| | | Propetamphos | 42 | 7 | 2 |
| R Dwyfach Bont Fechan | 22682 | Diazinon | 47 | 8 | 2 |
| RMerddwr (Conwy) Pentrefoelas | 25013 | Diazinon | 436 | 8 | 1 |
| R Elwy Llanfair T H | 2503 | Diazinon | 27 | 7 | 1 |
| | | Propetamphos | 21 | 7 | 2 |
| R Conwy Ysbyty Ifan | 25136 | Diazinon | 72 | 8 | 2 |
| Afon Roe (Conwy) Pont Farchwel | 25368 | Cypermethrin | 3 | 8 | 1 |
| R Cefni Llangefni | 27505 | Diazinon | 21 | 7 | 2 |
| R Braint Dwyran | 27635 | Diazinon | 38 | 7 | 2 |
| | | Cypermethrin | 4 | 7 | 1 |
| A Ddu Llanfairfechan | 28605 | Diazinon | 6 | 7 | 1 |
| | | Cypermethrin | 1 | 7 | 1 |
| A Ceiriog u/s Pandy STW | 557 | Diazinon | 15 | 9 | 1 |
| R Wnion A470 Dolgellau | 20004 | No positive results | - | 8 | 0 |

**Table 3.2.2 Biological results for the Gwryfai catchment summer and autumn 1998 sheep dip surveys**

| Site No. | Site description | NGR | Summer | Autumn |
|---|---|---|---|---|
| 1 | Gwyrfai; 200m d.s bridge at Bontnewydd | SH 4825 5995 | 80 | 52 |
| 2 | Gwyrfai; Waunfawr nr. Riding Stables | SH 5090 5950 | 83 | 69 |
| 3 | Gwyrfai; d.s Cwellyn WTW discharge | SH 5360 5720 | 72 | 61 |
| 4 | Gwyrfai; u.s Betws Garmon | SH 5475 5630 | 74 | 59 |
| 5 | Trib. Of Gwyrfai; Plas Glan yr Afon | SH 5020 5995 | 97 | 118 |
| 6 | Trib. Of Gwyrfai; Treflan Isaf | SH 5370 5845 | 65 | 83 |
| 7 | Trib. Of Gwyrfai; South of caravan park | SH 5340 4870 | 103 | 108 |
| 8 | Trib. of Gwyrfai; North of caravan park | SH 5325 5895 | 112 | 87 |

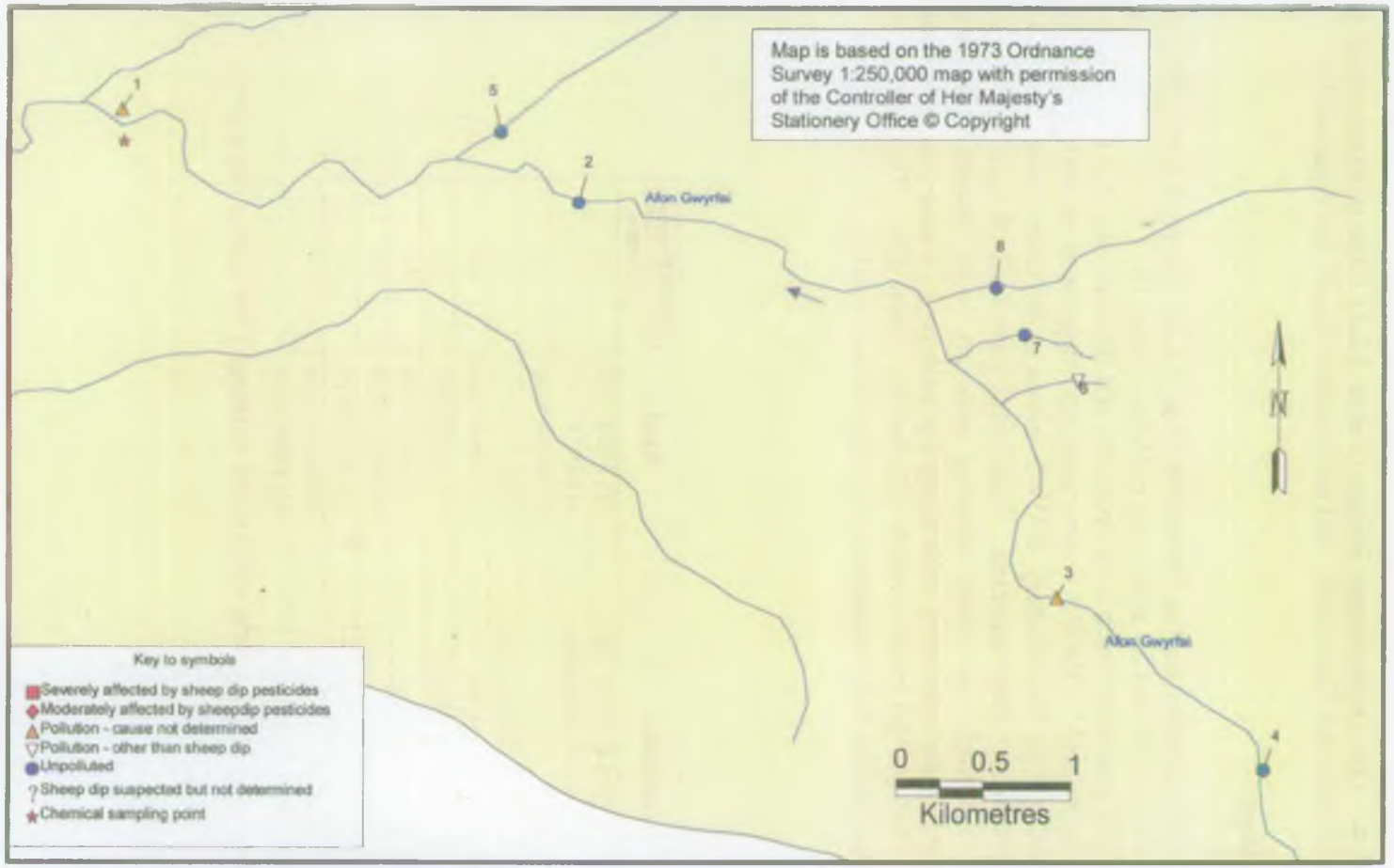



**Fig. 3.2.1 Map of Gwyrfai catchment**

## 3.2.2 Ddu catchment

### 3.2.2.1 Stream chemistry

One site was sampled at Old Dolbenmaen Bridge (Table 3.2.1). One positive result was recorded for each of diazinon and flumethrin, and two positive results for cypermethin.

### 3.2.2.2 Stream biology

A total of eleven sites were sampled during November (Fig. 3.2.2). Three of these sites were found to have been severely affected by sheep dip pollution (sites 10, 11, 12). There was a significant drop in BMWP scores between sites upstream and downstream of a farm, where a sheep dip structure was located. BMWP scores remained depressed at both of the sites surveyed further downstream on the tributary. BMWP scores at the lower sites surveyed on the main Afon Ddu were poorer than expected. These sites were located downstream of an un-named tributary. Although no sheep dipping structure was located, the faunal compositions at these sites were consistent with sheep dip pollution. It was estimated that at least 1.6 km of the catchment had been severely affected by sheep dip. The downstream extent of the impact could not be fully assessed as the river is inaccessible.

| Site No. | Site description | NGR | BMWP score |
|---|---|---|---|
| | | | Autumn |
| 9 | Un-named trib. u.s farm yard & sheep dip | SH 6990 7460 | 84 |
| 10 | Un-named trib. u.s farm yard & sheep dip | SH 6975 7460 | 35 |
| 11 | Un-named trib. d.s Gerlan | SH 6950 7440 | 43 |
| 12 | Un-named trib. u.s confluence with A. Ddu | SH 6930 7410 | 27 |
| 13 | Glan Sais u.s confluence with A. Ddu | SH 6980 7360 | 69 |
| 14 | Ddu u.s confluence with A. Glan Sais | SH 6980 7365 | 83 |
| 15 | Ddu u.s footbridge | SH 6940 7390 | 84 |
| 16 | Ddu u.s roadbridge d.s small stream | SH 6930 7410 | 75 |
| 17 | Ddu drainpipe d.s roadbridge | SH 6930 7410 | 30 |
| 18 | Ddu d.s roadbridge | SH 6920 7400 | 17 |
| 19 | Ddu Nant y Pandy u.s roadbridge | SH 6880 7420 | 15 |

**Table 3.2.3 Biological results for the Ddu catchment autumn 1998 sheep dip survey**

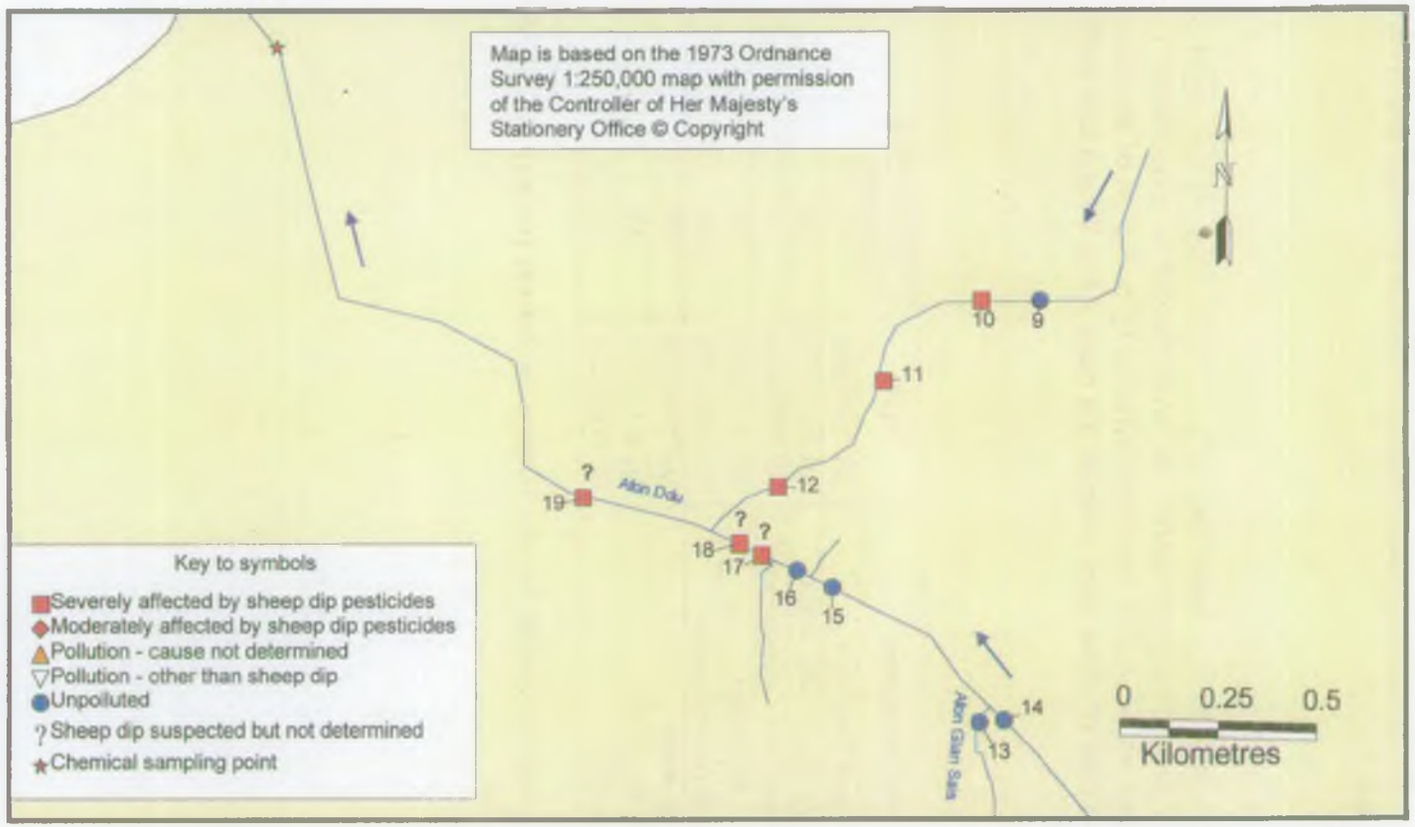



**Fig. 3.2.2 Map of Ddu catchment**

## 3.2.3 Wnion catchment

### 3.2.3.1 Stream chemistry

One site was sampled at the A470 Dolgellau, where one positive result of 4 ng/l was recorded for the SP dip flumethrin (Table 3.2.1.).

### 3.2.3.2 Stream biology

A total of 8 sites were surveyed during September (Fig. 3.2.3). Four of the eight sites surveyed were found to be of good biological quality and were classed as 'unpolluted' (sites 22, 24, 25, 26). Four sites were considered to have been affected by pollution of an unknown cause (sites 20, 21, 23, 27). Three of these sites were on the main Afon Wnion and one was on the Afon Harnog.

| Site No. | Site description | NGR | BMWP score |
|---|---|---|---|
| | | | Autumn |
| 20 | Wnion; bridge @ Dolgellau | SH 7280 1801 | 32 |
| 21 | Wnion; bridge next to ARC depot | SH 7385 1790 | 38 |
| 22 | Wnion; Caravan Park @ Bontnewydd | SH 7720 2010 | 76 |
| 23 | Wnion; A487 roadbridge | SH 7950 2100 | 59 |
| 24 | Wnion; next to disused railway | SH 8180 2295 | 87 |
| 25 | Arran; Pont yr Arran | SH 7295 1780 | 73 |
| 26 | Eiddon; Pont Rhydmain | SH 8050 2220 | 67 |
| 27 | Harnog; Pont Gawr | SH 8160 2230 | 33 |

**Table 3.2.4 Biological results for the Wnion catchment for autumn 1998 sheep dip survey**

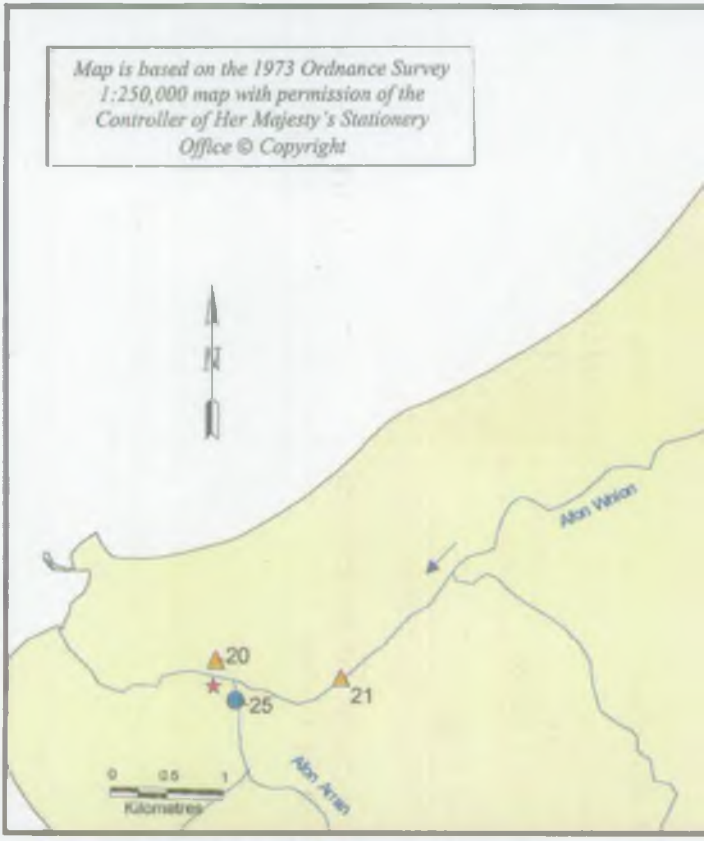
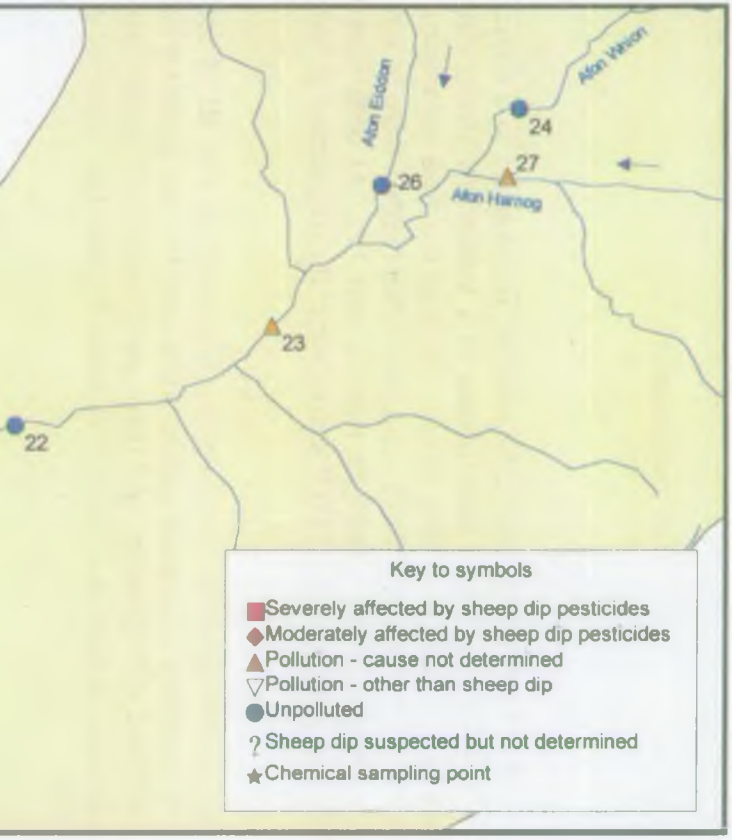



**Fig. 3.2.3 Map of Wnion catchment**


Afon Eidda
Afon Hanog
24
26
27
23
22
Key to symbols
Severely affected by sheep dip pesticides
Moderately affected by sheep dip pesticides
Pollution - cause not determined
Pollution - other than sheep dip
Unpolluted
Sheep dip suspected but not determined
Chemical sampling point

## 3.2.4 Rhiw Saeson (Dyfi) Catchment

### 3.2.4.1Stream chemistry

Water quality monitoring was not carried out in this catchment.

### 3.2.4.2 Stream biology

Two sites were surveyed on the Afon Rhiw Saeson in September, in response to a request to sample immediately upstream and immediately downstream of a vulnerable sheep dipping structure. Six sites were assessed in the November survey. Both of the sites (upstream and downstream of the reported sheep dipping structure) surveyed in September were suspected to have been severely polluted by sheep dip pesticides (site 32 and 33). At both sites few taxa were present and abundances were low. BMWP scores were also depressed at both of the sites surveyed.

During the November survey, it was apparent that recovery had occurred and all of the six sites surveyed were of good to excellent biological quality. However it is not known whether sites 28 –31 and 34 were unaffected in September, and these are therefore not categorised on Figure 3.2.4. It was suspected that at least 0.23km of the Rhiw Saeson had been severely affected by sheep dip pollution.

| Site No. | Site Description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | September | November |
| 28 | Rhiw Saeson; u.s Pentre Celyn | SH 8940 0580 | - | 57 |
| 29 | Rhiw Saeson; d.s Pentre Celyn | SH 8930 0570 | - | 64 |
| 30 | Cwm; u.s confluence with A. Saeson | SH 9020 0530 | - | 103 |
| 31 | Rhiw Saeson; d.s Farm | SH 9030 0380 | - | 70 |
| 32 | Rhiw Saeson; u.s railway bridge | SH 8990 0310 | 23 | - |
| 33 | Rhiw Saeson; d.s roadbridge Llanbrynmair u.s farm | SH 8990 0290 | 29 | 60 |
| 34 | Rhiw Saeson; d.s farm | SH 8990 0280 | - | 55 |

**Table 3.2.5 Biological results for the Rhiw Season catchment in September and November 1998 sheep dip survey**

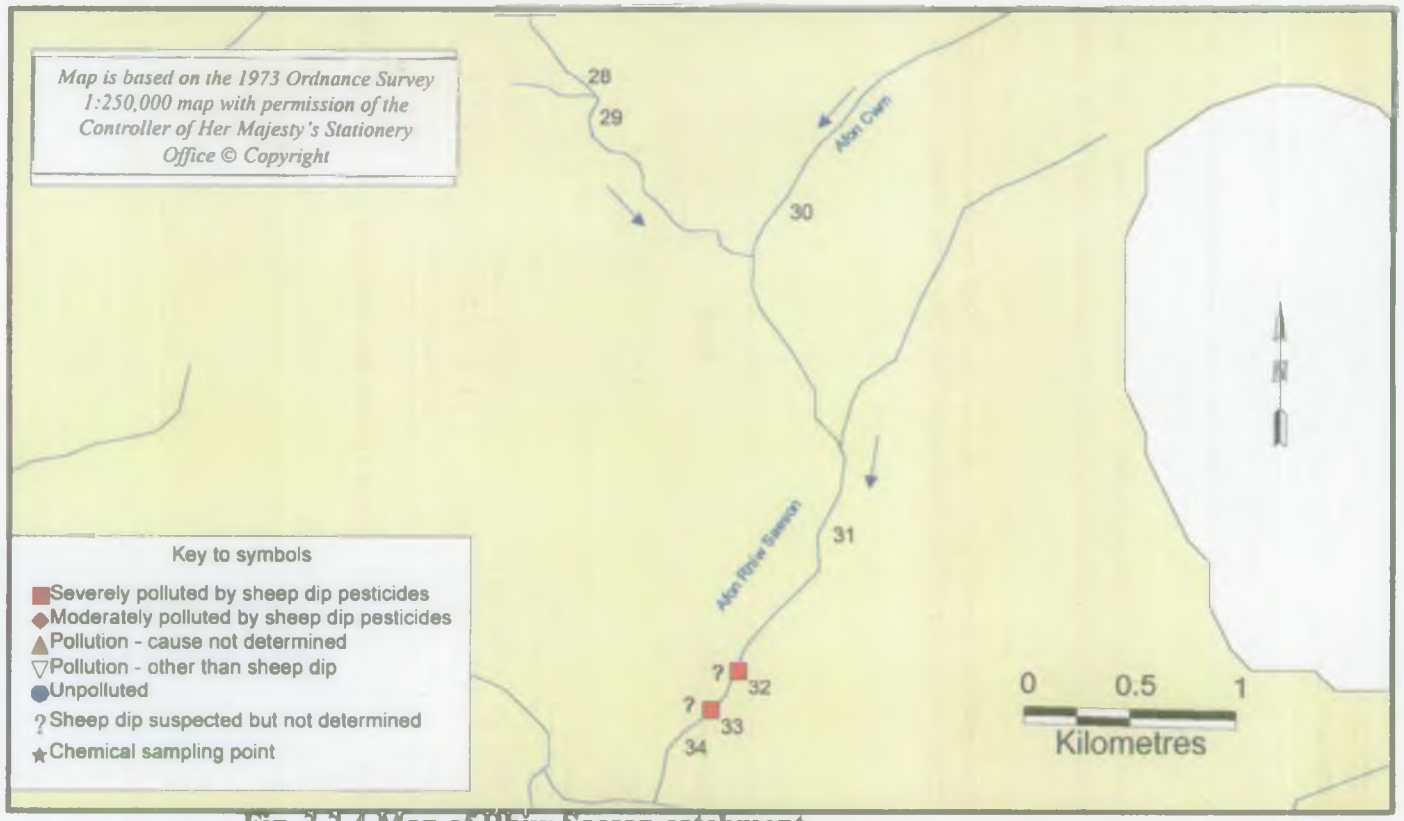



**Fig. 3.2.4 Map of Rhiw Saeson catchment**

## 3.2.5 Anglesey rivers

### 3.2.5.1 Stream chemistry

One site was sampled at Dwyran on the Braint, where two positive results for diazinon and for cypermethrin were recorded, one of the latter being four times the MAC.

One site was sampled on the Cefni at Llangefni, where two positive results were recorded for diazinon, the maximum concentration was 21ng/l (Table 3.2.1)

### 3.2.5.2 Stream biology

**Braint catchment**

Due to unfavourable river conditions it was possible to survey only two sites during November (Fig. 3.2.5). Biological quality at both of these sites was considered to be good.

**Cefni catchment**

A total of five sites were surveyed during November (Fig. 3.2.6). Four of these sites (sites 37, 39, 40, and 41) were considered to be unpolluted and one (site 38) was affected by pollution of an unknown cause.

| Site No. | Site description | NGR | BMWP score |
|---|---|---|---|
| | | | Autumn |
| 35 | Braint; d.s roadbridge | SH 4730 6940 | 58 |
| 36 | Braint; d.s roadbridge | SH 5230 7270 | 62 |
| 37 | Cefni; u.s Cefni reservoir d.s Llyn Frogwy | SH 4290 7590 | 110 |
| 38 | un-named trib. of Cefni; u.s Cefni reservoir | SH 4460 7820 | 26 |
| 39 | un-named trib. of Cefni; u.s Cefni reservoir | SH 4510 7840 | 46 |
| 40 | un-named trib. of Cefni; @ Tre Ysgawen Hotel | SH 4530 8110 | 43 |
| 41 | un-named trib. of Cefni; u.s Llangefni | SH 4620 7630 | 50 |

**Table 3.2.6 Biological results for the Anglesey rivers for autumn 1998 sheep dip survey**

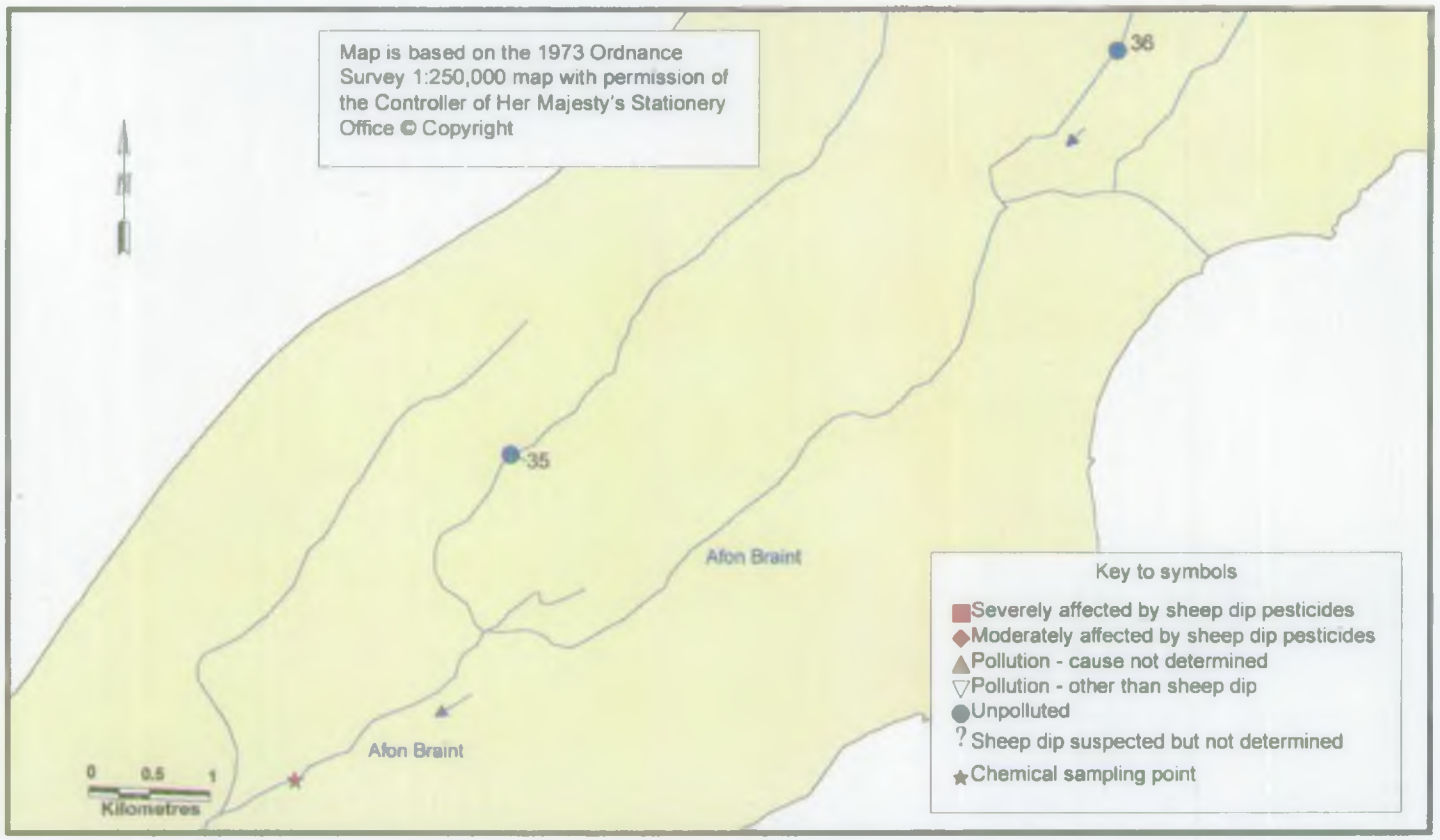



**Fig. 3.2.5 Map of Braint catchment**

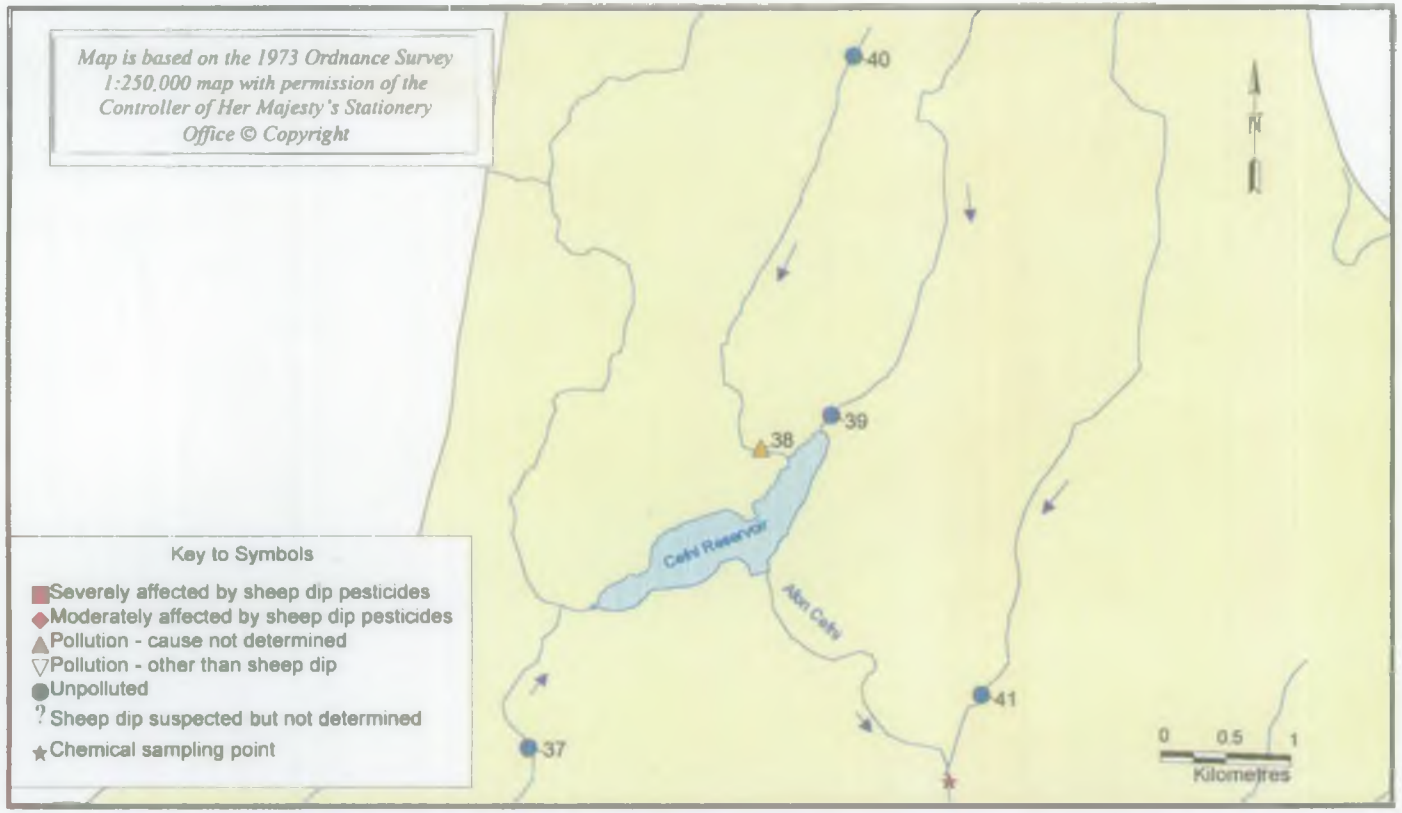



**Fig. 3.2.6 Map of Cefni catchment**

## 3.2.6 Conwy catchment

### 3.2.6.1 Stream chemistry

One site was sampled on the Roe at Pont Farchwel upstream of the Afon Conwy, where there were two positive results for cypermethin. (Table 3.2.1)

One site was sampled on the Conwy at Ysbyty Ifan, where two positive results were recorded for diazinon, the maximum concentration being 72ng/l (Table 3.2.1).

One site was sampled at Pentrefoelas on the Merddwr, as this river had been found to have high levels of sheep dip compounds in 1997. Whilst only one positive result for diazinon was recorded, at 436 ng/l. This was greater than four times the MAC of 100ng/l. A visit campaign followed to identify potential sources.

### 3.2.6.2 Stream biology

#### Roe catchment

A total of four sites were sampled during July (Fig. 3.2.7); the Roe catchment was not included in the autumn survey programme as it was considered to be of lower priority for this project. All of the four sites assessed were considered to be unpolluted.

#### Merddwr catchment

A total of seven sites were surveyed during May (Fig. 3.2.8). Six of these were reassessed in November, with the addition of one other site close to the chemical sampling point. During the May survey, six of the seven sites were considered to be unpolluted. Site 48, on an un-named tributary, adjacent to a farm, was considered to have been affected by pollution of an unknown cause.

The autumn survey showed that the majority of the catchment was unpolluted. Two sites, one on the main Afon Merddwr at Pentrefoelas, the other on an un-named tributary (sites 49 and 52) had been affected by pollution of an undetermined cause

#### Conwy catchment

A total of seven sites were sampled during July (Fig 3.2.8); the Conwy catchment was not included in the autumn survey programme as it was considered to be of lower priority. Of the seven sites assessed, two were found to be unpolluted. The remaining five were affected by pollution of an unknown cause. Three of these sites were on the Afon Conwy, the remaining two were on Afon Serw, and the Nant Adwy'r-llan.

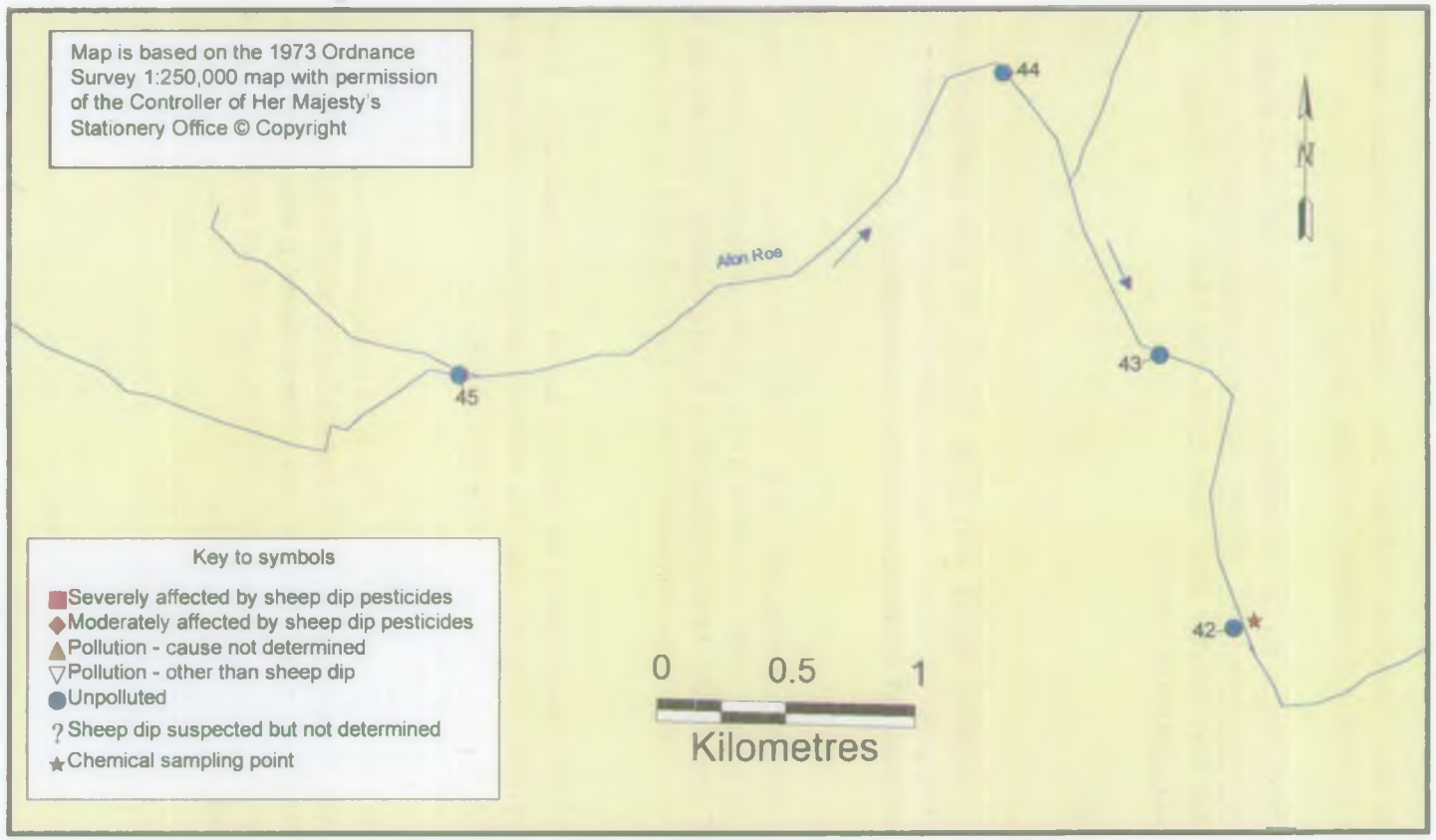



**Fig. 3.2.7 Map of Roe catchment**

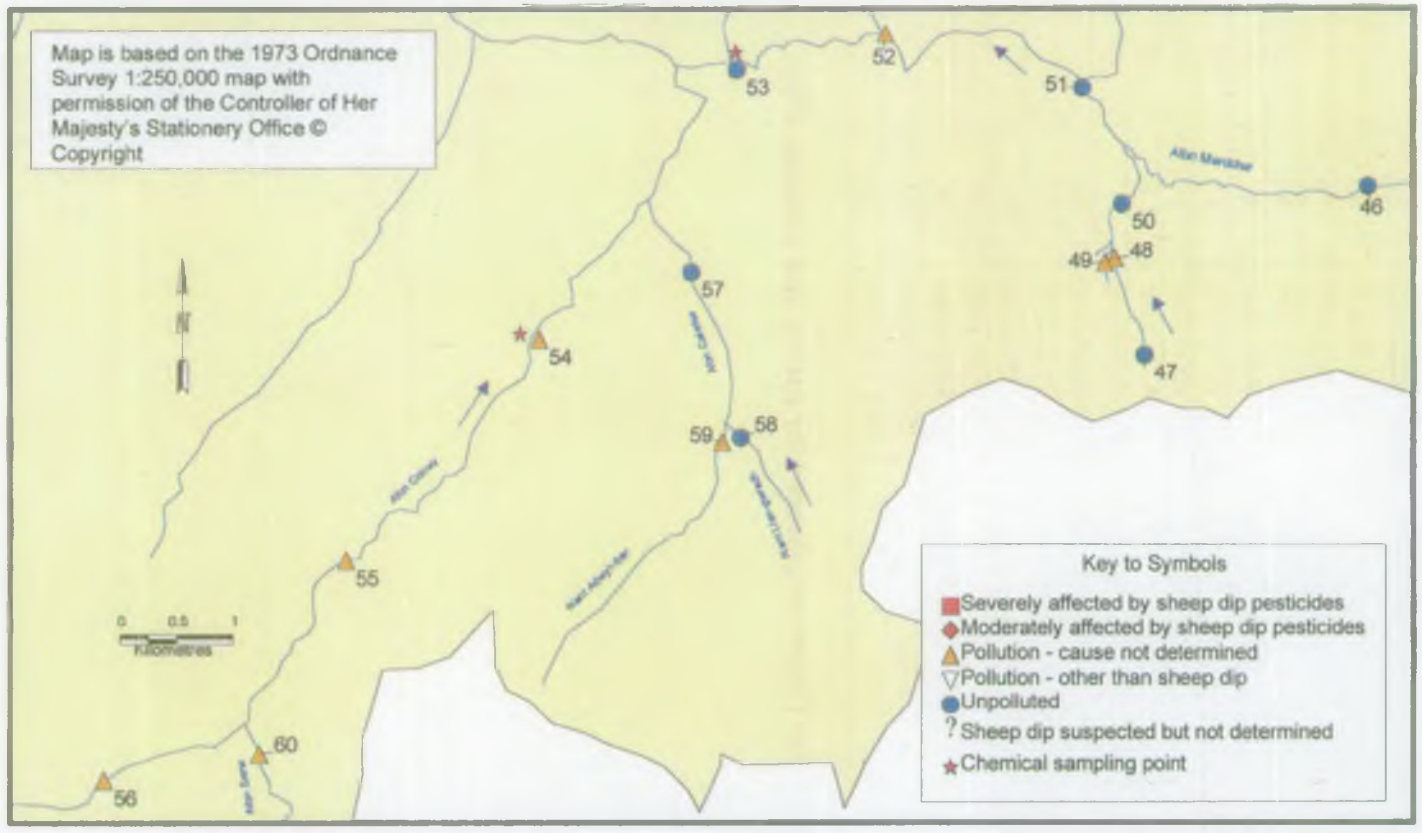



**Fig. 3.2.8 Map of upper Conwy catchment**

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 42 | Roe; d.s Pont Farchwel | SH 7670 6980 | 75 | - |
| 43 | Roe; u.s Pontwgan | SH 7650 7080 | 85 | - |
| 44 | Roe; Roewen footbridge | SH 7590 7190 | 63 | - |
| 45 | Roe; d.s Pont Hafodty Gwyn | SH 7380 7070 | 102 | - |
| 46 | Merddwr; Glasfryn | SH 9170 4990 | 60 | 72 |
| 47 | Un-named trib. u.s farms (Bryn Ffynnon & Bryn Dedwydd) | SH 8960 4850 | 79 | - |
| 48 | Un-named trib. Adjacent to Hafodty Bach | SH 8940 4940 | 43 | 73 |
| 49 | Un-named trib. Hafodty Bach | SH 8940 4940 | 97 | 46 |
| 50 | Un-named trib. d.s Hafodty Bach (Garn Brys) | SH 8950 4980 | 73 | 94 |
| 51 | Merddwr; Rhydlydan | SH 8930 5080 | 80 | 67 |
| 52 | Merddwr; Pentrefoelas by Tourist Information | SH 8740 5140 | 132 | 54 |
| 53 | Merddwr; Pont Newydd | SH 8610 5120 | - | 104 |
| 54 | Conwy; Ysbyty Ifan | SH 8430 4870 | 40 | - |
| 55 | Conwy; Pennant Bridge | SH 8250 4690 | 37 | - |
| 56 | Conwy; u.s WTW | SH 8030 4500 | 21 | - |
| 57 | Caletwr; 25 m u.s roadbridge | SH 8570 4930 | 59 | - |
| 58 | Nant Llan Gwrach; u.s confluence @ Cerrigellgwm Isaf | SH 8630 4780 | 71 | - |
| 59 | Nant Adwyr Llan; u.s Cerrigellgwm Isaf ford | SH 8600 4800 | 42 | - |
| 60 | Serw; Serw Ford | SH 8170 4520 | 22 | - |

**Table 3.2.7 Biological results for the Conwy catchment for spring and autumn 1998 sheep dip surveys**

## 3.2.7 Dwyfor catchment

### 3.2.7.1 Stream chemistry

One site was sampled on the Dwyfawr at Old Dolbenmaen Bridge (Table 3.2.1). One positive result was recorded for each of diazinon and flumethrin, and two positive results for cypermethin.

One site was sampled at Bont Fechan on the Dwyfach, where two positive results were recorded for diazinon, the highest concentration being 48ng/l. One factor that could influence water quality is the presence of the discharge from Bryncir STW. The results of the monitoring for that effluent discharge are discussed later under ' 3.2.12 Sewage Treatment Works Monitoring'.

### 3.2.7.2 Stream biology

**Dwyfawr catchment**

A total of twelve sites were surveyed during August (Fig.3.2.9). Six of these were reassessed in November, and a further six sites were surveyed to help locate potential pollution sources.

Of the twelve sites assessed during August, nine sites were found to have a lower than expected biological quality (sites 61, 62, 63, 64, 65, 66, 70, 71, 76, Fig. 3.2.9). Six of these were suspected to have been severely affected by sheep dip pesticides (61 63, 64, 70, 71, 76) with few taxa being present and with low abundances of individuals. Two sites were thought to have been moderately affected by sheep dip pesticides (62, 65) as BMWP scores and taxon abundances were clearly depressed, but were slightly greater than in those sites suspected to be severely impacted. The impact on site 66 was attributed to a cause other than sheep dip pesticides. Overall, the August survey showed that the majority of the catchment, including stretches of the Afon Dwyfawr, Afon Henwy, and the Afon Cwm Llefrith, was suspected to have been moderately or severely affected by sheep dip pesticides. Only the Afon Ddu was found to be of good biological quality.

During the autumn survey, ten sites were considered to have been of lower than expected biological quality (sites 61, 64, 66, 67, 70, 71, 72, 76, 77, 78). Seven sites were suspected to have been severely impacted by sheep dip pesticides (sites 61, 64, 70, 71, 72, 76, 77) and one site was suspected to have been moderately impacted by sheep dip pesticides (site 66). Two sites were considered to have been impacted by causes other than sheep dip (sites 67 and 78). Of the areas surveyed during November, only the upper reaches of the Afon Dwyfawr were considered to be unpolluted. It was estimated that a total of 12.2 km. had been severely or moderately affected by sheep dip pesticides.

**Dwyfach catchment**

A total of three sites were surveyed in November in order to assess the impact of the discharge from Bryncir Sewage Treatment Works, which was found to contain sheep dip pesticides. All of the three sites (79, 80, 81) were found to have a lower than expected BMWP score, however the impact was thought to be caused by pollution other than sheep dip pesticides.

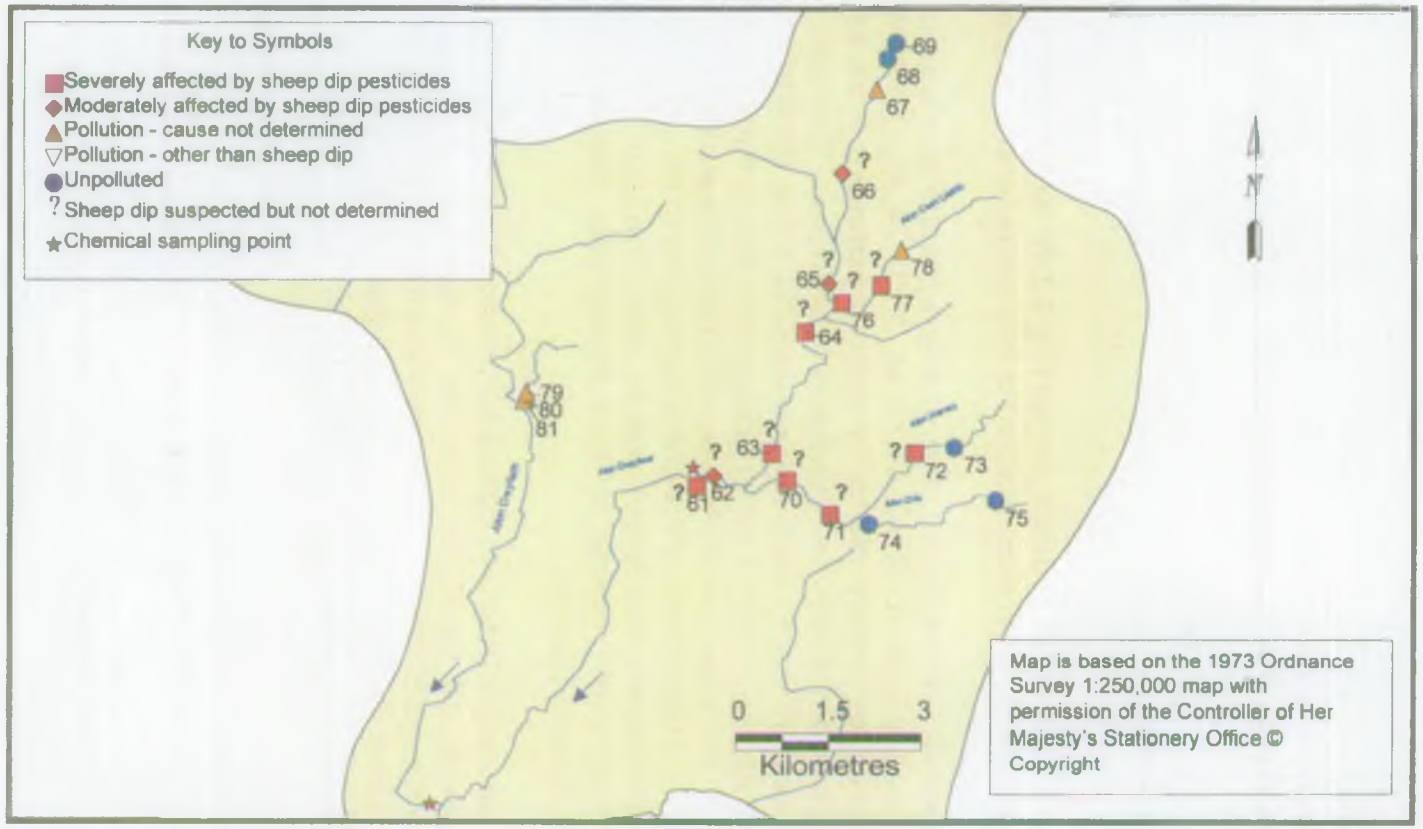



**Fig. 3.2.9 Map of Dwyfor catchment**

| Site No. | Site Description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 61 | Dwyfawr; Old bridge at Dolbenmaen | SH 5080 4300 | 33 | 17 |
| 62 | Dwyfawr; u.s WTW abstraction | SH 5099 4299 | 40 | - |
| 63 | Dwyfawr; Lodge Bridge | SH 5199 4330 | 30 | - |
| 64 | Dwyfawr; Pont Llyfangel | SH 5260 4520 | 36 | 13 |
| 65 | Dwyfawr; u.s Pont y Plas | SH 5300 4595 | 48 | - |
| 66 | Dwyfawr; d.s footbridge | SH 5320 4770 | 42 | 54 |
| 67 | Dwyfawr; u.s Braich y Dinas | SH 5385 4905 | - | 49 |
| 68 | Dwyfawr; d.s Blaen Pennant | SH 5405 4955 | - | 67 |
| 69 | Dwyfawr; u.s Blaen Pennant | SH 5420 4970 | | 69 |
| 70 | Henwy; d.s bridge at Brynkir Lodge | SH 5225 4290 | 35 | 23 |
| 71 | Henwy; u.s woollen mill at stepping stones | SH 5295 4235 | 32 | 32 |
| 72 | Henwy; d.s Cefn Coch Uchaf & Waen | SH 5440 4330 | - | 16 |
| 73 | Henwy; Pont y Pandy mill | SH 5495 4340 | 82 | - |
| 74 | Ddu; u.s road bridge | SH 5350 4220 | 64 | - |
| 75 | Ddu; u.s trib. From Llyn Ddu | SH 5560 4245 | 69 | - |
| 76 | Cwm Llefrith; c. 100m u.s A. Dwyfawr | SH 5320 4565 | 14 | 11 |
| 77 | Cwm Llefrith; Rhwngddwyafon | SH 5385 4590 | - | 25 |
| 78 | Cwm Llefrith; u.s Cwrt Isaf | SH 5420 4640 | - | 46 |
| 79 | trib. of Dwyfach; u.s garage @ Brincir | SH 4807 4438 | - | 47 |
| 80 | trib. of Dwyfach; u.s STW d.s garage | SH 4803 4429 | - | 39 |
| 81 | trib. of Dwyfach; d.s STW | SH 4800 4426 | - | 49 |

**Table 3.2.8 Biological results for the Dwyfor catchment for summer and autumn 1998 sheep dip surveys**

## 3.2.8 Dee catchment

### 3.2.8.1 Stream chemistry

The Ceiriog was sampled upstream of Pandy Sewage Treatment Works. Only one positive result was recorded for diazinon at 15ng/l (Table 3.2.1). Water quality sampling was not carried out in the Hirnant catchment

One site was sampled at on the Llafar at Pont-y-Llafar, where two positive results for diazinon were recorded, the highest at 24ng/l (Table 3.2.1)

The Twrch , sampled upstream of the Afon Dyfrdwy, had suffered from pollution following an incident in 1997 where some 8km of river had been affected by sheep dip pollution. The results of the monitoring showed that there was still some evidence of traces of cypermethrin and flumethrin entering the watercourse (Table 3.2.1) Follow up visits were undertaken within the catchment.

### 3.2.8.2 Stream biology

**Ceiriog catchment**

Eight sites in the Ceiriog catchment were sampled in August (Fig. 3.2.10). No impacts from sheep dip pesticides were detected although only a few farmers in the catchment had dipped due to the unusual weather conditions. At the lowest four sites (82, 83, 85 & 86) on the main river BMWP scores were lower than expected, although the family composition and abundances did not suggest an impact from sheep dip pesticides. The causes of the pollution at these sites remained unknown given the time constraints of the investigations, but were probably localised impacts. The upper Ceiriog sites and the one site sampled on the Afon Teirw were unpolluted, with fairly high summer bankside BMWP scores.

**Hirnant catchment**

Two sites were surveyed on the Afon Hirnant in response to a request to sample immediately upstream and immediately downstream of a vulnerable sheep dipping structure sited within ten metres of the river bank. Taxon abundances and the BMWP score downstream of the dipping structure were significantly lowered compared with those upstream. It was concluded that sheep dip pesticides had caused a moderate impact on the Afon Hirnant.

**Llafar catchment**

Eight sites were sampled in the Llafar catchment during the autumn (Fig. 3.2.11). The biological quality at sites in the upper reaches of the Afon Llafar and the Afon Isaf was considered to reflect unpolluted conditions. Lower down these rivers, the BMWP scores were depressed. These lower scores did not suggest an impact from sheep dip pesticides, but nor could they be readily attributed to other impacts in the time available.

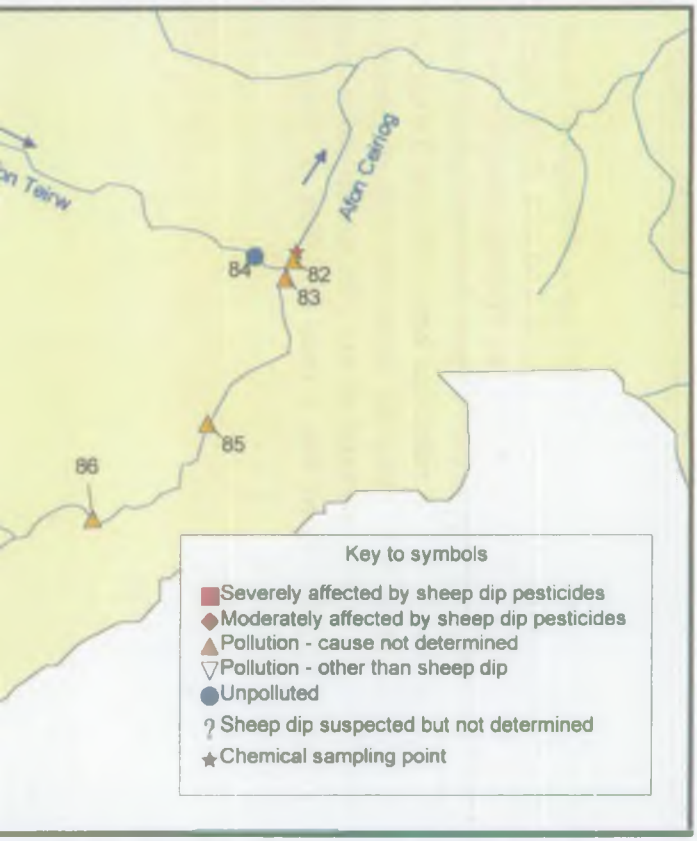
**Twrch catchment**

Sixteen sites were sampled in the Twrch catchment during the summer (Fig 3.2.11). Six of these were re-assessed and an additional two sites sampled in November.

In July, only the two uppermost sites on the Afon Twrch were found to be unpolluted, along with one site upstream of its confluence with the Afon Dyfrdwy. At the sites on the remainder of the Twrch, and on the main tributary, the Afon Croes, BMWP scores were depressed, with fairly low abundances of many taxa. No obvious source of pollution was detected, although sheep dip was suspected. Despite the serious pollution incident in spring 1997, it was felt that the biology should have recovered and a more recent incident in 1998 was suspected.

During the autumn sampling BMWP scores were again very poor throughout most of the catchment. Increasingly lower scores up the Afon Croes were traced to a sheep dipping tank at the top end of the catchment. The site (117) upstream of the dipping structure on the same river had a low BMWP score and a sheep dip pesticide impact from spreading used dip or from crossing the river after dipping could not be ruled out here. On the Twrch above its confluence with the Afon Croes, an impact from sheep dip pesticides was suspected to have reduced the BMWP scores at sites 107 and 108, although at site 109, an unknown impact had depressed the biological quality. It was estimated that a total of 10km of river had been impacted by sheep dip pesticides


**Fig. 3.2.10 Map of Ceiriog catchment**


Afon Cerrig
84
82
83
85
86
Key to symbols
Severely affected by sheep dip pesticides
Moderately affected by sheep dip pesticides
Pollution - cause not determined
Pollution - other than sheep dip
Unpolluted
? Sheep dip suspected but not determined
Chemical sampling point

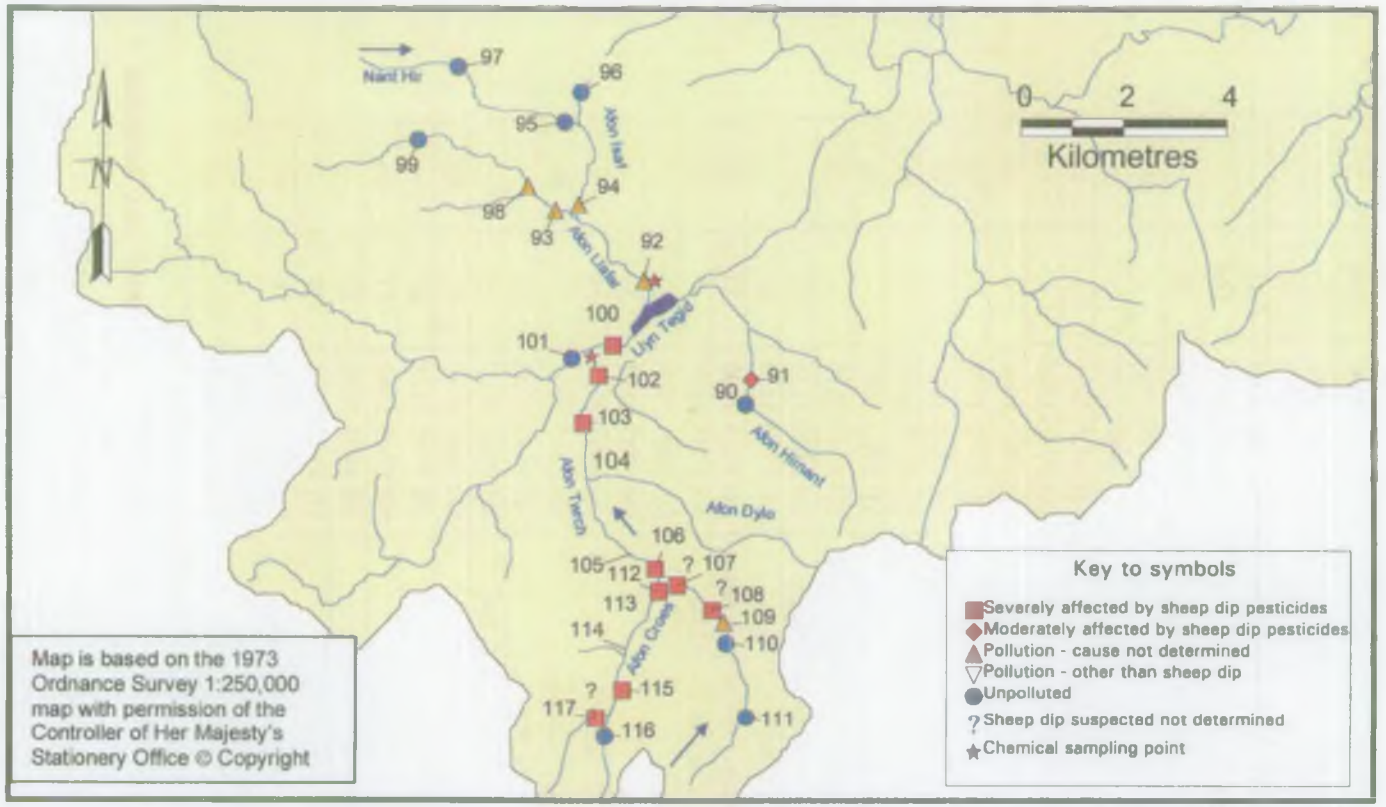



**Fig. 3.2.11 Map of upper Dee catchment**

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 82 | Ceiriog; d/s A. Teirw | SJ 1965 3590 | 57 | - |
| 83 | Ceiriog; u/s A. Teirw | SJ 1960 3580 | 61 | - |
| 84 | Teirw; u/s A. Ceiriog | SJ 1940 3600 | 100 | - |
| 85 | Ceiriog; d/s Pont Ricket | SJ 1880 3440 | 64 | - |
| 86 | Ceiriog; d/s Pont y Felin @ Tregeiriog | SJ 1780 3355 | 65 | - |
| 87 | Ceiriog; d/s Pont Fawr, Llanarmon DC | SJ 1590 3285 | 82 | - |
| 88 | Ceiriog; d/s footbridge @ Pentre Pant | SJ 1390 3410 | 108 | - |
| 89 | Ceiriog; d/s Tuhwntir Afon, Pentre | SJ 1365 3470 | 93 | - |
| 90 | Hirnant; u.s sheep dip | SH 9490 3040 | - | 93 |
| 91 | Hirnant; d.s sheep dip | SH 9485 3045 | - | 53 |
| 92 | Llafar; u/s of A494 road bridge | SH 8925 3250 | - | 58 |
| 93 | Llafar; u/s Pont y Parc in Parc | SH 8750 3390 | - | 52 |
| 94 | Isaf; d/s Pont Llwyn-hir | SH 8805 3400 | - | 39 |
| 95 | Isaf; d/s road bridge by public footpath | SH 8770 3558 | - | 61 |
| 96 | Nant Aberduldog; d/s Cynythog farm | SH 8805 3610 | - | 72 |
| 97 | Nant Hir; u/s footbridge above Cefn-y-maes | SH 8570 3675 | - | 85 |
| 98 | Llafar; u/s A. Dylo @ Ty-du | SH 8702 3433 | - | 46 |
| 99 | Llafar; u/s bridge @ Blaen-y-cwm | SH 8520 3570 | - | 78 |
| 100 | Dyfrdwy; d/s A. Twrch & u/s Llyn Tegid | SH 8850 3135 | 31 | - |
| 101 | Dyfrdwy; u/s cofluence with A. Twrch | SH 8795 3120 | 65 | - |
| 102 | Twrch; u/s footbridge below Dolfawr farm | SH 8825 3100 | 23 | 26 |
| 103 | Twrch; d/s roadbridge in Llanuwchllyn | SH 8795 2980 | 7 | 21 |
| 104 | Twrch; d/s A. Fechan | SH 8805 2930 | 25 | - |
| 105 | Twrch; u/s Cae-poeth | SH 8887 2732 | 22 | - |
| 106 | Twrch; d/s A.Croes @ Talardd | SH 8935 2700 | 25 | - |
| 107 | Twrch; u/s A. Croes @ Talardd | SH 8955 2695 | 33 | 48 |
| 108 | Twrch; d/s Ty Nant farm & trib | SH 9040 2620 | 36 | - |
| 109 | Twrch; directly u/s Ty Nant farm & trib | SH 9050 2610 | 45 | - |
| 110 | Twrch; d/s Nant Hir farm | SH 9065 2595 | 62 | 63 |
| 111 | Twrch; u/s Blaen-y-Cwm | SH 9100 2425 | 67 | - |
| 112 | Croes; u/s A.Twrch @ Talardd | SH 8945 2690 | 17 | 16 |
| 113 | Croes; d/s Gweirglodd-gilfach farm | SH 8935 2680 | 27 | - |
| 114 | Croes; u/s Nant-y-Llyn farm | SH 8870 2550 | 39 | - |
| 115 | Croes; u/s bridge @ top end of track | SH 8850 2456 | 54 | 16 |
| 116 | Trib of Croes; @ Cwm Du | SH 8829 2420 | - | 71 |
| 117 | Croes; u/s of trib @ Cwm Llwyd | SH 8825 2425 | - | 35 |

**Table 3.2.9 Biological results for the Dee catchment for summer and autumn 1998 sheep dip surveys**

## 3.2.9 Clwyd catchment

### 3.2.9.1 Stream chemistry

The Elwy was sampled at Llanfair Talhaiarn, where two positive results were recorded for diazinon and propetamphos (Table 3.2.1).

One site was sampled at Pont Telpyn on the Dwr Ial, upstream of the River Clwyd. A high diazinon result of 198 ng/l, almost twice the MAC, was recorded which instigated a biological survey. This resulted in a pollution source being identified and formal action was subsequently taken against the farmer.

One site was sampled on the Hesbin at Pont Eyarth Uchaf where one positive SP result was recorded. A farm pollution prevention campaign was undertaken in 1996 in this catchment.

The Clywedog was sampled at Rhwng y Ddwy Afon downstream of the confluence with the Afon Concwest. There was just one positive diazinon result of 6 ng/l.

### 3.2.9.2 Stream biology

**Elwy catchment**

A total of five sites were sampled in July (Fig. 3.2.12), four of which were reassessed during November. The decreased biological quality at site 122 on the Afon Cledwen in July, which was reflected by the lower than expected BMWP score and decreased taxon abundances, was considered to have been caused by pollution other than sheep dip pesticides. It should however be noted that the flow velocity was higher than normal at the time of sampling. The autumn survey showed that recovery had occurred by November.

**Dwr Ial catchment**

A total of twelve sites were surveyed during July (Fig. 3.2.13), seven of which were re-surveyed in November. The survey in July indicated good biological quality on the Dwr Ial upstream of an unnamed tributary with no evidence of impact from sheep dip pesticides. Site no. 131 showed a reduced BMWP score that was attributed to the close proximity of a stock watering area. The sites downstream of the unnamed tributary (Sites 123, 124, 125) had low BMWP scores and taxon abundances (BMWP 14-36). Investigation of the tributary demonstrated very low BMWP scores (BMWP 1-6) downstream of a field drain. Upstream of this drain the biological quality improved (BMWP 46-66) and it was inferred that a toxic substance had entered the tributary via the field drain. Upon investigation with an Environment Protection Officer, this drain was traced to a ditch that was intercepting effluent from a sheep dip bath soakaway. The officer was informed that the sheep had been dipped two weeks previously using a cypermethrin dip. The poor biological score recorded at site no. 130 was attributed to poor habitat at the sampling location .

The survey undertaken in November again demonstrated poor biological quality in the lower reaches of the catchment, downstream of the field drain. There had been some improvement at sites 124 (BMWP 45), 125 (BMWP 45) and 128 (BMWP 43) but all families present were found in low abundance.

The total length of the Dwr Ial severely affected by sheep dip pesticides was 5.4 km.

**Hesbin catchment**

A total of 6 sites were surveyed during July and a follow up visit was made to one site in November. The survey undertaken in July indicated good biological quality through out the catchment with no evidence of impact caused by sheep dip pesticides. The decrease in BMWP score at site 135 in the autumn could not be investigated due to time limitations. However at that site the abundances were good with a diverse faunal composition suggesting that the decrease was not due to sheep dip pesticides

**Clywedog catchment**

A total of 12 sites were surveyed during July. The biological quality was good through out the Clywedog catchment except for site 147 where the BMWP score of 38 was lower than expected. The reason for this was undetermined. The catchment was not surveyed in the autumn as it was considered a low priority.

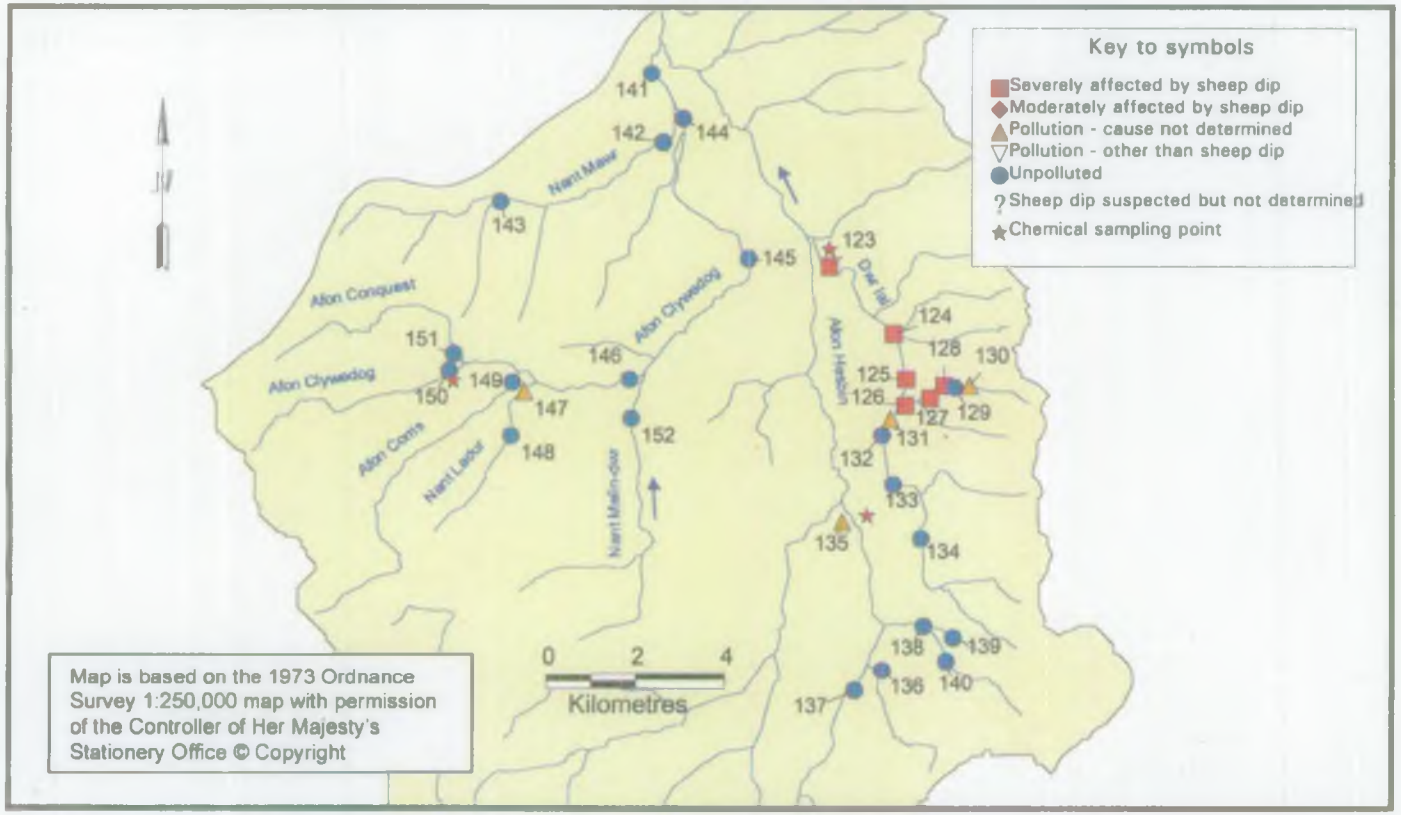



**Fig. 3.2.13 Map of upper Clwyd catchment**

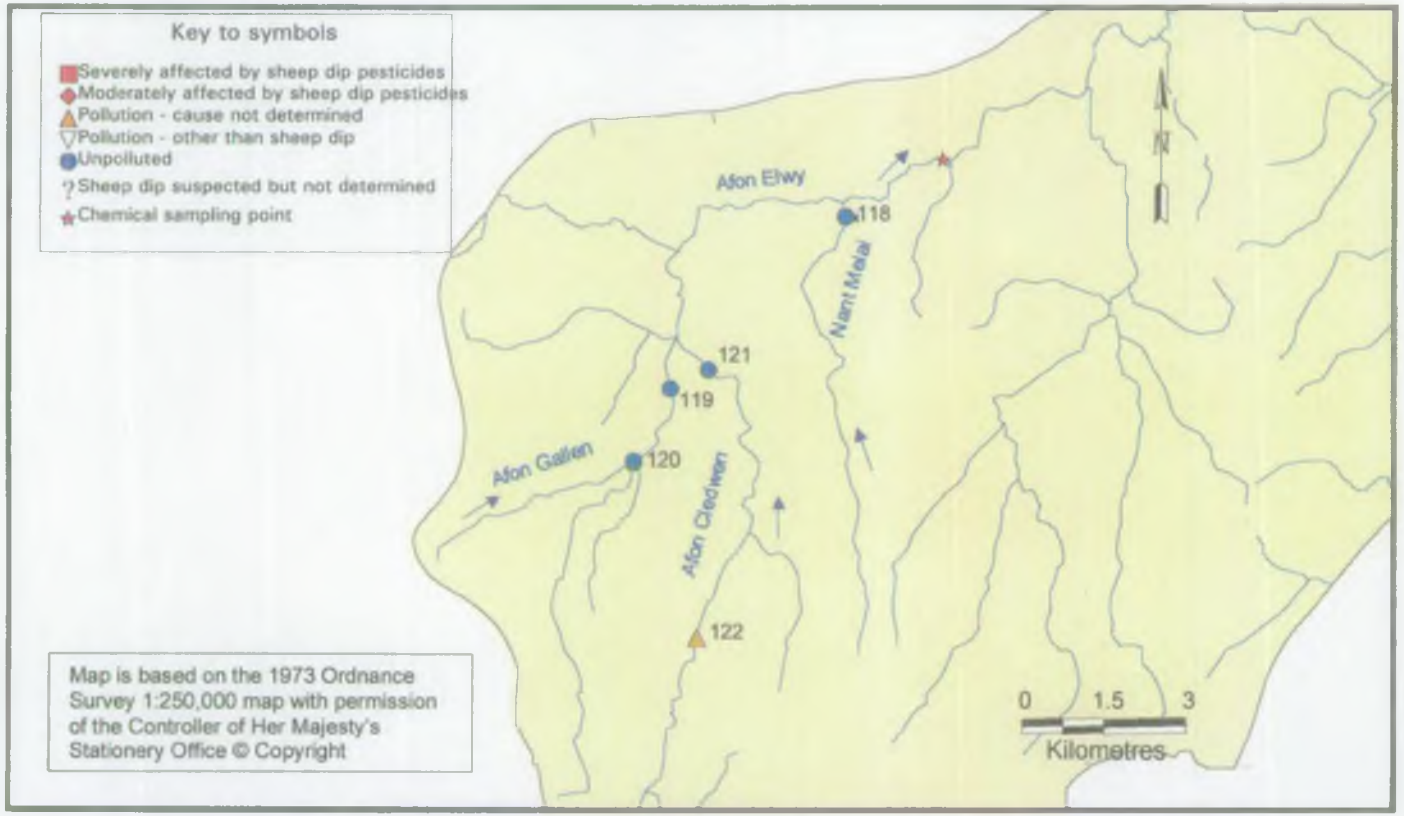



**Fig. 3.2.12 Map of Elwy catchment**

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 118 | Nant Melai; Henllys Farm | SH 9080 6960 | 83 | 71 |
| 119 | Gallen; Hendre Ddu | SH 8780 6630 | 60 | 75 |
| 120 | Gallen; d.s confluence A. Derfyn & A. Dyffryn-gall | SH 8670 6525 | 61 | - |
| 121 | Cledwen; Pont Sylltu | SH 8840 6670 | 61 | 60 |
| 122 | Cledwen; Gwytherin Pont y Felin | SH 8780 6180 | 43 | 98 |
| 123 | Dwr Ial;@ Melin y Wern | SJ 1212 6065 | 36 | 36 |
| 124 | Dwr Ial;d/s Pont Rhyd Dwr Ial | SJ 1395 5875 | 16 | 45 |
| 125 | Dwr Ial; Plas Llan Rhydd | SJ 1420 5780 | 14 | 45 |
| 126 | Dwr Ial; Trib d/s Bathafarn Genus | SJ 1425 5735 | 5 | - |
| 127 | Dwr Ial; Trib @ Bathafarn farm | SJ 1500 5765 | 6 | - |
| 128 | Dwr Ial; Trib d/s Pipe Parc Gwyn | SJ 1490 5755 | 1 | 43 |
| 129 | Dwr Ial; Trib u/s Pipe Parc Gwyn | SJ 1520 5760 | 66 | 75 |
| 130 | Dwr Ial; Trib u/s Bathafarn WTW | SJ 1525 5770 | 46 | - |
| 131 | Dwr Ial; u/s Trib from Bathafarn | SJ 1395 5735 | 26 | - |
| 132 | Dwr Ial; @ The Firs | SJ 1360 5665 | 71 | 61 |
| 133 | Dwr Ial; d/s Graigfechan STW | SJ 1375 5555 | 61 | 57 |
| 134 | Dwr Ial; @ Glanarafon | SJ 1445 5440 | 68 | - |
| 135 | Afon Hesbin; u/s Pont Eyarth | SJ 1287 5496 | 95 | 61 |
| 136 | Afon Hesbin; right hand trib d/s Glan Hesbin | SJ 1322 5174 | 75 | - |
| 137 | Afon Hesbin; d/s Glan Hesbin | SJ 1320 5170 | 83 | - |
| 138 | Afon Hesbin; Nant y Garth | SJ 1440 5240 | 71 | - |
| 139 | Afon Hesbin;d/s Llainwen | SJ 1465 5235 | 75 | - |
| 140 | Afon Hesbin; u/s Llysfasi College | SJ 1460 5230 | 89 | - |
| 141 | Clywedog;u/s river Clwyd | SJ 0875 6425 | 89 | - |
| 142 | Clywedog;Nant Mawr @ Hen Vicarage,Llanrhaeadr | SJ 0900 6285 | 89 | - |
| 143 | Clywedog;Nant Mawr, Felin-Prion | SJ 0545 6170 | 88 | - |
| 144 | Clywedog;u/s bridge | SJ 0955 6340 | 76 | - |
| 145 | Clywedog;Rhyd-y-cilgwyn, Rhewl | SJ 1082 6040 | 77 | - |
| 146 | Clywedog; u/s Bontuchel weir | SJ 0820 5780 | 84 | - |
| 147 | Clywedog; Nant Lladur@ Cyffylliog | SJ 0600 5765 | 38 | - |
| 148 | Clywedog; Nant Lladur@ Pentre Potes | SJ 0570 5670 | 54 | - |
| 149 | Clywedog; Afon Corris u/s Clywedog | SJ 0580 5785 | 90 | - |
| 150 | Clywedog;u/s Concwest @ Rhwng y Dwy Afon | SJ 0440 5820 | 63 | - |
| 151 | Clywedog; Afon Concwest u/s Clywedog | SJ 0450 5822 | 87 | - |
| 152 | Clywedog; Nant Melindwr Forestry Hide | SJ 0820 5720 | 90 | - |

**Table 3.2.10 Biological results for the Clwyd catchment for summer and autumn 1998 sheep dip surveys**

## 3.2.10 Other Catchments

### 3.2.10.1 Stream Chemistry

Water quality monitoring was carried out at eleven other sites in catchments where biological surveys were not carried out as follows. The results are shown in Table 3.2.11

Afon Dyfi was sampled at the B4404 road bridge, and gave two positive OP results and one positive SP result each for cypermethrin and flumethrin with a concentration of 2 ng/l.

Afon Artro sampled at Llanbedr, had no positive results for either OP or SP dip chemicals.

Afon Dysynni was sampled at Pont y Garth, where only one positive result of 7 ng/l was recorded for propetamphos.

Afon Fathew was sampled at Pont Felindre, where only one positive result was recorded, again for propetamphos at 12 ng/l.

Afon Seiont was sampled at Pont y Gromlech, where no positive OP or SP results were recorded.

Afon Erch was sampled at the A497 Abererch, and gave two positive results for diazinon, one positive result for propetamphos and one positive cypermethrin result.

For the Afon Soch, one exceedence of the SP MAC was recorded for cypermethrin, with one positive result for each of diazinon and propetamphos.

River Clwyd was sampled downstream of Ruthin Sewage Treatment Works, and no positive results were recorded.

River Wheeler was sampled upstream of the confluence with the River Clwyd, and gave just one positive SP result for cypermethrin. A pollution prevention campaign was undertaken in this catchment in 1994 to reduce the risk of farm pollution in the river which supports two fish farms.

Afon Morwynnion was sampled at Carrog, where two positive results were recorded, one for diazinon and one for propetamphos

For the Afon Lliw, only one positive result was recorded for flumethrin at Pont Lliw.

**Table 3.2.11 A summary of positive water column sampling results for the Northern Area catchments. EQS failures in bold**

| Site name | Site code | Determinands with positive results | Max (ng/l) | No. samples | No. positive |
|---|---|---|---|---|---|
| Afon Lliw at Pont Lliw | 196 | Diazinon | 7 | 9 | 1 |
| R Dysynni Pont Y Garth | 20002 | Propetamphos | 7 | 7 | 1 |
| R Clwyd d/s Ruthin SDW | 1203 | No positive results | - | 6 | 0 |
| R Dyfi B4404 Road Bridge | 20195 | No positive results | - | 8 | 0 |
| R Seiont Pont Y Gromlech | 22506 | No positive results | - | 8 | 0 |
| R Fatthew Pont Y Felindre | 20224 | No positive results | - | 8 | 0 |
| R Wheeler u/s R Clwyd | 2055 | No positive results | - | 8 | 0 |
| R Erch A497 Abererch | 22683 | Diazinon | 11 | 8 | 2 |
| | | Propetamphos | 12 | 8 | 1 |
| | | Cypermethrin | 1 | 8 | 1 |
| R Soch | 22837 | Diazinon | 12 | 8 | 1 |
| | | Propetamphos | 5 | 8 | 1 |
| | | Cypermethrin | 2 | 8 | 1 |
| Afon Morwynnion @ Carrog | 274 | Diazinon | 18 | 12 | 2 |
| | | Propetamphos | 10 | 12 | 1 |
| | | Flumethrin | 1 | 12 | 1 |
| R Artro Llanbedr | 20063 | No positive results | - | 9 | 0 |

## 3.2.11. Pollution prevention activities

Due to the large number of small catchments covered by the monitoring programme in Northern Area, it is not possible to report on an individual catchment basis.

A number of initiatives were implemented in 1998 following the efforts in 1997 to minimise the pollution risks associated with sheep dipping activities.

### Site Inspections

Some fifty-eight dipping sites were assessed and farmers advised to seal off drain holes to sub-surface soakaways or discharges to adjacent watercourses. The level of awareness was generally good, however, there was misapprehension that the synthetic pyrethroid chemicals with lower risk for operators corresponded to lower risk to the aquatic environment. In all cases pollution prevention leaflets were left with the farmer/operator.

### Type of treatment

**Table 3.2.12 Treatment methods used in Northern Area**

| Treatment method | % sites visited |
|---|---|
| OP dips | 47 |
| SP dips | 35 |
| SP & OP dips | 0 |
| Injection | 3 |
| Pour on | 2 |
| Shower/Jetter | 10 |
| Don't know | 3 |

### Disposal

**Table 3.2.13 Disposal methods in the Northern area**

| Disposal Method | % Sites Visited |
|---|---|
| Soakaway | 19 |
| Landspreading | 73 |
| Off-site Disposal | 2 |
| Direct Discharge | 6 |

### 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 | 21 |
| Medium | 15 |
| Low | 64 |

## Mobile Dippers

A list of mobile dippers collated in 1997 was reviewed and some twenty contractors were ultimately identified who either undertook dipping or leased out mobile dip equipment. Each contractor was invited to contact the Agency to discuss methods of reducing risk associated with the operations. However, only a relatively small number (25%) responded directly. Of those contractors who did contact the Agency, all were prepared to pass on guidance leaflets

to their customers. A more vigorous campaign is recommended in 1999 to visit every contractor to raise awareness.

### Liaison with the National Trust

The Agency initiated dialogue with the National Trust with regard to the farms on the Ysbyty Estate in the Upper Conwy valley. Discussions are underway to arrange joint inspection visits in 1999 at a number of holdings to determine if there are any improvements required to dipping facilities.

### Liaison with HSE

Discussions have taken place with the HSE office at Wrexham following concerns raised by their inspectors while inspecting facilities in the course of their inspection programme. It is proposed that HSE staff will be briefed fully on EAW concerns and the results of the 1998 survey so that existing links can be strengthened and where appropriate an exchange of information may be of mutual benefit.

## 3.2.12 Sewage Treatment Works monitoring

Two Sewage Treatment Works, at Ruthin and Bryncir were initially selected for effluent monitoring for sheep dip pesticides in April 1998. In October two additional STWs were added, St Asaph and Gaerwen. (Table 3.2.14).

**Table 3.2.14 Positive results from sampling sewage treatment works in Northern Area.**

| Site | Date | Diazinon ng/l | Propetam-phos ng/l | Chlorven-vinphos ng/l | Cyper-methrin ng/l | Flumethrin ng/l |
|---|---|---|---|---|---|---|
| St Asaph | 13/11/98 | 37 | 17 | | 3 | |
| | 26/11/98 | 45 | 34 | | 6 | |
| Ruthin | 16/6/98 | 13 | | | | |
| | 29/7/98 | 79 | 23 | | | |
| | 31/7/98 | 73 | | | | |
| Gaerwen | 12/10/98 | **292** | | | 1 | |
| | 5/11/98 | **173** | 75 | | **2** | |
| Bryncir | 31/7/98 | 82 | 20 | | 3 | |
| | 17/8/98 | 36 | | | 1 | |
| | 18/9/98 | **116** | 35 | | 9 | |

Ten samples were taken, at Ruthin STW of which nine showed positive results for OP dip, peaking at 79 ng/l for diazinon and 23 ng/l for propetamphos.

Only two samples were taken at Gaerwen STW, both of which had positive results, the highest being 292 ng/l for diazinon and 75 ng/l for propetamphos.

Five samples were taken and peak results of 116 ng/l for diazinon, 35 ng/l for propetamphos, and 9 ng/l for cypermethrin were recorded at Bryncir STW

At St Asaph STW, all three samples gave positive results for diazinon, peaking at 45 ng/l. Two samples gave positive results for propetamphos, and two samples gave positive results for cypermethrin, both of which were greater than MAC EQS.

## 3.2.13 Assessment of sites impacted in 1997

Resurveys were carried out on the Twrch catchment following an incident in 1997. At the sites on the Twrch, and on the main tributary, the Afon Croes, biological scores were depressed, with fairly low abundances of many taxa. No obvious source of pollution was detected, although sheep dip was suspected. Despite the serious pollution incident in spring 1997, it was felt that the biology should have recovered and a more recent incident in 1998 was suspected.

## 3.2.14 Recommendations

1. Continue pollution prevention site inspections in 1999 at selected catchments

2. Liaise with the Health and Safety Executive, Farmers Union Wales, National Farmers Union, Country Landowners Association, National Trust and others to raise awareness and educate operators

3. Visit every mobile dipping contractor, using resources offered by FER of a dedicated officer for assistance

4. Visit farming groups as part of raising awareness of Groundwater Regulations.

# 3.3 SOUTH WEST AREA

## 3.3.1 Teifi catchment

### 3.3.1.1 Stream chemistry

Two sample points were located on the Afon Teifi and one on a tributary, the Afon Cych. Diazinon was found on the Afon Cych on two occasions at low levels, and of the eighteen samples taken on the Teifi, diazinon was found six times up to levels of 109 ng/l. Propetamphos and cypermethrin were found once each on the Teifi, with the latter exceeding the MAC EQS.

**Table 3.3.1 A summary of positive water quality results for the Teifi catchment. EQS failures in bold**

| SITE | Site code | Determinands with positive samples | Max ng/l | No. Samples | No. positives |
|---|---|---|---|---|---|
| Teifi u/s Pontrhydfendigaid STW | 83001 | Diazinon | 22 | 9 | 1 |
| | | Cypermethrin | 7 | 9 | 1 |
| Teifi Lampeter R.B | 34404 | Diazinon | **109** | 9 | 5 |
| | | Propetamphos | 37 | 9 | 1 |
| Cych at Abercych | 34488 | Diazinon | 18 | 8 | 2 |

### 3.3.1.2 Stream biology

A total of 41 sites were sampled on the middle and upper Teifi in July and 57 sites in October and November (Fig 3.3.1).

There was one confirmed case of sheepdip pollution on the tributaries Fflur and Gorffen affecting sites 4,6,16 and 18. In the summer, site 6 had a very low BMWP score of 3. The farmer confirmed that dipping had taken place and from the position of the dip and the elimination of fauna in the stream below the structure, it was confirmed that a pollution had occurred. At site 17, upstream of the dip, the fauna was good (BMWP 68). The sites were resampled in the autumn and the fauna showed recovery (BMWP score 48 at site 6). At site 12, in Pontrhydfendigaid, a low BMWP score of 31 with low abundances of just 5 families, was found in the autumn. However, further biological sampling found that effluent from a water treatment works was the most probable cause of poor BMWP scores at sites 12, 50, 52 and 53 on the upper reaches of the Teifi.

There were a number of other issues affecting the biological quality of this catchment, including probable acidification effects at sites 33 and 34 on the Clywedog, site 36 on the Brefi, site 43 on the Berwyn and site 44 on the Groes. The fauna at sites 54 and 9 on the headwaters of the Teifi also showed some evidence of acidification.

Organic pollution was the suspected cause of the poor fauna at site 3 and sewage fungus growth at site 20. A quarry was found to be polluting the tributaries Marchnant and Meurig at sites 15, 42 and 45, with heavy deposition of suspended solids on the bed and a very low BMWP score of 6 at site 45. Abandoned metal mines are the most probable cause of low biological quality at sites 42 and 48 on a tributary of the Meurig. Pollution from surface water run off from spoil tips may be contributing to the very poor quality of the Meurig at sites 15 (BMWP 5, one tipulid larvae) and 42. Site 13 on the Nant Lluest is also affected by run off from spoil tips.

### 3.3.1.3 Farm visit programme

Two farms were visited on the Teifi as a result of EAT surveys. One was found to use poor disposal practices. Sixty-eight farms were visited within the Afon Cych catchment, thirty-four dips were inspected. Visits were carried out in this catchment as the Cych flows into the Teifi not far upstream of a public potable abstraction, and there is a high density of sheep farms within the upper parts of the catchment.

**Type of treatment**

**Table 3.3.3 Treatment methods used in the Cych catchment**

| Treatment method | % Sites visited |
|---|---|
| OP dips | 45 |
| SP dips | 21 |
| SP & OP dips | - |
| Injection | 3 |
| Pour on | 9 |
| Shower/Jet | 19 |
| Don't know | 3 |

The general standard of construction of sheep dips in use was good in this catchment. One dip was found discharging directly through a roadside hedge to enter land on the other side. The vast majority of farms were using OP dips. Some potential problems were highlighted and are being addressed by the owners.

**Table 3.3.4 Disposal methods in the Cych catchment**

| Disposal method | % Sites visited |
|---|---|
| Soakaway | 20 |
| Landspreading | 77 |
| Off-site Disposal | 3 |
| Direct Discharge | - |

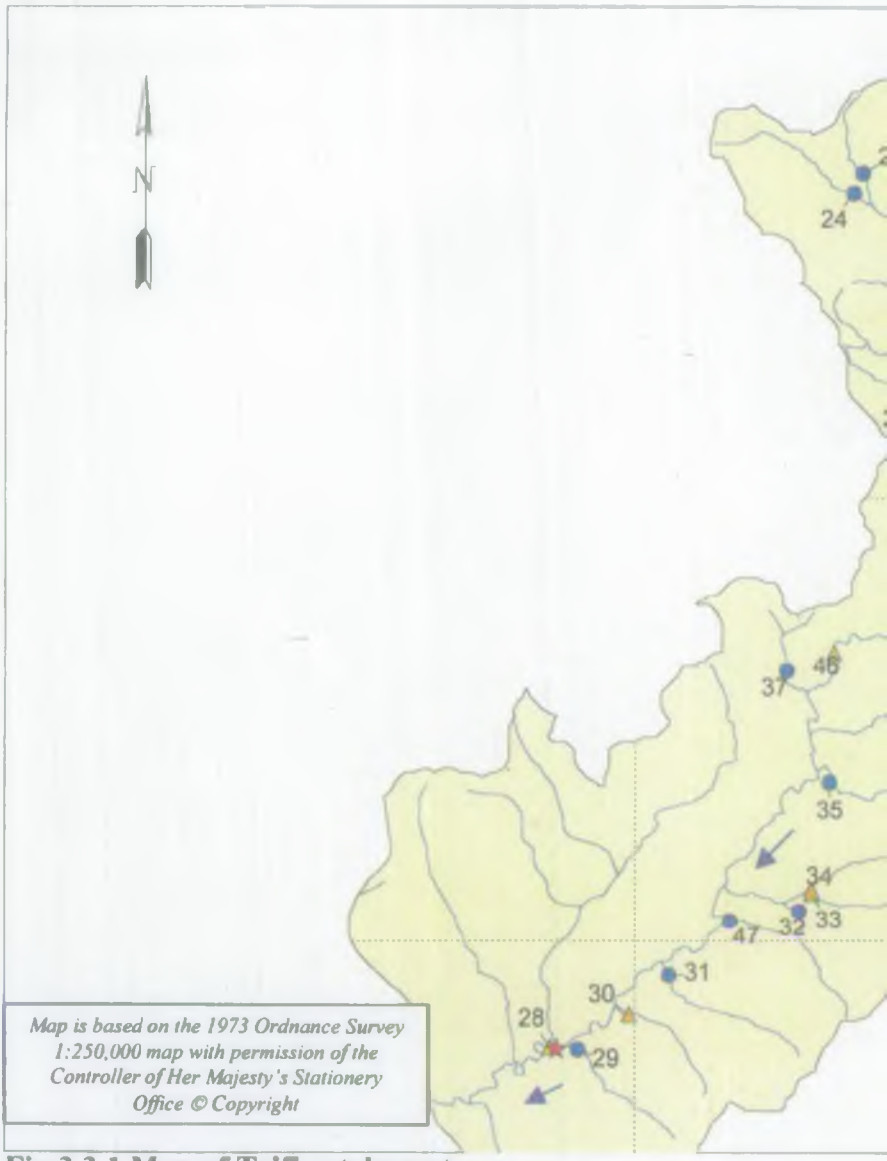
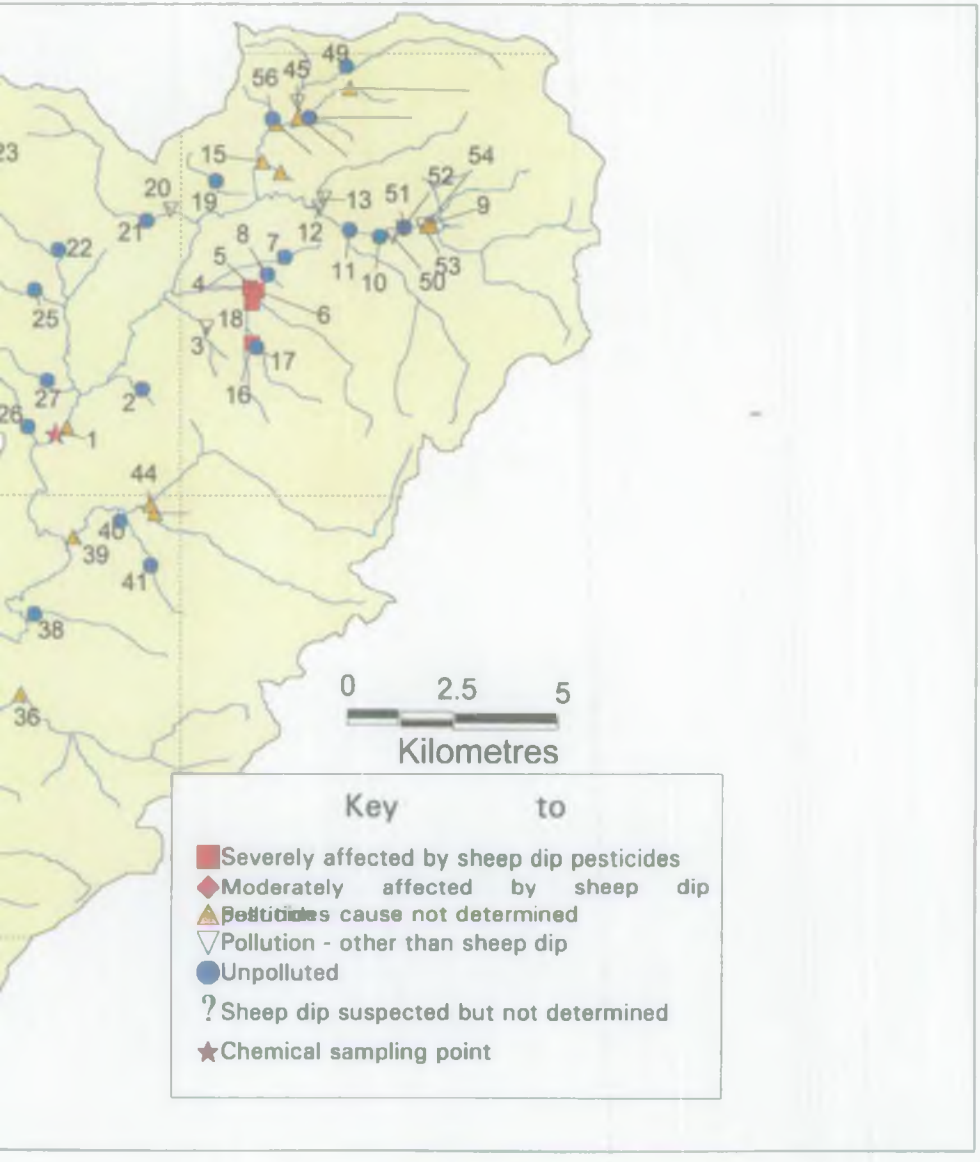



**Fig.3.3.1 Map of Teifi catchment**


49
56
45
15
54
52
20
19
13
51
9
21
8
7
12
22
5
11
10
53
50
4
25
18
6
3
17
27
16
2
26
1
44
40
39
41
38
36
0
2.5
5
Kilometres
Key to
Severely affected by sheep dip pesticides
Moderately affected by sheep dip
Pollution - other than sheep dip
Unpolluted
Sheep dip suspected but not determined
Chemical sampling point

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Teifi; above Pont Eynon RB | SN 6710 6830 | 63 | 33 |
| 2 | Trib of Teifi; u/s road | SN 6910 624 | 70 | 89 |
| 3 | Trib of Teifi; u/s road | SN 7060 638 | 12 | 14 |
| 4 | Fflur; 25m d/s road | SN 7160 647 | 22 | 54 |
| 5 | Fflur; above Goffen | SN 7176 646 | 47 | 68 |
| 6 | Nant Gorffen; u/s Fflur ' | SN 7175 646 | 3 | 48 |
| 7 | Trib of Teifi; d/s road | SN 7240 654 | 92 | 71 |
| 8 | Trib of Teifi; u/s road | SN 7200 650 | 106 | 65 |
| 9 | Teifi; u/s water works | SN 7580 662 | 72 | 52 |
| 10 | Trib of Teifi; Field next to Abbey | SN 7460 658 | 57 | 63 |
| 11 | Glasffrwd; d/s RB | SN 7390 660 | 75 | 80 |
| 12 | Teifi; Red Lion Hotel | SN 7320 665 | 55 | 31 |
| 13 | Nant Lluest; u/s conf | SN 7330 667 | 47 | 40 |
| 14 | Trib. of Teifi; near roadside | SN 7230 673 | 35 | 8 |
| 15 | Meurig; u/s RB | SN 7188 675 | 43 | 5 |
| 16 | Trib of Gorffen; u/s Gorffen | SN 7165 634 | 7 | 56 |
| 17 | Gorffen; u/s trib | SN 7175 633 | 68 | 79 |
| 18 | Gorffen; u/s farm | SN 7165 643 | 27 | 62 |
| 19 | Trib of Teifi; nr. Maesbanaddog | SN 7080 671 | 40 | 65 |
| 20 | Camddwr Fach; d/s Swyddffynnon | SN 6975 664 | 59 | 42 |
| 21 | Camddwr Fach; d/s Swyddffynnon Bridge | SN 6920 662 | 63 | 95 |
| 22 | Camddwr; u/s RB | SN 6715 655 | 63 | 89 |
| 23 | Trib of Camddwr; u/s RB nr Rhyd-Fudr | SN 6525 673 | 65 | 67 |
| 24 | Camddwr; u/s RB | SN 6505 669 | 76 | 63 |
| 25 | Nant yr Efail; d/s RB | SN 6660 646 | 82 | 80 |
| 26 | Trib of Teifi; d/s RB | SN 6645 615 | 56 | 61 |
| 27 | Trib of Teifi; d/s small bridge | SN 6690 626 | 88 | 68 |
| 28 | Teifi; d/s Lampeter RB | SN 5805 476 | 81 | 66 |
| 29 | Trib of Teifi; u/s RB @ farm | SN 5870 475 | 84 | 64 |
| 30 | Nant Gou; nr Bayliau | SN 5990 485 | 37 | 106 |
| 31 | Nant Ffrwd Cynon; 30m d/s RB by farm | SN 6080 492 | 86 | 90 |
| 32 | Clywedog isaf; d/s RB | SN 6380 507 | 80 | 64 |
| 33 | Clywedog ganol; u/s RB | SN 6410 511 | 83 | 57 |
| 34 | Clywedog uchaf; d/s RB | SN 6410 512 | 81 | 52 |
| 35 | Trib of Teifi: d/s RB | SN 6450 536 | 91 | 87 |
| 36 | Brefi; u/s RB | SN 6630 555 | 84 | 55 |
| 37 | Nant Bryn-Maen; u/s RB | SN 6350 561 | 86 | 112 |
| 38 | Trib of Teifi; Abercarfan RB | SN 6660 573 | 86 | 86 |
| 39 | Afon Brennig; u/s conf with Teifi | SN 6740 590 | 71 | 68 |
| 40 | Trib. of Berwyn | SN 6870 596 | 63 | 84 |
| 41 | Trib. of Berwyn; nr farm | SN 6930 584 | 84 | 101 |
| 42 | Afon Meurig; u/s confluence | SN 7290 6870 | | 24 |
| 43 | Berwyn; u/s RB | SN 6940 590 | | 54 |
| 44 | Groes; Bottom of field | SN 6930 5980 | | 56 |
| 45 | Marchnant; below quarry tributary | SN 7280 6860 | | 6 |
| 46 | Teifi; n'r site of Roman fort | SN 6460 5650 | | 32 |
| 47 | Small trib. of Teifi; d/s road | SN 6210 5050 | | 37 |
| 48 | Meurig; Tanyrhydiau | SN 7390 6920 | | 20 |
| 49 | Marchnant; u/s main bridge | SN 7380 6970 | | 63 |
| 50 | Teifi; d/s water works, opposite bungalow | SN 7490 6590 | | 25 |
| 51 | Trib. of Teifi; d/s farm | SN 7515 6605 | | 56 |
| 52 | Teifi; 400m below WTW discharge abv Caemadog tri | SN 7515 6605 | | 15 |
| 53 | Teifi; 50m below WTW discharge | SN 7564 6625 | | 16 |
| 54 | Teifi; 15m u/s Strata WTW | SN 7565 6625 | | 41 |
| 55 | Afon Meurig; u/s small trib. from Tancnwch | SN 7220 6840 | | 15 |
| 56 | Tancnwch trib.; u/s conf. Meurig | SN 7210 6850 | | 53 |
| 57 | Trib. of Meurig; small trib. | SN 7290 6860 | | 75 |

**Table.3.3.2 Biological results for summer and autumn 1998 sheep dip survey on the Teifi catchment**

## 3.3.2 Gwydderig sub–catchment of the Tywi

### 3.3.2.1 Stream chemistry

Twelve samples were taken on the Gwydderig at Llandovery. On two occasions propetamphos was found at low levels, and diazinon was also found on two occasions peaking at 640 ng/l (6x MAC). The MAC for cypermethrin was exceeded on one occasion.

**Table 3.3.5 Summary of positive water quality results for rivers in the Tywi catchment. EQS failures in bold.**

| SITE | Site code | Determinands with positive samples | Max ng/l | No. Samples | No. positives |
|---|---|---|---|---|---|
| Gwydderig at Llandovery | 88001 | Diazinon | **640** | 12 | 2 |
| | | Propetamphos | 11 | 12 | 2 |
| | | Cypermethrin | **2** | 11 | 1 |
| Cothi at Pumpsaint | 89150 | Diazinon | 52 | 9 | 3 |
| | | Propetamphos | 16 | 9 | 1 |
| Bran nr Llandovery | 31611 | Diazinon | 36 | 9 | 2 |
| Gwili at Llanpumsaint | 32044 | Diazinon | 7 | 7 | 1 |
| Duad U/S Conwyl Elfed STW | 34225 | Diazinon | **207** | 7 | 1 |
| Towy at Dolauhirion | 88118 | Diazinon | 9 | 9 | 1 |
| | | Propetamphos | 5 | 9 | 1 |

## 3.3.4.2 Stream biology

A total of fourteen sites were surveyed on the Gwydderig during July. These were reassessed during November, along with three other sites added to locate a potential pollution source. Of the fourteen sites assessed during July only one site was found to have impoverished fauna (site 8, Fig.3.3.2), but this was not attributed to pesticide inputs.

The autumn survey found the majority of the catchment to be of excellent biological quality. Taxon abundances on main river sites were not as high as might be expected, although there were no markedly poor BMWP scores. A problem was subsequently located at the top of the catchment (sites 2 and 15) where abundances and BMWP scores were clearly depressed. Taxon abundances and biological quality increased upstream of a tributary. No sheep dip structures were apparent adjacent to the sites, but the fauna at sites 2 and 15 was consistent with sheep dip pollution. It was estimated that 1.2 km of the river has been moderately affected by sheep dip pollution. No sites were severely affected.

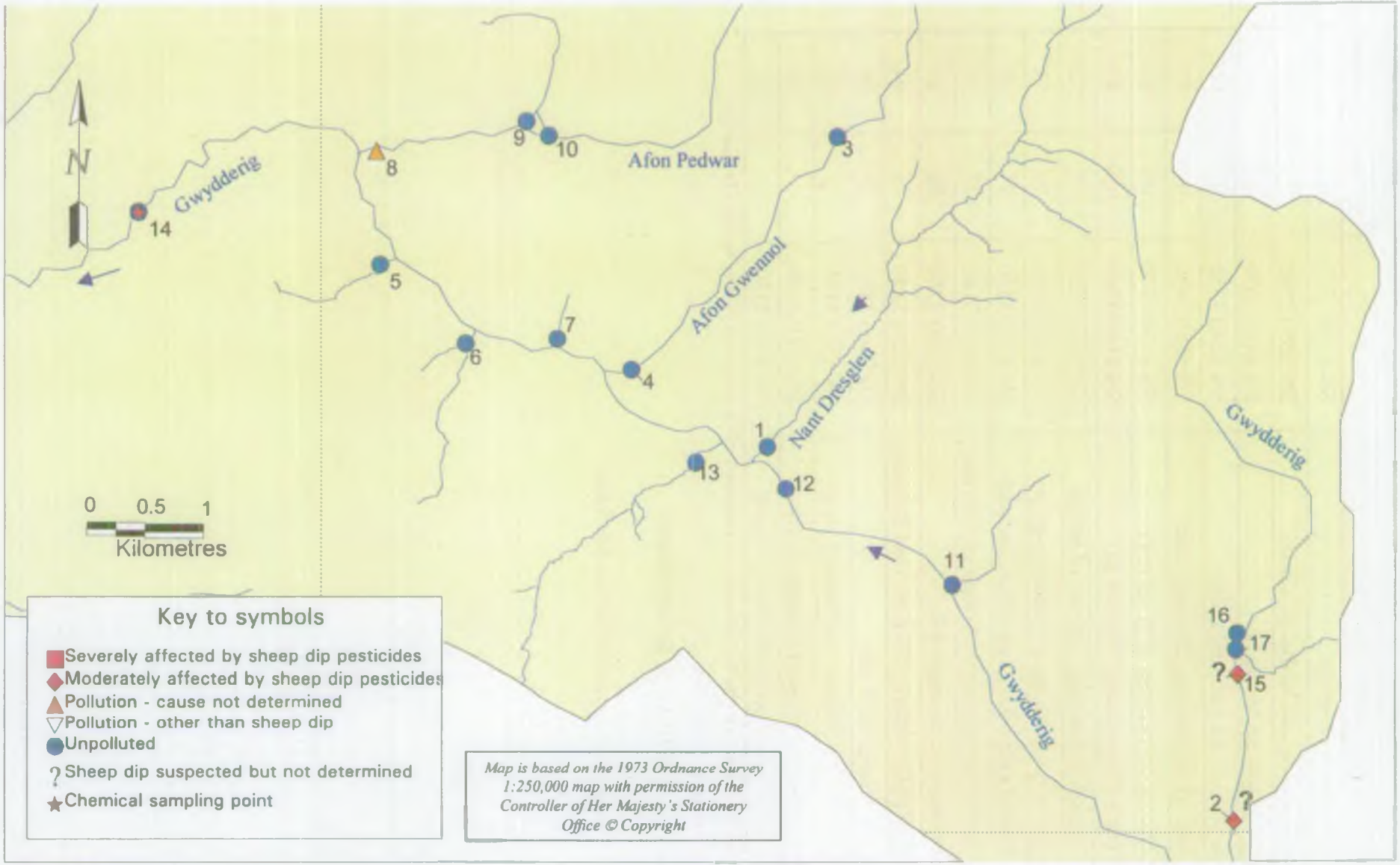



**Fig.3.3.2 Map of Gwydderig catchment**

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Dresglyn; u/s bridge | SN 8340 3290 | 87 | 75 |
| 2 | Gwydderig; u/s bridge @ Llywel | SN 8690 2990 | 97 | 55 |
| 3 | Gwennol; d/s bridge | SN 8400 3530 | 105 | 81 |
| 4 | Gwennol; d/s ford and bridge | SN 8240 3350 | 95 | 124 |
| 5 | Trib of Gwydderig; u/s main road | SN 8050 3430 | 62 | 87 |
| 6 | Trib of Gwydderig; 25m u/s road | SN 8120 3370 | 68 | 85 |
| 7 | Trib of Gwydderig; 20m u/s RB | SN 8160 3360 | 100 | 87 |
| 8 | Trib of Gwydderig; 30m u/s of bridge | SN 8040 3520 | 57 | 92 |
| 9 | Trib of Gwydderig; nr Pentre-ty-gwyn | SN 8160 3540 | 99 | 91 |
| 10 | Trib of Gwydderig; u/s FB on footpath | SN 8170 3530 | 74 | 96 |
| 11 | Trib of Gwydderig; nr bridge on sideroad | SN 8490 3190 | 71 | 113 |
| 12 | Gwydderig; u/s main RB | SN 8360 3260 | 88 | 80 |
| 13 | Trib of Gwydderig; 30m u/s road & house | SN 8290 3280 | 78 | 94 |
| 14 | Gwydderig; GQA site | SN 7860 3470 | 75 | 95 |
| 15 | Gwydderig; d/s trib. and Nant Gwared | SN 8710 3125 | | 51 |
| 16 | Gwydderig; u/s Nant Gwared & trib. | SN 8710 3150 | | 90 |
| 17 | Trib. of Gwydderig; d/s Nant Gwared | SN 8710 3130 | | 66 |

**Table.3.3.6 Biological results for summer and autumn 1998 sheep dip survey on the Gwydderig**

### 3.3.2.3 Farm visit programme

No farm visits were carried out in this catchment

## 3.3.3 Cothi catchment

### 3.3.3.1 Stream chemistry

Nine samples were taken on the Cothi at Pumsaint road bridge between 9/4/98 and 19/11/98. Propetamphos was found on one occasion at 16 ng/l and diazinon was found on three occasions peaking at 52 ng/l. (Table 3.3.5).

### 3.3.3.2 Stream biology

A total of 28 sites were surveyed during August. This number increased to 78 sites when the catchment was revisited in October and November in order to pinpoint the numerous problems which were discovered in the headwaters. The autumn survey estimated that the biological quality in approximately 7.7 km of the Afon Cothi and 12.6 km of the Afon Twrch was severely affected by inputs of sheep dip pesticides, whilst a further 2.4 km and 0.2 km on the Cothi and Twrch respectively were moderately affected by sheep dip pollution.

**Lower Cothi Catchment**

In the lower Cothi catchment (Fig 3.3.3) the lower reaches of the Afon Marlais were found to be moderately affected by sheep dip pollution (see sites 4 and 6).

Further up the Cothi catchment, on the River Annell, the biological quality of three of the six sites surveyed was moderately affected by sheep dip pollution and one was severely affected. The problems in this sub-catchment were attributed to inputs from 3 separate farms. Downstream of the Annell, at site 13, the main river Cothi was also moderately affected.

All but one of the remaining sites on the Lower Cothi were found to be unpolluted, with the invertebrate fauna being diverse and abundant. The lower abundance of taxa at site 1 was attributed to pollution of an unknown cause.

**Upper Cothi Catchment**

The summer survey showed the Twrch catchment to be of good biological quality, with no evidence of sheep dip pollution. The Upper Cothi also was of good biological quality with the exception of two sites (31 and 34) where a problem was identified and reported to Environment Protection. In contrast with these findings, eight separate problems were identified in the Twrch and Upper Cothi catchments during the autumn survey (Fig. 3.3.4). BMWP scores were generally very low and abundances very depressed in both catchments as follows.

**Cothi**

A very low BMWP score of 4 was found on the Cothi at site 23. Samples were taken at sites 41 and 42, where scores were found to be higher but abundances were still depressed. The river was found to be unpolluted further upstream at site 26. Investigation of the small tributaries in this area failed to pinpoint the source of this input but it is suspected to be sheepdip.

The main River Cothi was found to be unpolluted between sites 26 and 44, but above this at site 28 a BMWP score of 0 was recorded. This severe depletion of invertebrates continued up to site 47, at a ford, where the BMWP score had risen to 60, although taxa abundances were still depressed. It is thought that this impact was caused either by landspreading of pesticides to adjacent fields or from an illegal discharge at the ford. Soil collected from land adjacent to the river and sediment from a ditch bordering the field, both showed positive levels of cypermethrin.

Two further problems were located upstream of this major impact. The first was at a location identified during the summer survey as causing a problem (site 34). Soil samples collected from a 'ditch' receiving runoff from a yard area next to a tributary of the Cothi showed very high levels of cypermethrin, flumethrin and diazinon. Sediment samples taken from the river also confirmed the presence of cypermethrin. Inputs from this location had a severe affect upon the biology of a tributary. A contravention report has been prepared by Environment Protection in respect of this input.

The second problem was traced to a sheep dip sited next to the river in the headwaters of the catchment. Both the BMWP scores and abundance of taxa were depleted for some distance downstream of the structure (see sites 39 and 33). Soil samples taken from land between the dip and the river showed high levels of both propetamphos and diazinon. The Cothi upstream of the dip (site 38), was still of moderate biological quality, although taxon abundances were higher than those below the dip. It is thought that the lower scores at this site may be due to the effects of acidification related to the geology and soil type of the headwaters of this catchment.

**Twrch**

Probable sites of pesticide inputs located in the Twrch catchment remained unconfirmed as investigations were not followed up as this catchment was within the ADAS programme of farm visits. A total of four possible inputs were discovered and these had a major effect upon the biological quality of a large stretch of the main river and two tributaries.

The Nant Troyddyn was found to be unpolluted during the summer survey (sites 51 and 52), but when resurveyed in November the BMWP scores were found to be much lower and taxon abundances had decreased. Investigation of this sub-catchment located a problem at the top of a tributary downstream of a farm. Above this farm at site 64, quality was found to be excellent, but below the stream was severely affected by sheep dip pollution, the effect being still detectable in the main Twrch at site 37. Organic pollution was also located at two sites in this sub-catchment but this did not seem to be having any effect upon the already depeleted fauna.

Further upstream, the main River Twrch continued to be affected by sheep dip pollution as far as site 58, where it was found to be unpolluted. The possible source of this impact was traced to a small field ditch. Above the confluence of the ditch into the Twrch, BMWP scores were good and taxa were abundant, below the ditch input there was a noticeable decrease in both.

The final problem was located in the headwaters of the Camnant. Here there was a severe impact upon biological quality for the length of the tributary. Several tributaries sampled in this sub-catchment were found to be unpolluted.

### 3.3.3.3 Farm visit programme

Enquiries are continuing, following up the results of the biological survey.

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Cothi; Pontarcothi RB nr Cothi Bridge Hotel | SN 5050 2170 | 92 | 69 |
| 2 | Trib of Cothi; d/s farm | SN 5320 2640 | 98 | 103 |
| 3 | Trib of Cothi; nr Penfarch | SN 5320 2810 | 104 | 73 |
| 4 | Marlais; u/s conf. Cothi | SN 5350 3010 | | 51 |
| 5 | Marlais; next to playground | SN 5250 3030 | | 76 |
| 6 | Trib of Marlais; u/s of ford | SN 5250 3020 | | 57 |
| 7 | Trib of Marlais; Afon Pib | SN 5040 3020 | | 96 |
| 8 | Trib of Marlais; Ystrad Farm d/s ford | SN 5030 2990 | | 90 |
| 9 | Trib of Marlais; nr Aber-Goleu | SN 5080 2970 | | 89 |
| 10 | Trib of Marlais; Nant Cwm Marydd | SN 5030 3040 | | 86 |
| 11 | Cothi; Bryn-Cothi Lodge | SN 5610 3220 | 94 | 79 |
| 12 | Gorlech; Abergorlech RB | SN 5840 3370 | 77 | 85 |
| 13 | Cothi; B4337 RB | SN 6340 3450 | 67 | 67 |
| 14 | Trib of Cothi; entrance of farm | SN 6410 3490 | | 79 |
| 15 | Marlais; nr Llansawel, farm RB | SN 6310 3660 | | 105 |
| 16 | Cothi; nr Hotel at RB | SN 6430 3710 | 71 | 64 |
| 17 | Afon Annell; first RB | SN 6460 3650 | | 37 |
| 18 | Afon Annell; nr Hotel at RB | SN 6540 3740 | | 95 |
| 19 | Trib of Annell; at entrance to farm | SN 6540 3690 | | 52 |
| 20 | Trib of Annell; Cwmcoygen farm track | SN 6620 3640 | | 97 |
| 21 | Trib of Annell; Cwmgogerddan farm track | SN 6620 3660 | | 48 |
| 22 | Afon Annell; between first RB and Hotel RB | SN 6480 3670 | | 57 |

**Table 3.3.7 Biological results for summer and autumn 1998 sheep dip survey, lower Cothi**

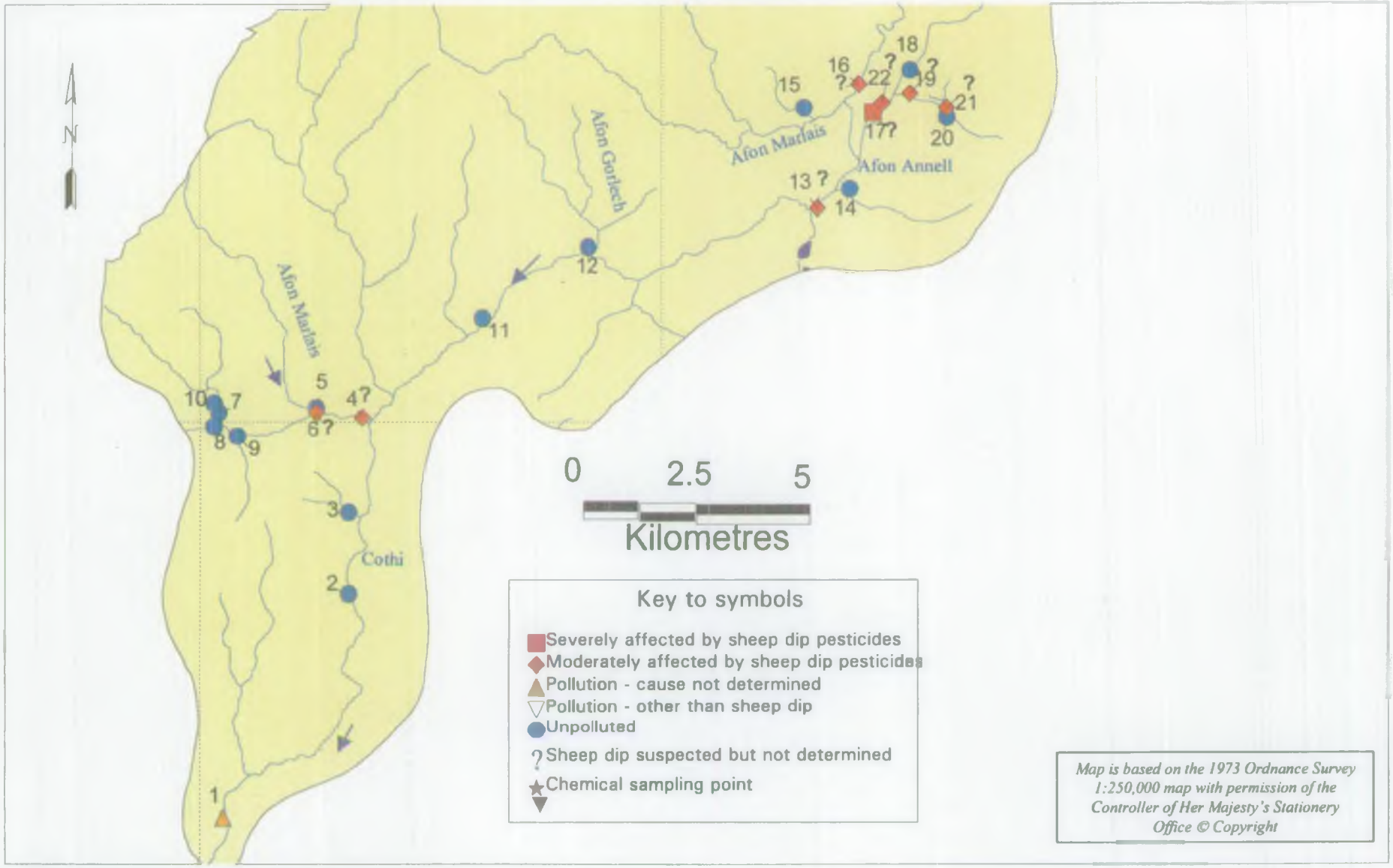



**Fig.3.3.3 Map of Lower Cothi catchment**

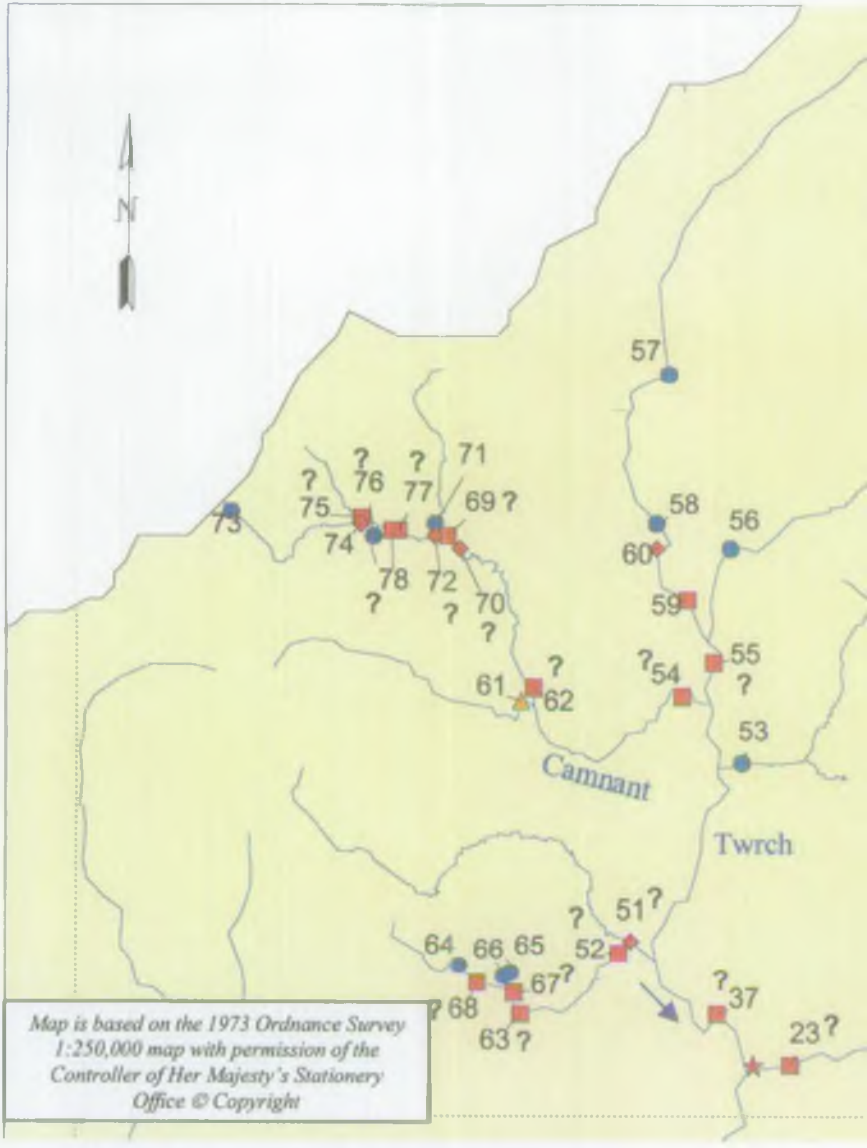
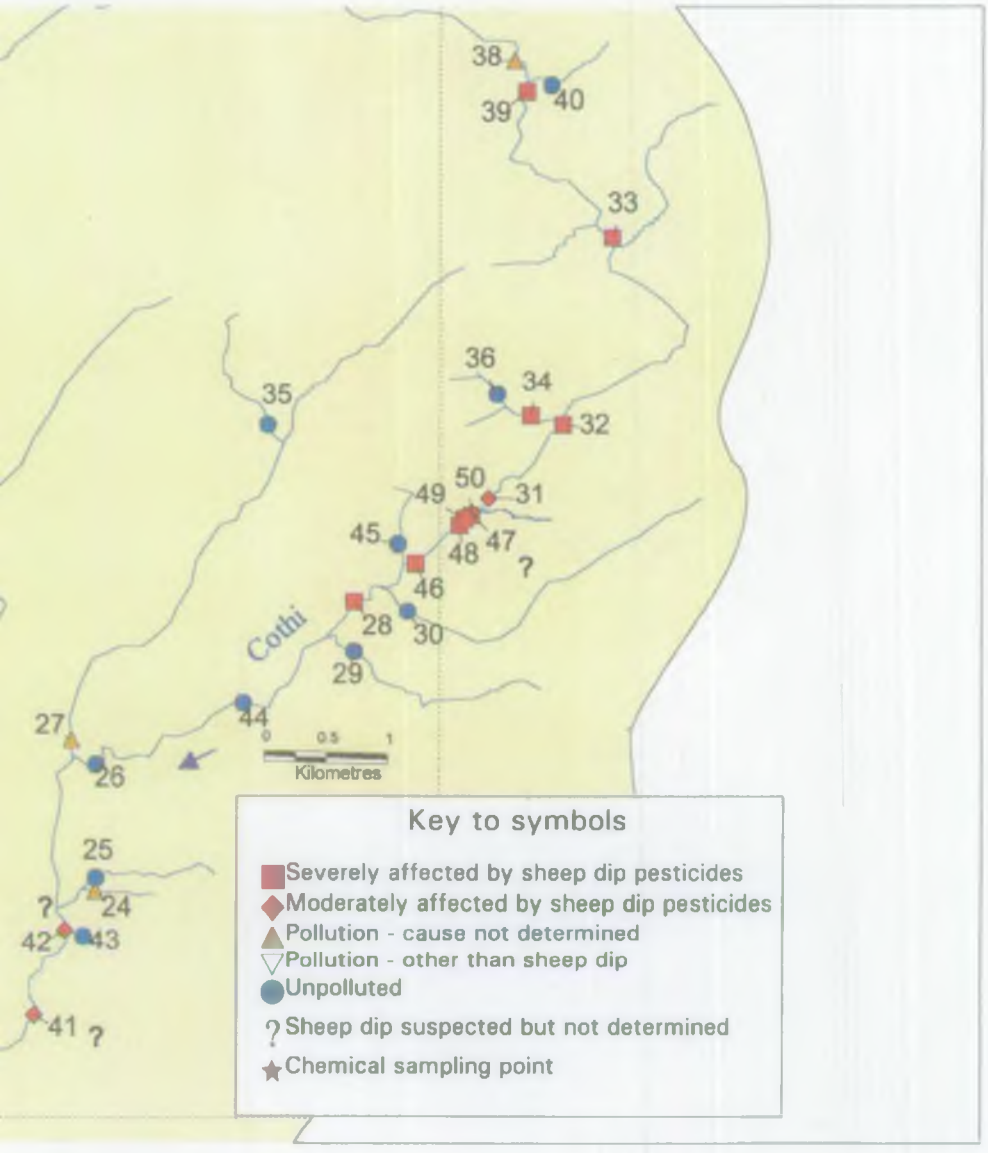



**Fig.3.3.4 Map of Upper Cothi catchment**


38
39
40
33
36
34
35
32
49
50
31
45
48
47
?
46
28
30
Cothi
29
44
27
0
0.5
1
Kilometres
26
25
?
24
42
43
41
?
Key to symbols
Severely affected by sheep dip pesticides
Moderately affected by sheep dip pesticides
Pollution - cause not determined
Pollution - other than sheep dip
Unpolluted
? Sheep dip suspected but not determined
Chemical sampling point

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 23 | Cothi; Pumsaint RB | SN 6580 4040 | 105 | 4 |
| 24 | Trib of Cothi; nr Brunant Mansion | SN 6720 4180 | 95 | 48 |
| 25 | Trib of Cothi; farm | SN 6720 4190 | 77 | 66 |
| 26 | Cothi; u/s RB | SN 6720 4280 | 77 | 73 |
| 27 | Afon Fanagoed; d/s falls at hunt kennels | SN 6700 4300 | 57 | 64 |
| 28 | Cothi; at Cwrt y Cadno | SN 6930 4410 | 52 | 0 |
| 29 | Trib of Cothi; at Pentwyn | SN 6930 4370 | 61 | 68 |
| 30 | Trib of Cothi; at Glanrhyd House | SN 6950 4420 | 124 | 71 |
| 31 | Cothi; field road | SN 7040 4480 | 53 | 43 |
| 32 | Cothi; u/s farm | SN 7100 4550 | 78 | 22 |
| 33 | Cothi; Forestry road at Garthynty | SN 7140 4700 | 72 | 16 |
| 34 | Trib of Cothi; d/s farm | SN 7080 4680 | 27 | 4 |
| 35 | Afon Fanagoed; d/s RB | SN 6860 4550 | 69 | 79 |
| 36 | Aber Branddu; u/s yard runoff. farm | SN 7075 4555 | | 60 |
| 37 | Trwch; Pumsaint | SN 6520 4080 | 85 | 27 |
| 38 | Cothi; u/s farm sheepdip | SN 7060 4840 | | 48 |
| 39 | Cothi; 30 m d/sNant yr Ast conf. | SN 7070 4815 | | 33 |
| 40 | Nant yr Ast; farm | SN 7090 4820 | | 53 |
| 41 | Cothi; u/s farm and mines | SN 6670 4080 | | 40 |
| 42 | Cothi; at Brunant mansion abv trib. | SN 6695 4150 | | 51 |
| 43 | Trib. of Cothi; above Brunant mansion | SN 6710 4150 | | 48 |
| 44 | Cothi; d/s RB | SN 6840 4330 | | 72 |
| 45 | Trib. of Cothi; in field at farm | SN 6970 4440 | | 62 |
| 46 | Cothi; u/s trib. @ Cwrt y Cadno | SN 6980 4440 | | 4 |
| 47 | Cothi; 2 m d/s Ty yn y coed ford | SN 7026 4480 | | 60 |
| 48 | Cothi; d/s of ditch and ford @ Tyn yn y coed | SN 7016 4470 | | 9 |
| 49 | Cothi; 10 m u/s farm ditch, d/s ford | SN 7020 4475 | | 15 |
| 50 | Cothi; 70 m u/s farm ditch | SN 7025 4478 | | 22 |
| 51 | Nant Troyddyn; Felin Fach u/s ford | SN 6450 4140 | 63 | 47 |
| 52 | Trib of Nant Troyddyn; Felin Fach | SN 6440 4130 | 74 | 37 |
| 53 | Trib of Trwch; Penbanc | SN 6540 4280 | 126 | 75 |
| 54 | Camnant; u/s conf with Trwch; | SN 6500 4350 | 62 | 21 |
| 55 | Trwch; u/s RB | SN 6500 4360 | 89 | 39 |
| 56 | Trib of Trwch; Fanafas | SN 6530 4450 | 85 | 69 |
| 57 | Trwch; u/s ford | SN 6480 4590 | 71 | 82 |
| 58 | Trwch; d/s bridge in Ffarmers | SN 6470 4470 | | 73 |
| 59 | Trwch; d/s Ffarmers and trib. at side of road | SN 6495 4410 | | 22 |
| 60 | Trwch; d/s bridge & trib. in Ffarmers | SN 6470 4450 | | 52 |
| 61 | Camnant trib.; under RB of B482 | SN 6360 4330 | | 52 |
| 62 | Camnant; u/s conf. with trib. | SN 6370 4340 | | 31 |
| 63 | Trib. of Nant Troyddyn; u/s farm drive | SN 6360 4080 | | 36 |
| 64 | Trib. of Nant Troyddyn; @ Fawr | SN 6310 4120 | | 99 |
| 65 | Trib. Nant Troyddyn; 15m d/s derelict house | SN 6350 4120 | | 68 |
| 66 | Trib. of Nant Troyddyn; u/s of conf. of derelict house trib. | SN 6348 4100 | | 77 |
| 67 | Main trib. of Nant Troyddyn; d/s farm | SN 6355 4097 | | 27 |
| 68 | Trib. of Nant Troyddyn; 150 m d/s farm | SN 6325 4105 | | 29 |
| 69 | Nant y Blaenau; 30m d/s RB | SN 6300 4460 | | 33 |
| 70 | Nant y Blaenau; d/s trib. from farm | SN 6310 4450 | | 52 |
| 71 | Camnan; u/s conf. Nant y Blaenau | SN 6290 4470 | | 83 |
| 72 | Nant y Blaenau; 5m d/s RB | SN 6290 4460 | | 41 |
| 73 | Headwater of Nant y Blaenau; nr Bryn Gareg Forest | SN 6125 4480 | | 67 |
| 74 | Trib. of Nant y Blaenau; from Bryn Gareg Forest | SN 6230 4470 | | 53 |
| 75 | Nant y Blaenau; from farm | SN 6230 4475 | | 13 |
| 76 | Trib. into Nant y Blaenau; u/s of conf. opposite farm | SN 6240 4460 | | 76 |
| 77 | Nant y Blaenau; d/s of farm trib. | SN 6260 4465 | | 38 |
| 78 | Nant y Blaenau; u/s of farm trib. | SN 6255 4465 | | 29 |

**Table.3.3.8 Biological results for summer and autumn 1998 sheep dip survey, upper Cothi**

## 3.3.4 Llangadog Bran catchment

No water quality monitoring or farm visits were carried out in this catchment

### 3.3.4.1 Stream biology

Eighteen sites on the Llangadog Bran were sampled in July and twenty-two sites in November.

The main river and major tributaries such as the Nant-y-Hiddl and Clydach showed a considerable decrease in biological quality between the summer and autumn sampling periods. Some lowering of the BMWP score was expected after extensive flooding in October. However, scores as low as 18, 14 and 21 at sites 1, 6 and 9 respectively indicated a polluting influence which could possibly be sheep dip pesticide.

Only one sheep dip structure was found adjacent to the watercourses during this survey. This was on a small tributary of the Clydach. A sample taken below this dip, at site 21, did not show any sign of pollution.

Organic pollution is thought to be the cause of low scores at sites 16 and 17 on small tributaries of the Bran. Siltation of the substrate was the cause of poor fauna diversity on the Tynewydd at site 11. Although there was a relatively low score at site 19, *Gammarus*, the freshwater shrimp was abundant and the fauna was typical of the habitat type. Therefore there was no evidence of sheep dip pollution.

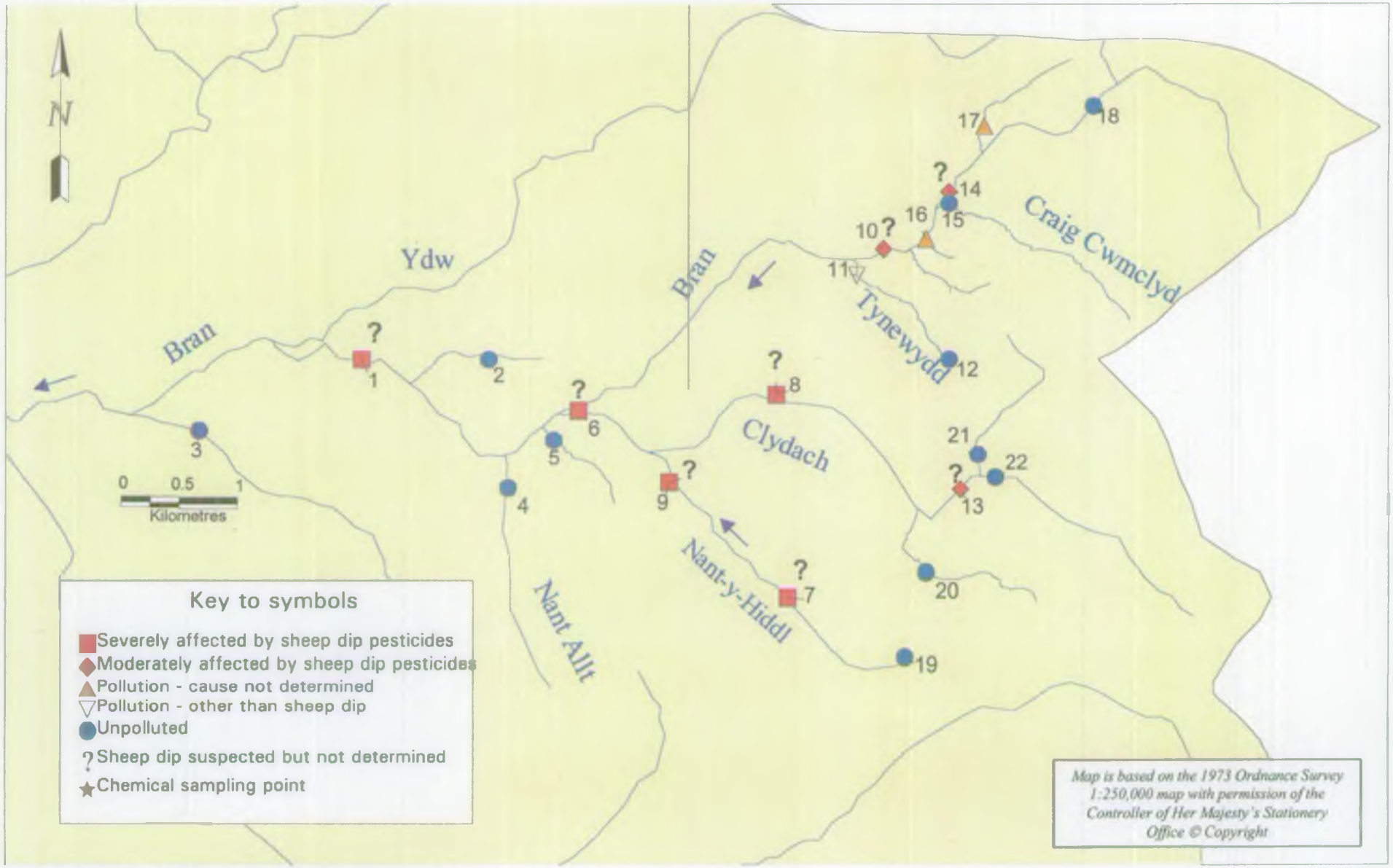



**Fig.3.3.5 Map of Llangadog Bran catchment**

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Bran; d/s bridge nr hotel | SN 7320 2890 | 54 | 18 |
| 2 | Trib of Bran; In field | SN 7430 2890 | 43 | 66 |
| 3 | Trib of Bran; Side of road | SN 7180 2830 | 73 | 61 |
| 4 | Nant Allt; 150m u/s of Bran | SN 7460 2810 | 83 | 89 |
| 5 | Trib of Bran; u/s conf with Bran | SN 7470 2830 | 90 | 66 |
| 6 | Nant-yr-Hiddl; u/s conf with Bran | SN 7490 2850 | 58 | 14 |
| 7 | Nant-yr-Hiddl; d/s bridge @ Cwm Taldru | SN 7690 2690 | 56 | 21 |
| 8 | Afon Clydach; d/s RB | SN 7680 2860 | 86 | 39 |
| 9 | Nant-yr-Hiddl; u/s conf with Clydach | SN 7590 2820 | 79 | 33 |
| 10 | Bran; nr Myddfia | SN 7750 2970 | 59 | 50 |
| 11 | Sarnau; u/s conf with Bran | SN 7750 2960 | 38 | 48 |
| 12 | Trib of Bran; nr source above farm | SN 7830 2890 | 52 | 86 |
| 13 | Clydach; d/s RB | SN 7840 2780 | 73 | 54 |
| 14 | Bran; d/s RB nr Pentwyn | SN 7830 3030 | 75 | 38 |
| 15 | Nant Craig; Cwm-clyd 10m u/s conf | SN 7830 3020 | 119 | 80 |
| 16 | Trib of Bran; 20m u/s conf | SN 7810 2990 | 40 | 13 |
| 17 | Trib of Bran; d/s RB near Beli-glas | SN 7860 3085 | | 55 |
| 18 | Bran; u/s farm, u/s RB in woodland | SN 7970 3130 | | 88 |
| 19 | Bran; top of Nant yr hiddl | SN 7790 2640 | | 26 |
| 20 | Trib. of Clydach | SN 7810 2710 | | 86 |
| 21 | Trib. of Clydach; nr dip | SN 7850 2790 | | 85 |
| 22 | Clydach; u/s dip tub | SN 7870 2790 | | 72 |
| 23 | Trib of Bran; 15m d/s bridge | SN 7830 3670 | 50 | |
| 24 | Trib of Bran; Cattlefield above railway | SN 7830 3700 | 72 | |

**Table.3.3.8 Biological results for summer and autumn 1998 sheep dip survey on the Llangadog Bran**

## 3.3.4 Tywi Catchment

### 3.3.5.1 Stream Chemistry

Three sites were sampled on the Tywi and its tributaries between 2/4/98 and 1/12/98. On the main river at Dolauhirion, diazinon and propetamphos were found at very low levels on one occasion each. On the two tributaries, diazinon was found on one occasion on each of them, 7 ng/l on the Gwili and 207 ng/l on the Duad (x2 MAC). Nine samples were taken on the Llandovery Bran. On two occasions Diazinon was found peaking at 36 ng/l. (Table 3.3.5)

### 3.3.5.2 Stream biology

No biological surveys were carried out in this catchment

### 3.3.5.3 Farm Visits

This catchment was chosen due to its high sheep farming density. One hundred and twenty-seven farm visits were carried out in this catchment. Forty-seven dips were found.

There were also nineteen farms found to be using other treatments, eg: injections, pour-ons or mobile dippers.

### Type of treatment

**Table 3.3.9 Treatment methods used in the Tywi catchment**

| Treatment method | % Sites visited |
|---|---|
| OP dips | 35 |
| SP dips | 41 |
| SP & OP dips | 3 |
| Injection | 10 |
| Pour on | 9 |
| Shower/Jet | 0 |
| Don't know | 2 |

**Sheep dipping structures**

The majority of dipping structures were in good order. Most were of sealed concrete construction. Owners of dips found to be in a poor condition were advised of remedial measures.

### Chemical stores

In the majority of cases dip was not stored, and was bought just before use. Any left over dip was used up as pour-ons in some cases.

### Disposal

**Table 3.3.10 Disposal methods in the Tywi catchment**

| Disposal method | % Sites visited |
|---|---|
| Soakaway | 16 |
| Landspreading | 78 |
| Off-site Disposal | 3 |
| Direct Discharge | 3 |

## 3.3.6 Amman, Tawe and Loughor catchments

### 3.3.6.1 Stream chemistry

Eight samples were taken on the Amman at Glanamman Hospital road bridge. Propetamphos was found on one occasion at low levels, and diazinon was found on one occasion above the MAC at 139 ng/l. Nine samples were taken on the Tawe, between 21/4/98 and 7/12/98; on one occasion propetamphos was found at very low levels. Eight samples were taken at Tir y Dair road bridge; cypermethrin was found on one occasion and diazinon was found on two occasions at low levels.

**Table 3.3.11 A summary of positive water quality results for the Amman, Tawe, and Loughor catchments. EQS failures in bold**

| SITE | Site code | Determinands with positive samples | Max ng/l | No. Samples | No. positives |
|---|---|---|---|---|---|
| Amman at Glanammanan hospital R.B | 72503 | Diazinon | 139 | 8 | 1 |
| | | Propetamphos | 7 | 8 | 1 |
| Tawe, Ystradgynlais R.B | 30002 | Propetamphos | 6 | 9 | 1 |
| Loughor, Tir y Dail R.B | 30404 | Diazinon | 29 | 8 | 2 |
| | | Cypermethrin | 1 | 8 | 1 |

### 3.3.6.2 Stream biology

A total of seven sites were sampled during July; the Amman catchment was not included in the Autumn survey programme as it was considered lower priority than other catchments. Of the seven sites assessed, four were found to be unpolluted, whilst the remaining three were affected by pollution of an unknown cause not suspected to be sheep dip. Two of these sites were located on the River Amman upstream of its confluence with the Nant Pedol and the other on the Nant Garnant.

No biological surveys were carried out in the Tawe and Loughor catchments.

### 3.3.6.3 Farm visit programme

No farm visits were carried out in these catchments

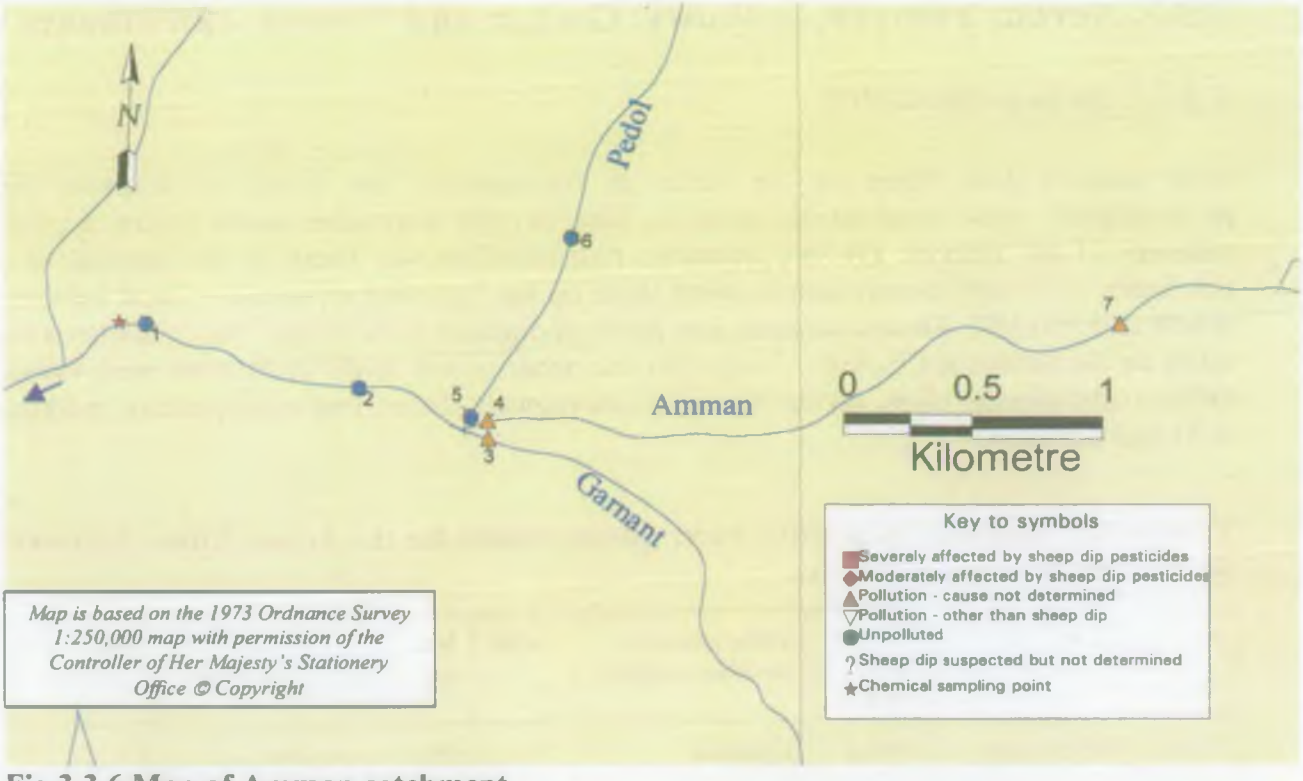



**Fig.3.3.6 Map of Amman catchment**

| Site No. | Site description | NGR | BMWP score |
|---|---|---|---|
| | | | Summer |
| 1 | Amman; nr RB over railway track | SN 6740 1370 | 73 |
| 2 | Amman; Glyn Amman RB | SN 6830 1350 | 82 |
| 3 | Garnant; u/s RB nr railway crossing | SN 6880 1330 | 61 |
| 4 | Amman; u/s conf with Pedol | SN 6880 1340 | 63 |
| 5 | Pedol; d/s RB u/s conf with Amman | SN 6870 1340 | 75 |
| 6 | Pedol; Glyn Deri | SN 6910 1410 | 118 |
| 7 | Amman; BrynAmman RB | SN 7130 1370 | 66 |

**Table.3.3.12 Biological results for summer 1998 sheep dip survey on the Amman**

## 3.3.7. Aeron, Ystwyth, Syfynwy, Gwaun and Nevern catchments

### 3.3.7.1 Stream chemistry

Four samples were taken on the Aeron at Blaenpennal; low levels of diazinon and propetamphos were found on one occasion. Nine samples were taken on the Diluw, a small tributary of the Ystwyth. On two occasions propetamphos was found in the samples, to a maximum of 27 ng/l. Seven samples were taken on the Syfynwy at Farthings Hook between 8/4/98 and 19/11/98. On one occasion low levels of diazinon were found. Nine samples were taken on the Gwaun at Cilrhedyn bridge. On one occasion low levels of diazinon were found. Of the eight samples taken on the Nevern at Llwyngwair Manor, four were positive, peaking at 31 ng/l diazinon.

**Table 3.3.13 Summary of positive water quality results for the Aeron, Diluw, Syfynwy, Gwaun and Nevern catchments.**

| SITE | Site code | Determinands with positive samples. | Max ng/L | No. Samples | No. positives |
|---|---|---|---|---|---|
| Aeron at Blaenpennal | 89114 | Diazinon | 19 | 4 | 1 |
| | | Propetamphos | 9 | 4 | 1 |
| Afon Diluw (Tributary of Ystwyth) | 89110 | Propetamphos | 27 | 9 | 2 |
| Syfynwy at Farthings Hook | 32500 | Diazinon | 49 | 7 | 1 |
| Gwaun at Cilrhedyn Bridge | 33601 | Diazinon | 76 | 9 | 1 |
| Nevern at Llwyngwair Manor | 84504 | Diazinon | 31 | 8 | 4 |

### 3.3.7.2 Stream biology

No biological surveys were carried out on the Ystwyth, Syfynwy, Gwaun and Nevern catchments.

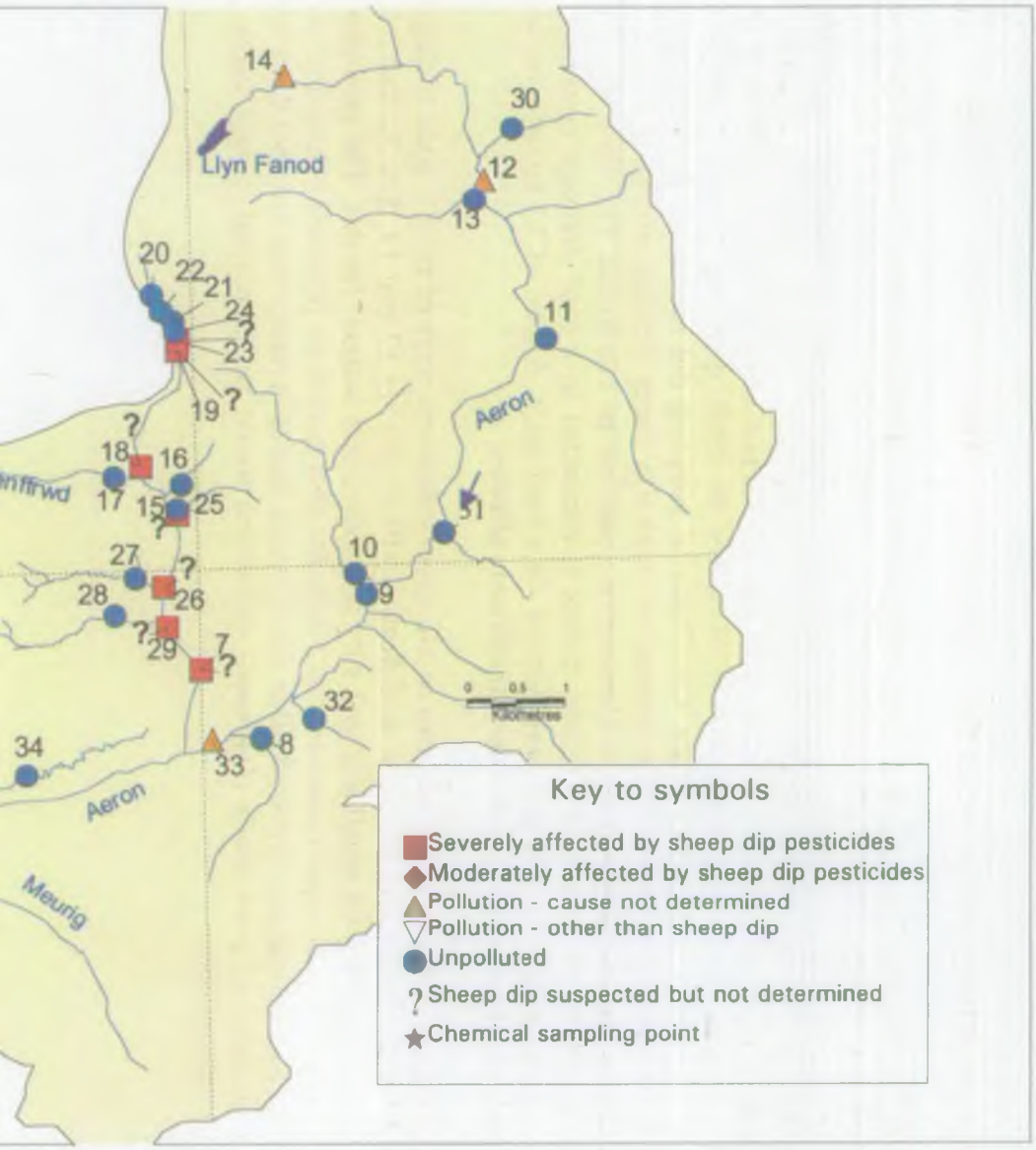
A total of fourteen sites were sampled in the Aeron catchment in July and thirty-six sites in October.

The summer survey indicated good biological quality at all the sites sampled. Site 6 was very small and silty but abundances of invertebrates were good.

When the survey was repeated in the autumn low abundances of sensitive fauna were found at the most downstream main river site, site 1. Additional samples were taken upstream on the Aeron at sites 35 and 36 and these were found to be similarly sparse in fauna abundance and also diversity. The majority of tributaries sampled were of good biological quality with the exception of the Gwenffrwd which had dropped from a BMWP score of 66 in the summer to just 4 in October. Sheep dip was suspected and further biological sampling pinpointed a field ditch as the source of the contaminant. At site 23, just below the ditch, the BMWP score was 1 (one Oligochaete worm). At site 24, above the ditch, there was a good diversity and abundance of fauna (BMWP score 70). Chemical sampling did not detect any pesticides in the sediment of the ditch and the absence of high risk sheep dipping structures adjacent to the stream meant that sheep dip contamination could not be confirmed. The ditch was short, running the width of one small field, before it connected to a road drainage system. It is possible the contaminant could have entered via a road drain. A total of 7.3 km of river were severely affected, with 3.7 km being moderately affected.

The main river Aeron and tributaries in the upper catchment were of mostly good biological quality apart from some probable acidification effects at sites 12 and 14. Site 32 had a low faunal diversity but the small size and silty substrate could account for this. The presence of many freshwater shrimps (*Gammarus* sp.) indicates that there is no pesticide contamination at the site. Site 34 was on a lowland ditch full of reeds; faunal diversity was low, but there were large numbers of pond snails (*Lymnaeia* sp.) which would be the normal natural fauna for such a watercourse.


**Fig.3.3.7 Map of Aeron catchment.**


14
Llyn Fanod
30
12
13
20
22
21
24
23
19
11
Aeron
18
16
17
15
25
31
10
27
26
9
28
29
7
32
34
33
8
Aeron
Meurig
0 0.5 1
Kilometres
Key to symbols
Severely affected by sheep dip pesticides
Moderately affected by sheep dip pesticides
Pollution - cause not determined
Pollution - other than sheep dip
Unpolluted
Sheep dip suspected but not determined
Chemical sampling point

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Aeron; u/s Talsarn Bridge | SN 5440 5620 | 69 | 62 |
| 2 | Nant Rhiw Afallen; RB on Talsarn to Llangeitho road | SN 5480 5650 | 79 | 54 |
| 3 | Nant Wysg; 30m u/s bridge | SN 5490 5560 | 83 | 71 |
| 4 | Trib of Aeron; nr Chapel in Abermeurig | SN 5650 5630 | 51 | 68 |
| 5 | Nant Meurig; 40m below RB | SN 5660 5670 | 66 | 66 |
| 6 | Trib of Aeron; Below RB | SN 5710 5750 | 22 | 40 |
| 7 | Nant Gwenffrwd; in grounds of Glangwenffrwd | SN 6000 5900 | 66 | 4 |
| 8 | Nant Lleucu; d/s of Pont Lleucu | SN 6060 5830 | 61 | 74 |
| 9 | Aeron; Llangeitho Bridge | SN 6170 5970 | 70 | 88 |
| 10 | Trib of Aeron; u/s Llangeitho Bridge | SN 6160 5980 | 83 | 80 |
| 11 | Trib of Aeron; u/s RB | SN 6360 6220 | 103 | 87 |
| 12 | Aeron; u/s of small trib | SN 6300 6380 | 43 | 68 |
| 13 | Trib of Aeron; u/s conf with Aeron | SN 6290 6360 | 80 | 79 |
| 14 | Aeron; Below Llyn Fanod | SN 6100 6490 | 62 | 27 |
| 15 | Gwenffrwd; u/s 3rd trib | SN 5980 6055 | | 20 |
| 16 | Gwenffrwd; Trib. u/s Llanerch-goch | SN 5985 6085 | | 54 |
| 17 | Trib. of Gwenffrwd; @ fork below Llanfaelog | SN 5945 6093 | | 74 |
| 18 | Gwenffrwd; @ fork below Llanfaelog | SN 5946 6093 | | 4 |
| 19 | Gwenffrwd; d/s RB near Glanrhyd | SN 5975 6223 | | 4 |
| 20 | Gwenffrwd; Gwenffrwd field corner above The-Nant | SN 5960 6275 | | 68 |
| 21 | Trib. of Gwenffrwd; 20m u/s conf. Gwneffrwd | SN 5956 6245 | | 78 |
| 22 | Gwenffrwd; Gwenffrwd above Penuwch trib. | SN 5959 6246 | | 86 |
| 23 | Gwenffrwd; u/s trib above site SN 5975 6223 | SN 5970 6228 | | 1 |
| 24 | Gwenffrwd; above ditch 50m above RB | SN 5970 6231 | | 71 |
| 25 | Gwenffrwd; 3rd trib. d/s Llanerch-goch | SN 5980 6060 | | 60 |
| 26 | Gwenffrwd; u/s 2nd trib. | SN 5964 5983 | | 14 |
| 27 | Gwenffrwd; 2nd trib. 30m u/s conf. | SN 5962 5983 | | 72 |
| 28 | Gwenffrwd; 30-40m u/s conf. | SN 5960 5948 | | 68 |
| 29 | Gwenffrwd; u/s 1st trib. | SN 5960 5950 | | 4 |
| 30 | Trib. of Aeron; @ Blaenpennar | SN 6330 6430 | | 72 |
| 31 | Trib. of Aeron; in field, 10m d/s road | SN 6250 6030 | | 80 |
| 32 | Trib. of Aeron; from farm 5m u/s conf. | SN 6090 5870 | | 12 |
| 33 | Aeron; above Gwenffrwd conf. | SN 6010 5830 | | 40 |
| 34 | Trib. from Castell; on farm lane from Castell | SN 5820 5800 | | 28 |
| 35 | Aeron; @ Trefan 60m u/s RB | SN 5740 5770 | | 26 |
| 36 | Aeron; u/s RB | SN 5640 5670 | | 49 |

**Table 3.3.14 Biological results for Aeron catchment for summer and autumn 1998 sheep dip survey.**

### 3.3.7.3 Farm visit programme

Following biological surveys on the Gwenffrwd (a tributary of the Afon Aeron), all six farms within the catchment of the ditch pinpointed as the source of possible contamination were visited. One of these farms had a dip, but it was low risk, and the used dip was disposed of to land outside of the catchment of the ditch. Two other treatments were used at other farms. No problems were found, and a GCMS scan of the sediment in the ditch showed no peaks.

One dip has been found adjacent to the Diluw, a tributary of the Ystwyth; investigations are continuing to locate the owner of the dip.

The Gwaun catchment was selected due to its high density of sheep farming. Twenty-seven farms were visited within the catchment; nineteen dips were inspected.

## Type of treatment

**Table 3.3.15 Treatment methods used in the Gwaun catchment**

| Treatment method | % Sites visited |
|---|---|
| OP dips | 80 |
| SP dips | 10 |
| SP & OP dips | 5 |
| Injection | 5 |
| Pour on | - |
| Shower/Jet | - |
| Don't know | - |

**Sheep dipping structures**

The general standard of the sealed sheep dips was satisfactory but three were in poor condition. A greater than average number of sheep dips discharged to soakaway systems and two were sited on the edge of streams. One sheep dip on a dairy farm had the drainage pen exit area falling towards a road and could result in loss of dip to the road drainage system. Also a mobile dip owner was using the dip on a concrete yard within close proximity to watercourses.

**Table 3.3.16 Disposal methods in the Gwaun catchment**

| Disposal method | % Sites visited |
|---|---|
| Soakaway | 50 |
| Landspreading | 50 |
| Off-site Disposal | - |
| Direct Discharge | - |

Seven farms in the Nevern catchment were revisited, as they were assessed as high risk during last year's survey. The sheep dip sites remain as high risk activities, but one has ceased dipping. General awareness has increased. However, a further two current high risk sites were identified and also three abandoned sheep dips which would have been categorised as high risk sites.

## 3.3.8 Taf and Neath catchments

No biological surveys or farm visits were carried out in these catchments.

### 3.3.8.1 Stream chemistry

Four sites were sampled on the Taf and its tributaries. On one occasion diazinon was found at low levels at Login. Four sites were sampled in the Afon Neath catchment, of which there were two occasions when sheep dip was found, peaking at 978 ng/l Propetamphos (x9 MAC), on the Clydach at Bryncoch.

**Table 3.3.17 Summary of positive water quality results for the Taf and Neath catchments. MAC EQS failures in bold.**

| SITE | Site code | Determinands with positive samples | Max ng/l | No. Samples | No. positives |
|---|---|---|---|---|---|
| Gronw @ Whitland | 87014 | No positive samples | - | 5 | 0 |
| Cynnen @ Cwmduhen | 32027 | No positive samples | - | 8 | 0 |
| Cynin @ Felindre | 32031 | No positive samples | - | 8 | 0 |
| Taf @ Login | 32034 | Diazinon | 25 | 7 | 1 |
| Nedd Fechan at Pontneddfechan | 10012 | No positive samples | - | 8 | 0 |
| Mellte | 10015 | No positive samples | - | 8 | 0 |
| Hepste @ Bryn-Cul Ford | 71611 | No positive samples | - | 6 | 0 |
| Clydach @ Bryncoch | 71618 | Propetamphos | 978 | 8 | 2 |

## 3.3.9 Pollution prevention activities

In 244 visits undertaken in South West Area, 111 dips were found, which were categorised as follows:

High risk: 28 (25%)
Medium risk: 36 (33%)
Low risk: 47 (42%)

Approximately 25-30 farms used other treatment methods, including: injections, pour-ons, and mobile dippers.

Pollution Prevention Guidelines were given to all farmers visited, and any procedures in use that were not in compliance with the guidelines were discussed. Farmers were strongly advised not to use soakaways and to permanently seal drain holes in their dip baths. Farmers were also advised of the risks of not allowing dip to drain off their sheep before putting them to pasture.

Disposal of the spent sheep dip often raised discussions, as it was found that, on occasion, spent dip disposal techniques used were not in line with the Environment Agency Pollution Prevention Guidelines. The majority of farmers entered into positive discussions relating to correct management of dipping and the disposal of spent dip.

Letters discussing remedial measures were sent to all farmers whose dip baths were assessed as high risk. Any measures discussed relating to dip baths assessed as medium or low risk were recorded on the site inspection form.

All known mobile dippers were contacted by letter, with pollution prevention guidelines attached, requesting meetings to discuss pollution prevention measures. Numerous mobile dippers responded, and several meetings were undertaken between the mobile dippers and the Agency.

## 3.3.10 Sewage Treatment Works monitoring

**Drefach/Felindre STW**
Nine samples were taken of the final effluent from the STW from April to December. Chlorfenvinphos and cypermethrin were found at low levels on one occasion each, and diazinon was found on one occasion at 3880 ng/l, which would require at least 1:39 dilution to achieve the MAC EQS in the receiving water.

**Ffairfach STW**

Nine samples were taken between April and November. Propetamphos and diazinon were found on two and four occasions respectively. Cypermethrin was also found on two occasions.

**Table 3.3.18 Positive results from sampling Sewage Treatment Works.**

| Site | Date | Diazinon ng/l | Propetamphos ng/l | Chlorven-vinphos ng/l | Cyper-methrin ng/l | Flumethrin ng/l |
|---|---|---|---|---|---|---|
| Drefach/ Felindre STW | 19/6/98 | | | 8 | | |
| | 8/7/98 | | | | 2 | |
| | 4/9/98 | 3880 | | | | |
| Ffairfach STW | 1/7/98 | 11 | | | | |
| | 23/7/98 | 69 | | | | |
| | 12/8/98 | | 6 | | 1 | |
| | 26/8/98 | | | | 1 | |
| | 17/9/98 | 9 | | | | |
| | 14/10/98 | 16 | 6 | | | |

Biological surveys upstream and downstream of the STWs in July detected no impact. However this was before the high effluent monitoring results in September.

## 3.3.11 Recovery of sites impacted in 1997

Biological monitoring in the Sawdde catchment in 1997 established that 1.6 km of the Afon Clydach and 0.7 km of the Nant Maesadda had been severely affected by leakage of cypermethrin into the Nant Maesadda. Follow-up monitoring in May and August 1998 indicated that the macroinvertebrate fauna had recovered from the incident. An assessmentof salmonid distribution and growth rates in August 1998 was unable to detect any decreased productivity in the stream length affected .

## 3.3.12 South West area recommendations

1. A chemical monitoring programme should be continued in 1999 in those catchments where repeated or high positive results were found in 1998, and other catchments to be added as resources allow.

2. The introduction of the Groundwater Regulations should be utilised to visit some of the sites of applications for authorisations to assess not only the disposal risk, but also the dip site and management. Farming groups should also be visited as part of raising awareness of the Regulations.

3. A supporting Code of Practice needs to be developed and issued to sheep farmers.

4. Problematic catchments where dips are known to be located, but the majority of farmers have not applied for authorisation under Groundwater Regulations should be targetted via biological surveys.

5. The sheep farms in those catchments most severely impacted in 1998 to be visited before dipping season in 1999. Biological surveys to be repeated on these later in the year. Sediment and soil sampling should be used to assist investigations during biological surveys

6. Reactive visits to those catchments giving elevated results during chemical monitoring programme in 1999, in conjunction with biological surveys to target inspections more effectively.

7. There is a need to assess the biological impact and effects on fisheries in selected catchments for example the upper Cothi, using student projects where appropriate.

8. Liaison should continue with ADAS to allow their visit programme to continue in selected catchments. There is a need to lobby Welsh Office to enable ADAS to increase involvement.

# 3.4 SOUTH EAST AREA

## 3.4.1 Wye catchment

### 3.4.1.1 Stream chemistry

Eleven sites were sampled as part of the main monitoring programme between May and December (Table 3.4.1). Of the eleven sites sampled, eight sites recorded positive results for organophosphate pesticides. Three of the samples exceeded the MAC EQS for propetamphos, twice at the River Arrow at Newchurch and once on the River Camddwr. Synthetic pyrethroids were detected at six of the sites, all of which were cypermethrin.

### 3.4.1.2 Stream biology

Eleven sub-catchments of the Wye, plus Builth Wells STW, were initially targeted for sheep dip monitoring. Olchon Brook was later added to this list after a possible problem area was identified by Enforcement staff. Dyfnant Brook is also included in these results after a LEAP Issue survey revealed low scores caused by sheep dip pesticides. A total of 70 sites were sampled in the summer, but due to flood events, only 49 were surveyed in the autumn.

**Olchon Brook sub-catchment**

Four sites were sampled in the summer only.

Biological quality was good at all sites with BMWP scores ranging from 100 to 120. There was no evidence of any of the effects of sheep dip pesticides on the macroinvertebrate fauna.

**River Arrow sub-catchment**

Four sites were sampled in the summer. Biological quality was good at all the sites with BMWP scores ranging from 92 to 113. No indication of any impact by sheep dip pesticides on the macroinvertebrate fauna was evident.

A total of fourteen sites were sampled in the autumn, due to the score of the most downstream site at Newchurch (Site 5), decreasing from 112 in the summer to 29 in the autumn. Moving upstream, Sites 6 and 7 scored poorly (16 and 31 respectively) with low abundances of all taxa present. Sites 8 and 9 scored slightly higher (43 and 50 respectively) and supported moderate abundances of the sensitive Heptagenid mayfly nymph. There was a large increase in score in the middle reaches of the sampling area (Sites 10, 12 and 14) indicating that the cause of the poor quality had occurred between Sites 9 and 10. This stretch of the river was examined but no obvious cause for the decline in scores in the lower reaches could be detected. It is possible that the high flows in the weeks prior to the survey had masked the point of impact by increasing the rate of invertebrate drift. Further investigation by Environment Protection determined that inappropriate disposal methods had been practised in the area. The results of the chemical monitoring show that the OP propetamphos was the most likely cause of the problem as levels twice exceeded the EQS MAC at Newchurch.

**Table 3.4.1 A summary of positive water column sampling results for the Wye catchment. EQS failures in bold.**

| SITE | Site Code | Determinands with positive samples | Max (ng/l) | No. samples | No. positive |
|---|---|---|---|---|---|
| Marteg at Pont Ar Marteg | 50005 | No positive results | - | 10 | 0 |
| River Duhow at A470 roadbridge | 50012 | Propetamphos | 12 | 10 | 1 |
| River Edw at Aberedw Bridge | 50013 | Diazinon | 21 | 10 | 2 |
| | | Propetamphos | 6 | 10 | 1 |
| | | Cypermethrin | 1 | 10 | 2 |
| Bachowey at confl. Wye | 50016 | Diazinon | 12 | 10 | 3 |
| | | Propetamphos | 15 | 10 | 2 |
| | | Cypermethrin | 2 | 10 | 1 |
| Garth Dulas at Garth Bridge | 50079 | Diazinon | 10 | 11 | 1 |
| River Chwefru at Park Bridge, Builth | 50081 | Diazinon | 10 | 11 | 2 |
| | | Propetamphos | 20 | 11 | 2 |
| River Aran at conf. Ithon | 50084 | Diazinon | 18 | 8 | 1 |
| | | Cypermethrin | 7 | 8 | 1 |
| River Ithon at Llanbadarn Fyndd | 50086 | Diazinon | 13 | 9 | 2 |
| Clywedog Brook at A44 roadbridge | 50087 | No positive results | - | 9 | 0 |
| River Camddwr at conf Ithon | 50820 | Diazinon | 6 | 10 | 1 |
| | | Propetamphos | 31660 | 10 | 3 |
| River Arrow at Newchurch | 50828 | Diazinon | 17 | 8 | 6 |
| | | Propetamphos | 184 | 8 | 3 |
| | | Cypermethrin | 1 | 8 | 1 |

Additional sites were also included in the upper reaches of the Arrow as the most upstream site of the summer survey, the Arrow at Site 15, had decreased from 92 in the summer to 55 in autumn. Sheep pens were located adjacent to the river further upstream and the score decreased from 71 upstream of the pens to 52 downstream. Whilst this was not a significant difference, no other obvious cause for the decrease could be located. Moderate abundances of heptagenids, limnephilids and gammarids were present at Sites 15 and 16, downstream of the pens. However, upstream of the pens the sites supported more sensitive taxa in higher abundances. Again, the flood event may have masked or minimised the impact of the pollutant.

**Bach Howey sub-catchment**

Six sites were sampled in the summer and autumn. One additional site was sampled in autumn after a low score was found.

In the summer the sites scored between 67 and 104 indicating that biological quality was good at all sites and there was no evidence of any effects of sheep dip pesticides on the macroinvertebrate fauna. In the autumn the lower reaches of the survey area scored similarly to the summer survey. However, further upstream the Bach Howey at Rhyd Lydan (Site 22) had decreased in score from 104 in the summer, to 45. An additional site further upstream at Paincastle (Site 23) also scored poorly (49). The two most upstream sites had similar scores in summer and autumn. No obvious cause for the decline in scores around Painscastle was evident.

In this catchment, farm inspections were undertaken by ADAS staff, and detailed results are not available.

**Edw sub-catchment**

Nine sites were sampled in the summer only. Biological quality was good at all sites with BMWP scores ranging from 43 to 112. The site scoring 43 (Site 30) was sampled using the sweep method as the stream was deep and silty. This type of habitat does not usually support a diverse, high scoring fauna, and the score was as expected for the site. There was no evidence of any effects of sheep dip pesticides on the macroinvertebrate fauna.

All the sites surveyed had been sampled in the 1997 sheep dip survey when sites on the Colwyn Brook and on the Edw downstream of the Colwyn Brook were found to have been severely or moderately affected by a pollutant, suspected as being a sheep dip pesticide. The scores on the Colwyn Brook and the Edw in the summer indicated that the fauna had made a good recovery, with one site increasing in score from 15 to 84.

**Duhonw sub-catchment**

Four sites were sampled in the summer only. Biological quality was good at all sites with BMWP scores ranging from 65 to 110. There was no evidence of any effects of sheep dip pesticides on the macroinvertebrate fauna.

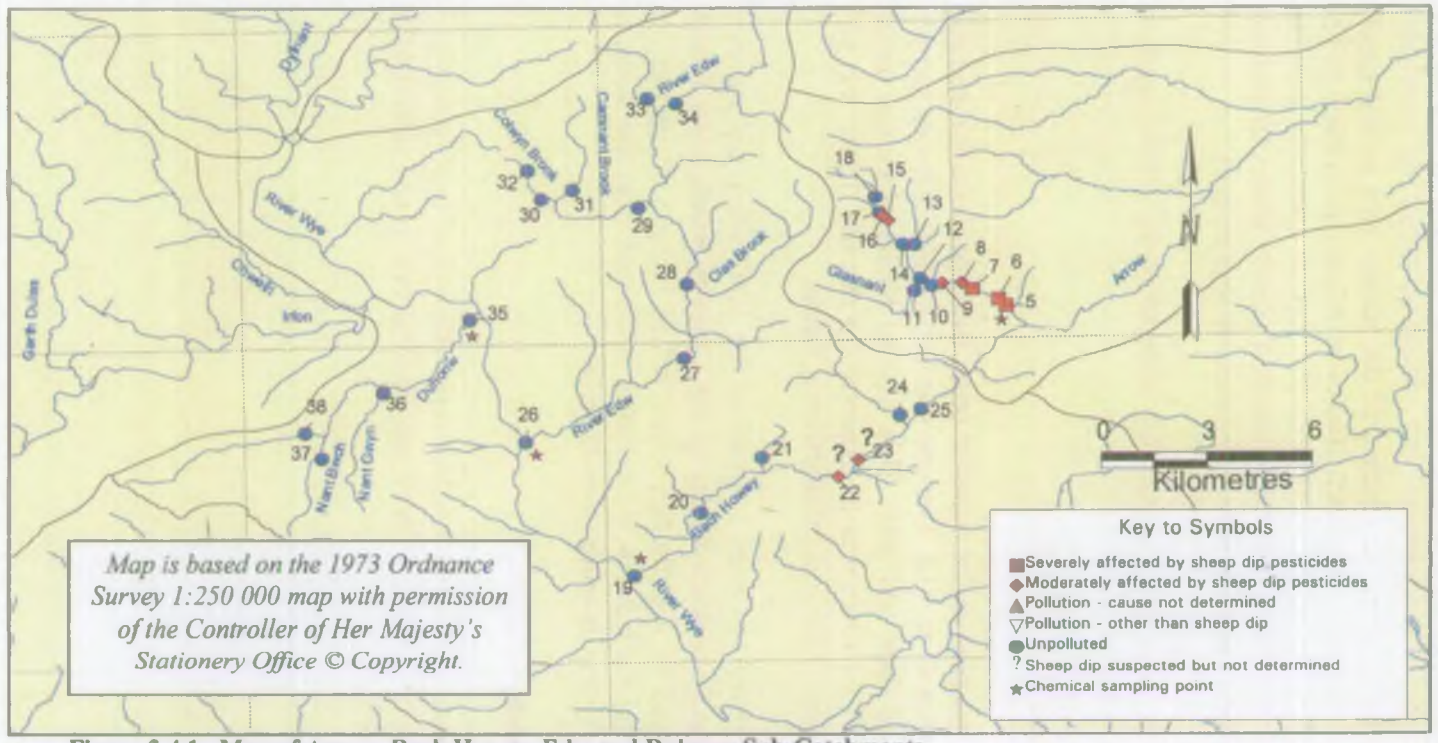



**Figure 3.4.1 –Map of Arrow, Bach Howey, Edw and Duhonw Sub-Catchments**

| Site No. | Site Description | NGR | BMWP Score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Olchon Brook nr Clodoch | SO 3260 2815 | 100 | |
| 2 | Olchon Brook nr Turnant | SO 3120 2980 | 120 | |
| 3 | Olchon Brook @ Farm | SO 3050 3065 | 105 | |
| 4 | Olchon Brook u/s farm | SO 2885 3170 | 112 | |
| 5 | Arrow @ Newchurch | SO 2170 5090 | 112 | 29 |
| 6 | Arrow u/s Newchurch | SO 2130 5125 | | 16 |
| 7 | Arrow u/s Farm | SO 2050 5150 | | 31 |
| 8 | Arrow u/s bridge and Farm | SO 2030 5170 | | 43 |
| 9 | Arrow u/s bridge and u/s small trib | SO 1970 5180 | | 50 |
| 10 | Arrow d/s Glasnant | SO 1940 5175 | | 100 |
| 11 | Glasnant nr farm | SO 1903 5170 | 113 | 71 |
| 12 | Arrow u/s Glasnant | SO 1930 5185 | | 95 |
| 13 | Trib. Of Arrow @ Cloggau | SO 1880 5280 | 106 | 81 |
| 14 | Arrow nr Cloggau | SO 1860 5295 | | 110 |
| 15 | Arrow @ farm | SO 1820 5370 | 92 | 55 |
| 16 | Arrow d/s sheep pens | SO 1805 5390 | | 52 |
| 17 | Arrow u/s sheep pens | SO 1795 5395 | | 71 |
| 18 | Arrow @ top site | SO 1785 5445 | | 93 |
| 19 | Bach Howey u/s Wye | SO 1053 4285 | 91 | 90 |
| 20 | Bach Howey @ Llandewi | SO 1270 4465 | 79 | 76 |
| 21 | Trib. Of Bach Howey @ Llanbedr | SO 1440 4640 | 80 | 68 |
| 22 | Bach Howey @ Rhyd Lydan | SO 1665 4570 | 104 | 45 |
| 23 | Bach Howey nr. Paincastle | SO 1720 4625 | | 49 |
| 24 | Bach Howey @ Rhos-goch | SO 1855 4745 | 74 | 77 |
| 25 | Trib. Of Bach Howey d/s Rhos-goch Common | SO 1885 4755 | 67 | 62 |
| 26 | Edw @ Aberedw | SO 0770 4697 | 112 | |
| 27 | Edw @ Lower Bridge | SO 1230 4950 | 83 | |
| 28 | Clas Brook u/s Edw | SO 1255 5180 | 91 | |
| 29 | Camnant @ Hundred House | SO 1110 5440 | 64 | |
| 30 | Colwyn Brook u/s Camnant Brook | SO 0918 5390 | 43* | |
| 31 | Camnant u/s Colwyn Brook | SO 0920 5395 | 80 | |
| 32 | Colwyn Brook d/s farm Trib. | SO 0800 5485 | 84 | |
| 33 | Trib. Of Edw u/s Edw | SO 1250 5780 | 74 | |
| 34 | Edw u/s roadbridge d/s trib. | SO 1251 5780 | 100 | |
| 35 | Duhonw u/s Wye | SO 0616 5085 | 65 | |
| 36 | Nant Gwyn @ Llanddewir Cwm | SO 0380 4877 | 110 | |
| 37 | Nant Bwch u/s Ford | SO 0190 4710 | 105 | |
| 38 | Duhonw @ Maesmyns | SO 0160 4750 | 95 | |

**Table 3.4.2 – 1998 Biological results for Arrow, Bach Howey, Edw and Duhonw Sub-Catchments**

**Chwefri sub-catchment**

Seven sites were sampled in the summer and three in the autumn. The scores and abundances in the summer were lower than expected given the habitat quality, from Site 45 in the upper reaches, to the confluence of the Chwefri with the Irfon (Site 41), a distance of approximately 15km. The source of the problem was traced to a site where sheep pens were located next to the river. However, subsequent information indicated that these pens were only used for drenching sheep internally for worms, and not for the treatment of ectoparasites. The sites immediately downstream of this area were severely affected, scoring between 27 and 38, with the sites further downstream improving slightly, to 55 at Site 41. This is still a lower score than would be expected given the good habitat at this site. It was suggested that the problem was caused higher up the catchment due to a mobile dip being emptied onto marshy ground, but this could not be substantiated.

High flows hindered the autumn survey, so only the top sites around the problem area could be sampled. A new site (site 47) on a tributary that entered the river near the sheep pens was sampled, which scored only 28. However, the tributary was only a small ditch and it is likely that it was only flowing as a result of the earlier heavy rainfall. In addition, the main river did not decrease in score downstream of the tributary, so no impact was evident. The main river appeared to have recovered from the impact of the summer pollutant, scoring 76 downstream of the tributary and 66 upstream.

**Garth Dulas sub-catchment**

Four sites were sampled in the summer, three of which were repeated in autumn. Biological quality was good at all sites in both the summer and autumn. A slight decrease in BMWP scores occurred between the seasons at all of the sites, but, given the presence and abundance of several pollution sensitive taxa, this was attributed to the recent floods rather than pollution. No evidence of any effects of sheep dip pesticides on the macroinvertebrate fauna was apparent.

**Dyfnant sub-catchment**

This small tributary of the Wye at Newbridge-on-Wye was sampled in the autumn for a purpose other than the sheep dip survey. Very low scores were found and the source was traced to a yard where a mobile sheep dip had been operating just prior to sampling. The score decreased from 92 upstream of the yard to 9 downstream. There was also a distinct disinfectant-like odour in the area. The stream was affected right down to its confluence with the Wye, the most downstream site scoring just 24. Any impact this may have had on the Wye could not be investigated due to high flows.

An extensive investigation by Environment Protection staff eventually located the tenant of the land adjacent to the watercourse who confirmed that a mobile dip contractor had been on site, but would not reveal the contractor's name. Assurance was given that the site would not be used in future.

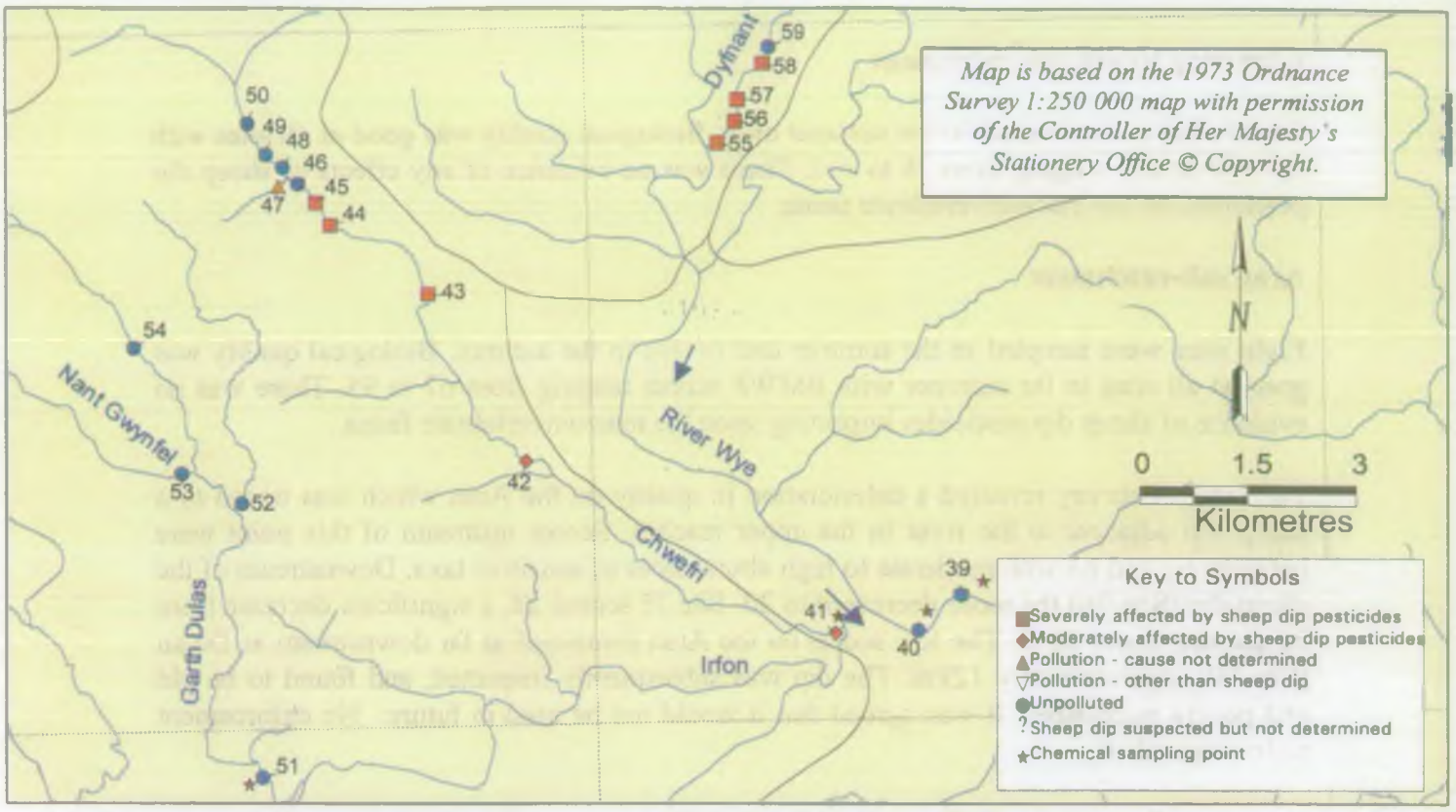



Figure 3.4.2 – Chwefri, Garth Dulas, Dyfnant and Builth Wells STW Sub-Catchments

| Site No. | Site Description | NGR | BMWP Score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 39 | Wye d/s Builth Wells STW | SO 0490 5175 | 76 | |
| 40 | Wye u/s Builth Wells STW | SO 0430 5125 | 79 | |
| 41 | Chwefri @ Builth Wells | SO 0315 5125 | 55 | |
| 42 | Chwefri nr Pencaerhelem | SN 9880 5385 | 57 | |
| 43 | Chwefri @ Llanfawr | SN 9740 5625 | 27 | |
| 44 | Chwefri @ Holiday Cottages | SN 9605 5730 | 32 | |
| 45 | Chwefri 500m u/s Holiday Cottages | SN 9575 5765 | 38 | |
| 46 | Chwefri d/s Sheep Pens and trib. | SN 9570 5780 | | 76 |
| 47 | Trib. u/s Chwefri | SN 9550 5785 | | 28 |
| 48 | Chwefri u/s Sheep Pens and trib. | SN 9560 5790 | | 66 |
| 49 | Chwefri u/s Sheep Pens | SN 9550 5790 | 64 | |
| 50 | Chwefri @ Abernefal | SN 9500 5870 | 64 | |
| 51 | Garth Dulas d/s Garth Bridge | SN 9493 4947 | 87 | 61 |
| 52 | Trib of Garth Dulas @ Glandulas | SN 9480 5325 | 92 | 66 |
| 53 | Nant Gwynfel @ Llwyn Gwrgan | SN 9400 5375 | 77 | |
| 54 | Garth Dulas @ Brongarth | SN 9525 5560 | 72 | 56 |
| 55 | Dyfnant @ Newbridge on Wye | SO 0100 5835 | | 24 |
| 56 | Dyfnant nr Newbridge On Wye | SO 0165 5860 | | 6 |
| 57 | Dyfnant @ Farm u/s Newbridge on Wye | SO 0165 5890 | | 20 |
| 58 | Dyfnant d/s Farm | SO 0223 5945 | | 9 |
| 59 | Dyfnant u/s Farm | SO 0230 5965 | | 92 |

Table 3.4.3 Biological results for Chwefri, Garth Dulas, Dyfnant and Builth Wells STW Sub-Catchments

**Clywedog Brook sub-catchment**

Seven sites were sampled in the summer only. Biological quality was good at all sites with BMWP scores ranging from 78 to 112. There was no evidence of any effects of sheep dip pesticides on the macroinvertebrate fauna.

**Aran sub-catchment**

Eight sites were sampled in the summer and twelve in the autumn. Biological quality was good at all sites in the summer with BMWP scores ranging from 67 to 95. There was no evidence of sheep dip pesticides impacting upon the macroinvertebrate fauna.

The autumn survey revealed a deterioration in quality on the Aran which was traced to a sheep dip adjacent to the river in the upper reaches. Scores upstream of this point were between 63 and 83 with moderate to high abundances of sensitive taxa. Downstream of the sheep dip (Site 76) the score decreased to 20. Site 75 scored 28, a significant decrease from its summer score of 72. The low scores on the Aran continued as far downstream as Dolau (Site 70), approximately 12km. The dip was subsequently inspected, and found to be old and poorly maintained. It was agreed that it would not be used in future. No enforcement action was taken.

**Camddwr Brook sub-catchment**

Four sites were sampled in the summer and five in the autumn. Biological quality was good at all sites in the summer with BMWP scores ranging from 62 to 148. No evidence of any impact from sheep dip pesticides on the macroinvertebrate fauna was apparent.

The scores were slightly lower in the autumn survey so further investigation was necessary. Scores were high in the upper reaches but decreased in the middle reaches. A decrease from 91 upstream to 52 downstream (Sites 83 and 82 respectively) occurred in the vicinity of a farm discharge. The presence of sewage fungus and moderate abundances of heptagenid and baetid mayflies and the freshwater shrimp, Gammaridae, indicated that a pollutant other than sheep dip pesticides was responsible for this deterioration in quality.

Lack of Environment Protection staff resources prevented further investigations in the catchment to identify sources of sheep dip pesticides detected by the water quality sampling.

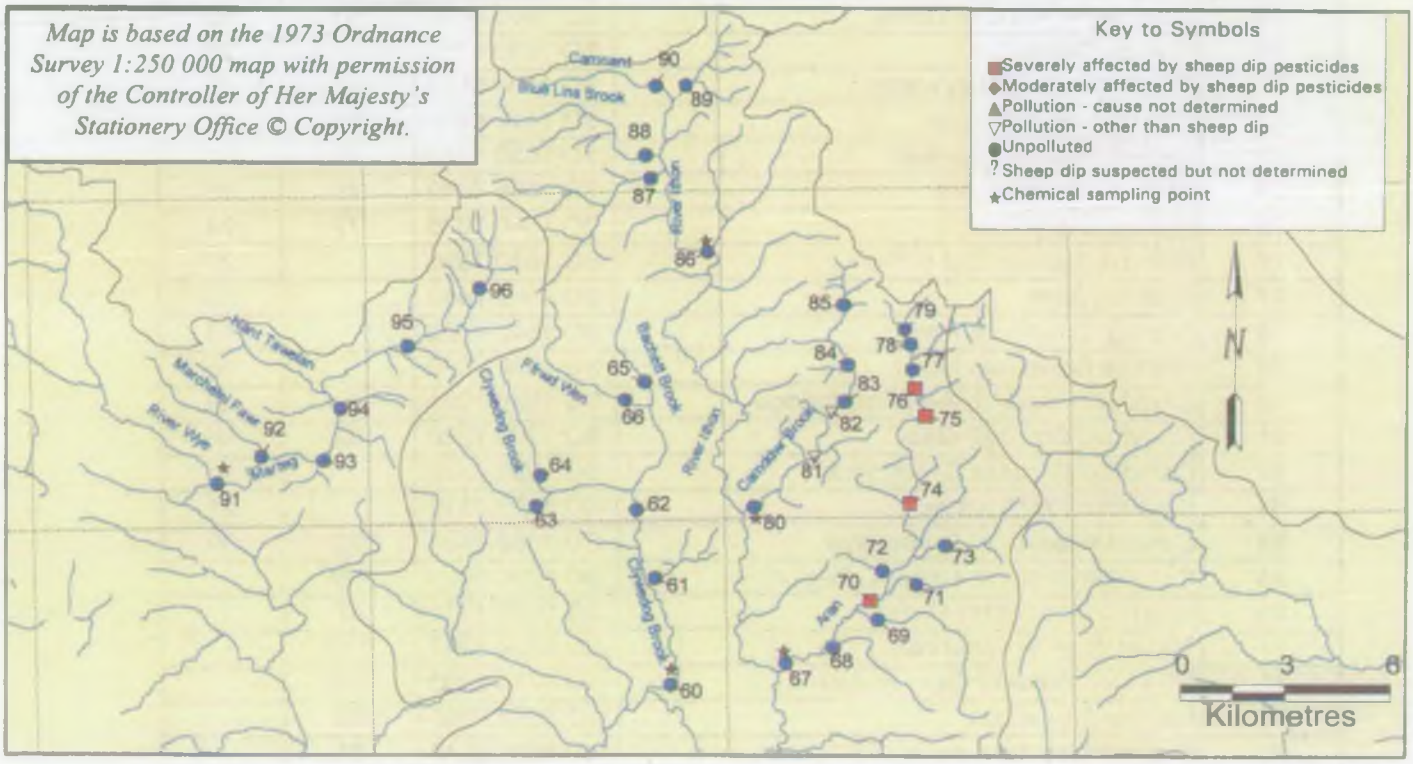
**Ithon sub-catchment**

Five sites were sampled in the summer only. Biological quality was good at all sites with BMWP scores ranging from 83 to 112 and no indication of any pollution problems.

## Marteg sub-catchment

Six sites were sampled in the summer only. Biological quality was good at all sites with BMWP scores ranging from 64 to 80. There was no evidence of any of the effects of sheep dip pesticides on the macroinvertebrate fauna.

**Figure 3.4.3 – Map of Clywedog, Aran, Camddwr, Ithon and Marteg Sub-Catchments**



| Site No. | Site Description | NGR | BMWP Score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 60 | Clywedog Brook u/s Ithon | SO 0837 6508 | 100 | |
| 61 | Trib. Of Clywedog Brook nr Cwmtelman | SO 0795 6823 | 78 | |
| 62 | Clywedog Brook nr Cwmcaerdy | SO 0760 7035 | 112 | |
| 63 | Trib of Clywedog Brook @ Abbeycwmhir | SO 0508 7097 | 101 | |
| 64 | Clywedog Brook @ Abbeycwmhir | SO 0505 7100 | 86 | |
| 65 | Bachett Brook u/s Ffrwd Wen | SO 0795 7360 | 103 | |
| 66 | Ffrwd Wen u/s Bachett Brook | SO 0790 7360 | 97 | |
| 67 | Aran u/s Ithon | SO 1170 6560 | 92 | 69 |
| 68 | Trib of Aran nr farm | SO 1320 6610 | 87 | |
| 69 | Cwm Metwys trib nr Dolau | SO 1400 6690 | 67 | 50 |
| 70 | Aran nr Dolau | SO 1380 6730 | | 29 |
| 71 | Trib of Aran nr Nantywellan | SO 1490 6803 | 83 | 77 |
| 72 | Trib of Aran nr Trevan | SO 1445 6835 | 84 | 52 |
| 73 | Trib of Aran @ Tinywaun | SO 1630 6910 | 95 | 115 |
| 74 | Aran nr Lower Pentre | SO 1535 7040 | 75 | 35 |
| 75 | Aran nr Dol-y-Fran | SO 1560 7370 | 72 | 28 |
| 76 | Aran u/s Farm nr Dol-y-Fran | SO 1550 7390 | | 20 |
| 77 | Aran d/s farm | SO 1550 7450 | | 63 |
| 78 | Aran @ Cnwch d/s Farm | SO 1540 7525 | | 83 |
| 79 | Aran @ Cnwch u/s Farm | SO 1530 7570 | | 76 |
| 80 | Camddwr Brook @ A483 roadbridge | SO 1080 7030 | 62 | 59 |
| 81 | Camddwr Brook @ Ddol | SO 1270 7230 | 68 | 46 |
| 82 | Camddwr Brook nr Crosscynon | SO 1305 7310 | | 52 |
| 83 | Camddwr Brook u/s pipe | SO 1320 7315 | | 91 |
| 84 | Camddwr Brook nr Crossways | SO 1360 7450 | 92 | 99 |
| 85 | Camddwr Brook nr Upper Cae-glas | SO 1350 7650 | 148 | |
| 86 | Ithon @ Llanbadarn Fynydd | SO 0980 7770 | 97 | |
| 87 | Trib of Ithon @ Crochran | SO 0820 8060 | 112 | |
| 88 | Blue Lins Brook nr Glan Yr Afon | SO 0730 8100 | 102 | |
| 89 | Ithon nr Tir-y-waun | SO 0895 8295 | 83 | |
| 90 | Camnant u/s Ithon nr Tir-y-Waun | SO 0850 8310 | 93 | |
| 91 | Marteg u/s Wye | SN 9520 7150 | 77 | |
| 92 | Marcheini Fawr u/s Marteg | SN 9670 7225 | 64 | |
| 93 | Marteg nr Gilfach-y-Rhiw | SN 9845 7205 | 73 | |
| 94 | Marteg nr St Harman | SN 9893 7370 | 68 | |
| 95 | Marteg @ Bryn Yr Wyntyll | SO 0090 7554 | 77 | |
| 96 | Marteg nr Bronde Fawr | SO 0303 7715 | 80 | |

**Table 3.4.4 – 1998 Biological results for Clywedog, Aran, Camddwr, Ithon and Marteg Sub-Catchments**

### 3.4.1.3 Farm visit programme

**Arrow catchment**

Seven farms were visited in the River Arrow catchment above Newchurch as a result of 1998 stream chemistry and poor BMWP scores. This was preceded by visits by fisheries staff to identify farms with static dips on site.

Three high risk sites were identified, all with inappropriate disposal methods: two to soakaway and the other pumped out into an adjacent field which sloped steeply to the River Arrow. No definite proof was found to establish that sheep dip was the cause of the poor biology, hence no enforcement action was taken. Requests have been made to use more acceptable methods of disposal. All three sites should be kept under surveillance during the next dipping season.

**Disposal**

**Table 3.4.5 Disposal methods in the River Arrow catchment**

| Disposal method | % Sites visited |
|---|---|
| Soakaway | 43 |
| Landspreading | 57 |
| Off-site Disposal | - |
| Direct Discharge | - |

**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 | 43% |
| Medium | 29% |
| Low | 28% |

### Type of treatment

**Table 3.4.6 Treatment methods used in the Arrow catchment**

| Treatment method | % Sites visited |
|---|---|
| OP dips | 57 |
| SP dips | 43 |
| SP & OP dips | - |
| Injection | - |
| Pour on | - |
| Don't know | - |

### Sheep dipping structures

One dipping structure was in a poor state of repair and had a drain hole. A request was made for remedial work to be carried out, to be followed up in 1999 before it is used again.

### Chemical stores

All farms only purchase what is needed. Any surplus would be held in a locked store.

### Edw sub-catchments : Colwyn and Clas Brook

Seven farms were visited in the River Edw sub-catchments of the Colwyn Brook and Clas Brook as a result of 1997 stream chemistry and biology.

One high risk site was identified where the used dip was thrown onto grass adjacent to the dip bath. A request was made for a more acceptable method of disposal. This should be followed up in 1999.

### Type of treatment

**Table 3.4.7 Treatment methods used in the Edw and sub-catchments (Colwyn and Clas Brook) catchment**

| Treatment method | % Sites visited |
|---|---|
| OP dips | 29 |
| SP dips | 43 |
| SP & OP dips | - |
| Injection | 14 |
| Pour on | - |
| Don't know | 14 |

### Sheep dipping structures

All dipping structures were found to be in a good state of repair.

### Chemical stores

All farms only purchase what is needed. Any surplus dip would be held in a locked store.

### Disposal

**Table 3.4.8 Disposal methods in the Edw and sub-catchments (Colwyn and Clas Brook) catchment**

| Disposal method | % Sites visited |
|---|---|
| Soakaway | 14 |
| Landspreading | 86 |
| Off-site Disposal | - |
| Direct Discharge | - |

### 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 | 14% |
| Medium | 14% |
| Low | 72% |

## 3.4.2 Usk catchment

### 3.4.2.1 Stream chemistry

Ten sites were sampled as part of the main monitoring programme between May and December (Table 3.4.9). Of the ten sites sampled eight sites recorded positive results for organophosphates. Only one sample exceeded the MAC EQS for propetamphos on the Afon Hydfer. Cypermethrin was detected at four sites. Flumethrin was not detected.

**Table 3.4.9 A summary of positive water column sampling results for the Usk catchment. EQS failures in bold.**

| SITE | Site code | Determinands with positive results | Max (ng/l) | No. samples | No. positive |
|---|---|---|---|---|---|
| Hydfer at Pont AR Hydfer | 40865 | Propetamphos | **855** | 11 | 1 |
| | | Cypermethrin | 1 | 11 | 1 |
| Afon Crai at Tan-y-Graig | 40875 | Diazinon | 9 | 8 | 1 |
| Nant Bran at conf | 40893 | Diazinon | 9 | 10 | 1 |
| | | Propetamphos | 15 | 10 | 1 |
| Afon Tarrell | 40897 | Diazinon | 29 | 10 | 1 |
| Afon Honddu | 40899 | Diazinon | 16 | 12 | 1 |
| | | Cypermethrin | 12 | 12 | 2 |
| Afon Cynrig | 40903 | Diazinon | 8 | 9 | 1 |
| | | Cypermethrin | 1 | 9 | 1 |
| Nant Menascin | 40913 | Propetamphos | 14 | 10 | 1 |
| | | Cypermethrin | **10** | 10 | 1 |
| Caerfanell at Old Talybont Station | 40917 | No positive results | - | 9 | 0 |
| Rhiangoll conf at River Usk | 40926 | Propetamphos | 8 | 9 | 1 |
| Grwyne Fawr at A40 roadbridge | 40937 | No positive results | - | 9 | 0 |

### 3.4.2.2 Stream biology

Eleven river sub-catchments were selected as principal study areas within the River Usk catchment. Sampling was initially carried out in the summer and a follow up survey carried out in the autumn. Due to flood events, the number of sites sampled during the autumn survey was greatly reduced, with only one or so main river sites being sampled on some of the sub-catchments where no problems were apparent.

**Grwyne Fawr sub-catchment**

Seven sites were sampled in the Grwyne catchment in the summer and five in the autumn (Fig 3.4.4).

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

**Rhiangoll sub-catchment**

A total of seven sites were sampled in the Rhiangoll catchment in the summer and three sites in the autumn (Fig 3.4.4).

The surveys undertaken in both seasons indicated good biological quality and there was no evidence of impacts caused by sheep dip pesticides.

**Caerfanell sub-catchment**

Five sites were sampled in the Caerfanell sub-catchment in July and one in November (Fig 3.4.4).

Good biological quality (BMWP range 92 - 100) was recorded at all the sites sampled during both seasons and there was no evidence of any impacts of sheep dip pesticides on the macroinvertebrate communities.

**Menascin sub-catchment**

Two sites were sampled in the Menascin catchment in both the summer and autumn surveys (Fig 3.4.4).

Biological quality was good at both sites during both seasons and there was no evidence of any effects of sheep dip pesticides on the macroinvertebrate fauna.

**Cynrig sub-catchment**

A total of four sites were sampled in the Cynrig catchment during the summer and three in the autumn (Fig 3.4.4). All the sites indicated good biological quality during both the summer and autumn surveys. No impact as a result of sheep dip pesticides was recorded.

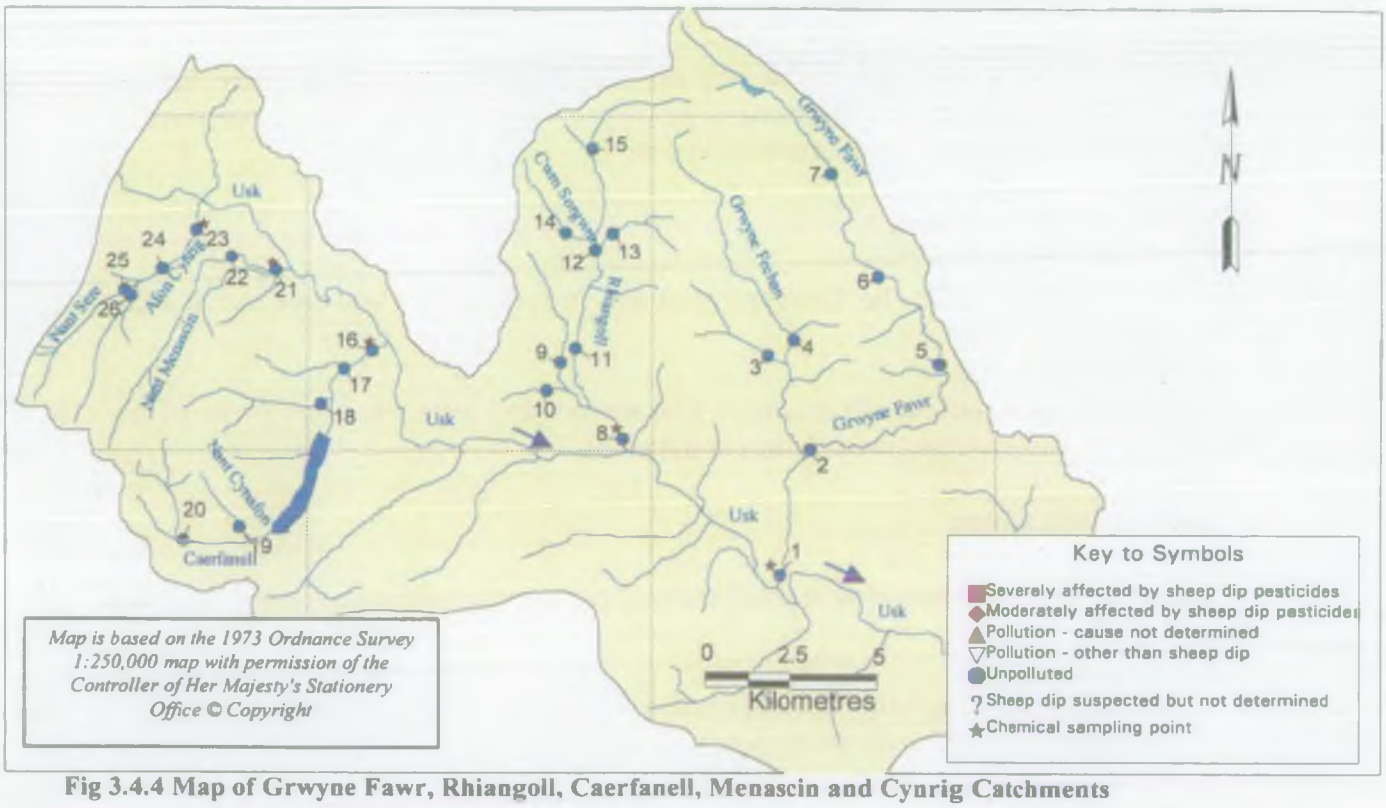



**Fig 3.4.4 Map of Grwyne Fawr, Rhiangoll, Caerfanell, Menascin and Cynrig Catchments**

| Site No. | Site Description | NGR | BMWP Score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 1 | Grwyne Fawr @ Glangrwyney | SO 2377 1630 | 85 | 87 |
| 2 | Grwyne Fechan @ Lower Cwm Bridge | SO 2457 1999 | 82 | 57 |
| 3 | Cwm Banw nr Bont | SO 2340 2285 | 119 | |
| 4 | Grwyne Fechan @ Blaenau | SO 2421 2331 | 93 | 68 |
| 5 | Grwyne Fawr nr Partrishaw | SO 2840 2260 | 120 | 92 |
| 6 | Grwyne Fawr @ Cadwgan | SO 2662 2520 | 105 | |
| 7 | Grwyne Fawr @ Blaen y Cwm | SO 2527 2830 | 135 | 92 |
| 8 | Rhiangoll @ Pont y Bryn Hurt | SO 1918 2008 | 79 | 72 |
| 9 | Trib of Rhiangoll d/s Felindre | SO 1736 2264 | 98 | |
| 10 | Trib of Rhiangoll @ Gaer | SO 1695 2180 | 62 | |
| 11 | Rhiangoll @ Felindre | SO 1779 2305 | 78 | 73 |
| 12 | Trib of Rhiangoll nr Pont Waun Fach | SO 1836 2601 | 102 | |
| 13 | Rhiangoll nr Pont Waun Fach | SO 1848 2610 | | 81 |
| 14 | Nant Sorgwm @ Blaenau Draw | SO 1750 2652 | 87 | |
| 15 | Rhiangoll @ Cwmforest | SO 1828 2903 | 101 | |
| 16 | Caerfanell @ Talybont on Usk | SO 1190 2300 | 92 | 92 |
| 17 | Cwm Cwy @ Talybont on Usk | SO 1108 2245 | 82 | |
| 18 | Tyle Clydach @ Aber | SO 1040 2139 | 85 | |
| 19 | Nant Cynafon @ Abercynafon | SO 0813 1740 | 100 | |
| 20 | Caerfanell @ Blaen y Gwyn | SO 0635 1705 | 97 | |
| 21 | Nant Menascin @ Pencelli | SO 0907 2539 | 108 | 90 |
| 22 | Nant Menascin @ Llanfrynach | SO 0780 2579 | 105 | 75 |
| 23 | Cynrig @ Abercynrig | SO 0675 2660 | 98 | 84 |
| 24 | Cynrig nr Upper Cantref Farm | SO 0572 2542 | 124 | |
| 25 | Nant Sere @ Pontbrench Neuadd | SO 0464 2479 | 125 | 95 |
| 26 | Cynrig nr Bailea | SO 0482 2461 | 126 | 97 |

**Table 3.4.10 1998 Biological Results for the Grwyne Fawr, Rhiangoll, Caerfanell, Menascin and Cynrig Catchments.**

### Honddu sub-catchment

Six sites were sampled in the Honddu sub-catchment in August and four in November (Fig 3.4.5).

Biological quality was good at all sites during both seasons and there was no evidence of any effects of sheep dip pesticides on the macroinvertebrate fauna. BMWP scores ranged from 70 to 133.

### Tarell sub-catchment

A total of seven sites were surveyed in the Tarell catchment during the summer and four in the autumn (Fig 3.4.5).

The surveys undertaken in both seasons indicated good biological quality, and no impact due to the effects of sheep dip pesticides was apparent.

**Bran sub-catchment**

Eight sites were sampled in the Bran catchment during July and three in November (Fig 3.4.5).

Biological quality was good at each of the sites surveyed during the summer and autumn indicating that there were no problems as a result of sheep dip in the catchment.

**Cilieni sub-catchment**

Only the lower Cilieni sub-catchment was targeted for the sheep dip survey programme, with four sites being sampled during the summer and one in the autumn. Two high risk sheep dips towards the upper reaches of the catchment were later reported by Environment Protection staff who requested that the sites were investigated further (Fig 3.4.5).

All the sites sampled in the lower part of the catchment and those later sampled in the upper reaches, were found to be of good biological quality, with no deterioration in quality having occurred in the autumn at Site 50, the only site to be sampled this season. This indicated that there was no impact on the macroinvertebrate fauna from sheep dip pesticides.

**Crai sub-catchment**

A total of five sites were sampled in the Crai catchment in the summer and two sites in the autumn (Fig 3.4.5).

Each of the sites during both the seasons surveyed supported good biological quality, with a diverse representation of sensitive invertebrate taxa. No evidence of pollution caused by sheep dip pesticides was found.

**Hydfer sub-catchment**

Four sites were sampled in the Hydfer catchment in the summer. These sites were all re-sampled in the autumn, along with two additional sites (Fig 3.4.5).

The results of the survey undertaken in July indicated that the biological quality of each of the sites was good and that there appeared to be no problems in the catchment. However, the autumn survey revealed a much reduced BMWP score and decrease in invertebrate diversity at Site 62, just upstream of the confluence with the River Usk, compared to the summer survey. Further investigation was therefore undertaken to pinpoint the source of the decline. Biological quality of the upstream tributaries was good and so also were other sites sampled on the main river upstream. A farm, approximately 0.5km upstream of Site 62, appeared to be the only potential source of a pollutant. This information was conveyed to Environment Protection Officers but lack of resources prevented them from undertaking farm inspections in the catchment.

| Site No. | Site Description | NGR | BMWP Score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 27 | Honddu @ Brecon | SO 0438 2867 | 86 | 80 |
| 28 | Trib of Honddu nr Llanddew | SO 0495 3080 | 70 | |
| 29 | Honddu @ Llandefaelog | SO 0350 3250 | 80 | 107 |
| 30 | Nant Fawr nr Lower Cwmtydu | SO 0240 3700 | 113 | |
| 31 | Honddu @ Cwmache | SO 0130 3780 | 112 | 105 |
| 32 | Honddu @ Upper Chapel | SO 0050 4050 | 133 | 84 |
| 33 | Tarell @ Brecon | SO 0338 2838 | 95 | 94 |
| 34 | Nant Gwdi @ Ffrwdgrech | SO 0285 2740 | 150 | |
| 35 | Afon Llwch d/s Waterfall | SO 0200 2685 | 116 | 112 |
| 36 | Trib of Tarell @ Gilwhybert | SO 0133 2670 | 100 | |
| 37 | Tarell nr Bolgoed | SO 0091 2699 | 142 | 107 |
| 38 | Trib of Tarell @ Libanus | SN 9925 2557 | 85 | |
| 39 | Tarell @ Old Glanrhyd | SN 9857 2414 | 152 | 119 |
| 40 | Nant Bran u/s Usk | SN 9873 2920 | 92 | 86 |
| 41 | Trib of Bran @ Soar | SN 9706 3213 | 82 | |
| 42 | Bran nr Ffosygerwn Farm | SN 9656 3213 | 89 | 100 |
| 43 | Trib of Bran @ Camnant | SN 9584 3255 | 87 | |
| 44 | Bran @ Llanfihangel | SN 9432 3418 | | 81 |
| 45 | Cwm Erchan @ Llanfihangel | SN 9428 3438 | 129 | |
| 46 | Trib of Bran nr Gwar y Felin | SN 9361 3520 | 102 | |
| 47 | Bran @ Blaendyryn | SN 9305 3710 | 135 | |
| 48 | Nant Cilieni u/s Usk | SN 9380 3015 | 80 | 70 |
| 49 | Trib of Cilieni nr Maesllwydiant Uchaf | SN 9350 3077 | 80 | |
| 50 | Cwm Den u/s Cilieni | SN 9281 3055 | 87 | |
| 51 | Trib of Cilieni @ Pentre'r Felin | SN 9217 3024 | 68 | |
| 52 | Cwm Mawan u/s Nant Eithrim | SN 8990 3530 | 93 | |
| 53 | Nant Eithrim @ Llandeilo'r Fan | SN 8960 3465 | 102 | |
| 54 | Usk d/s Sennybridge STW | SN 9252 2952 | 113 | |
| 55 | Usk u/s Sennybridge STW | SN 9245 2916 | 94 | |
| 56 | Afon Crai @ Danygraig | SN 8950 2742 | 111 | 92 |
| 57 | Trib of Crai nr Llwyneuadd | SN 8850 2440 | 86 | |
| 58 | Afon Crai @ Felin Crai | SN 8815 2365 | | 73 |
| 59 | Felin Crai Trib u/s Crai | SN 8791 2361 | 90 | |
| 60 | Cwm Padest nr Blaencrai | SN 8769 2297 | 76 | |
| 61 | Crai d/s Crai Reservoir | SN 8809 2270 | 88 | |
| 62 | Afon Hydfer @ Pont ar Hydfer | SN 8613 2753 | 131 | 57 |
| 63 | Bryntywarch Trib u/s Afon Hydfer | SN 8560 2700 | 112 | 95 |
| 64 | Afon Hydfer u/s Bryntywarch Trib | SN 8560 2690 | | 80 |
| 65 | Meity Isaf Trib @ Meity Isaf | SN 8595 2615 | | 123 |
| 66 | Meity Fawr Trib @ Meity Fawr | SN 8500 2555 | 129 | 82 |
| 67 | Afon Hydfer @ Blaenau Isaf | SN 8455 2580 | 119 | 90 |

**Table 3.4.10 – 1998 Biological Results for the Honddu, Tarell, Bran, Cilieni, Sennybridge STW, Crai and Hydfer Catchments**

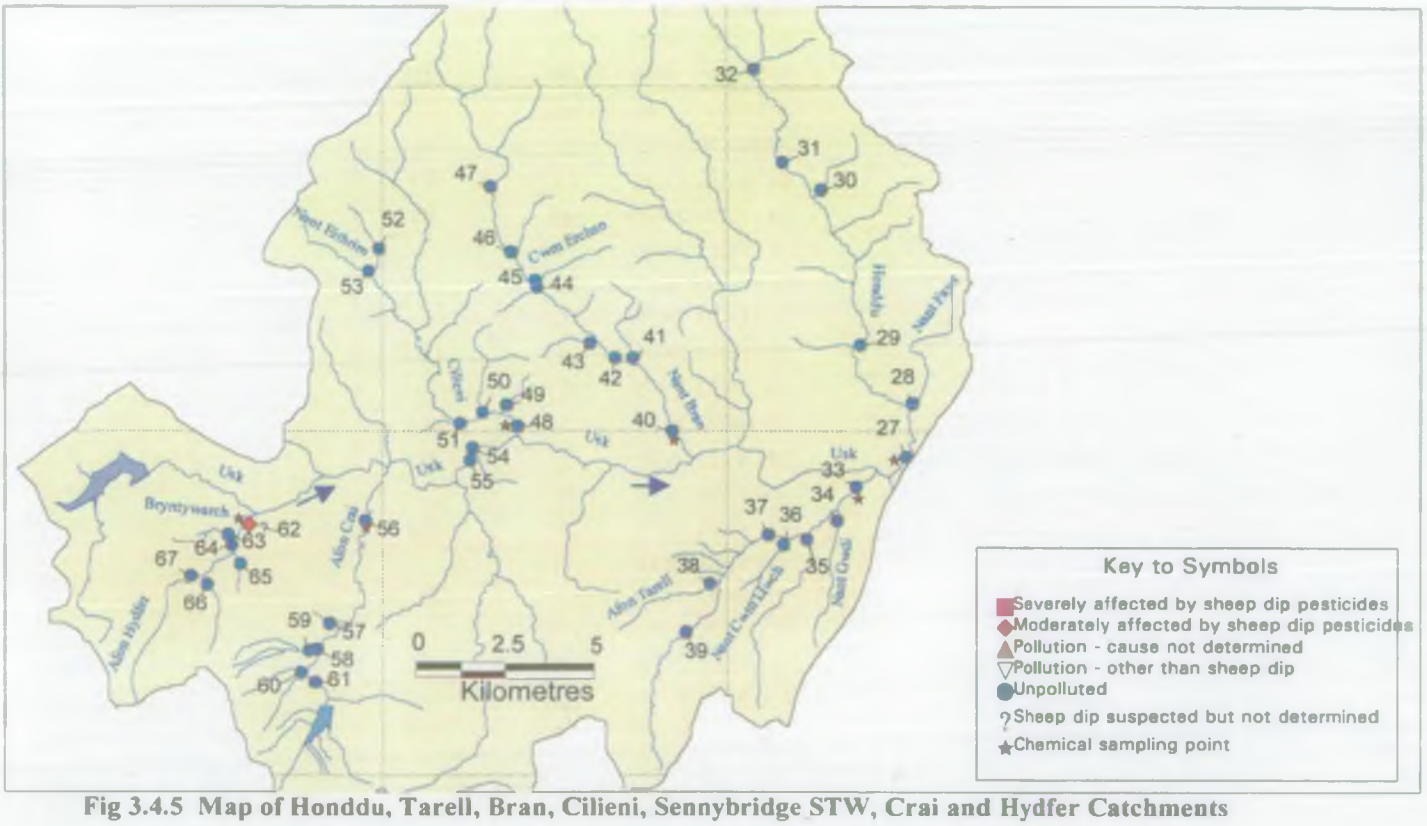



**Fig 3.4.5 Map of Honddu, Tarell, Bran, Cilieni, Sennybridge STW, Crai and Hydfer Catchments**

### 3.4.1.3 Farm visit programme

**Senni catchment**

Nineteen farms were inspected in the Senni catchment as a result of the 1997 stream chemistry and biology results. All dip sites were found to be low risk.

**Type of treatment**

**Table 3.4.11 Treatment methods used in the Senni catchment**

| Treatment method | % Sites visited |
|---|---|
| OP dips | 68 |
| SP dips | 26 |
| SP & OP dips | - |
| Injection | - |
| Pour on | 6 |
| Don't know | - |

**Sheep dipping structures**

All structures were found to be in a good state of repair.

**Chemical stores**

All farms only purchase what is needed. Any surplus was stored in a locked store.

**Disposal**

**Table 3.4.12 Disposal methods in the Senni catchment**

| Disposal method | % Sites visited |
|---|---|
| Soakaway | - |
| Landspreading | 95 |
| Off-site Disposal | 5 |
| Direct Discharge | - |

**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 | 0 |
| Medium | 0 |
| Low | 100% |

## Cilieni

Thirteen farms were inspected in the Cilieni catchment as a result of the 1997 stream chemistry and biology results. Three sites were found to be high risk. The problems were identified as follows; poor disposal methods, location of dip in relation to watercourse and disposal of empty containers. Remedial measures were requested in all cases.

## Type of treatment

**Table 3.4.13 Treatment methods used in the Cilieni catchment**

| Treatment method | % sites visited |
|---|---|
| OP dips | 69 |
| SP dips | 31 |
| SP & OP dips | - |
| Injection | - |
| Pour on | - |
| Don't know | - |

## Chemical stores

All farms only purchased what was needed. Any surplus was held in a locked store.

## Disposal

**Table 3.4.14 Disposal methods in the Cilieni catchment**

| Disposal method | % Sites visited |
|---|---|
| Soakaway | - |
| Landspreading | 100 |
| Off-site Disposal | - |
| Direct Discharge | - |

## 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 | 23% |
| Medium | 15% |
| Low | 62% |

## 3.4.3 Taff catchment

### 3.4.3.1 Stream chemistry

Five sites were sampled within the Taff catchment between April and November.

At two of the sites, propetamphos was detected on three occasions, all below the MAC EQS. No synthetic pyrethroids were detected.

**Table 3.4.15 A summary of positive water column sampling results for the Taff catchment. EQS failures in bold.**

| SITE | Site code | Determinands with positive results | Max (ng/l) | No. samples | No. positive |
|---|---|---|---|---|---|
| Nant Clydach u/s Lady Windsor Colliery | 17017 | No positive results | - | 11 | 0 |
| River Cynon u/s Penderyn | 17036 | Propetamphos | 11 | 8 | 2 |
| River Taf Fechan d/s Vaynor | 17046 | No positive results | - | 8 | 0 |
| Taf Fawr d/s Cefn Coed STW | 17135 | Propetamphos | 7 | 9 | 1 |
| Rhondda Fawr at Tynewydd | 68187 | No positive results | - | 8 | 0 |

### 3.4.3.2 Stream Biology

Three river sub-catchments of the Taff, in addition to the Taf Fechan and Taf Fawr upstream of Merthyr Tydfil, were targeted for sheep dip monitoring. A total of 27 sites were sampled in the summer, however, due to high flows only 26 were surveyed in the autumn.

**Rhondda Fawr sub-catchment**

Two sites were surveyed in the Rhondda Fawr catchment in both summer and autumn (Fig 3.4.6).

Both sites supported good biological quality in both seasons, with a diverse representation of sensitive invertebrate taxa. No evidence of pollution caused by sheep dip pesticides was found.

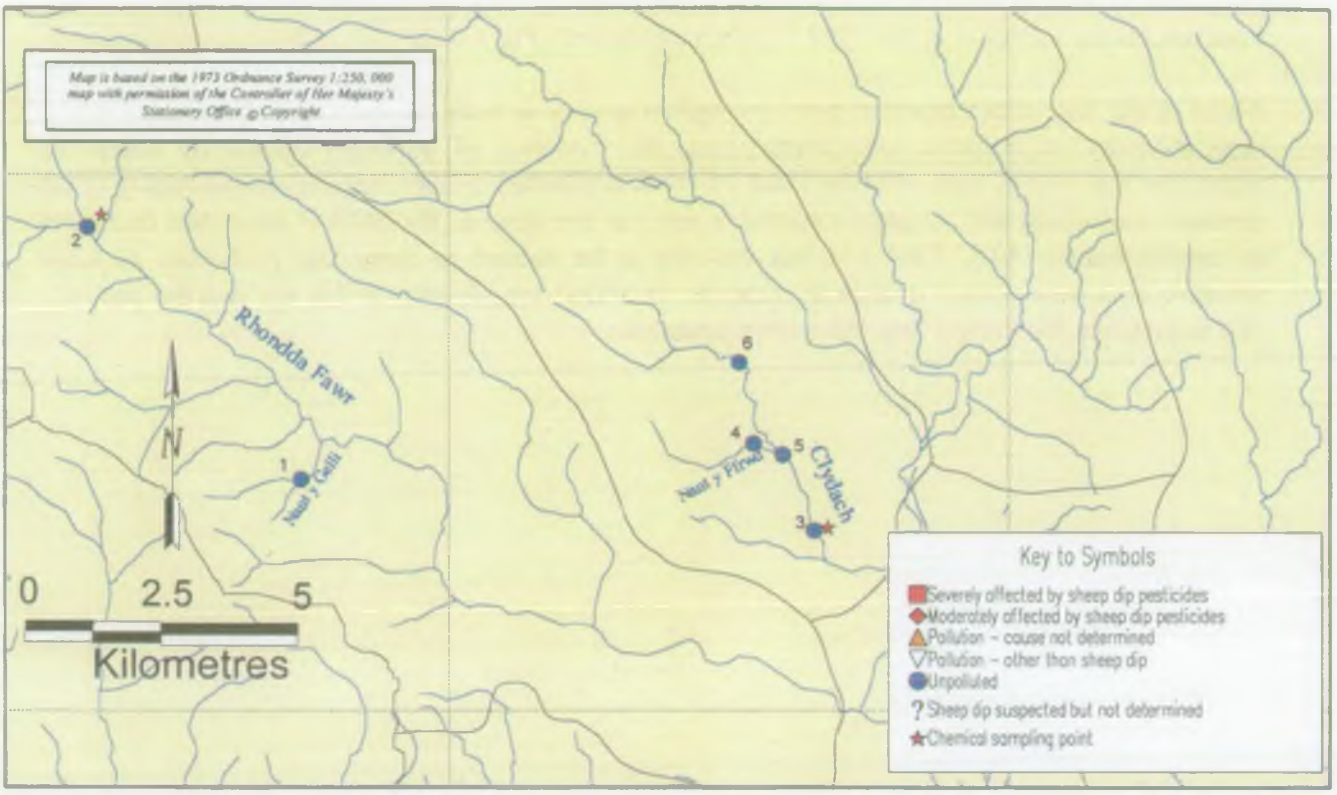



**Figure 3.4.6 Map of Rhondda and Clydach sub-catchments.**

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Winter |
| 1 | Nant y Gelli | SS 9680 9430 | 67 | 61 |
| 2 | Rhondda Fawr | SS 9310 9900 | 69 | 63 |
| 3 | Nant Clydach u/s Lady Windsor | ST 0623 9403 | 85 | 73 |
| 4 | Nant y Ffrwd u/s c.f. Nant Clydach | ST 0530 9500 | 111 | 66 |
| 5 | Nant Clydach | ST 0550 9510 | 84 | 72 |
| 6 | Nant Clydach | ST 0480 9670 | 91 | 64 |

**Table 3.4.16 1998 Biological results for the Rhondda and Clydach sub-catchments**

**Cynon sub-catchment**

One site was surveyed on the Cynon in both seasons (Fig 3.4.7).

The site supported good biological quality in both the summer and autumn, with a diverse representation of sensitive invertebrate taxa. No evidence of pollution caused by sheep dip pesticides was found.

**Nant Clydach sub-catchment**

Four sites were surveyed in the Nant Clydach catchment (Fig 3.4.6).

Three of the four sites supported good biological quality in both the summer and autumn, with a high diversity of sensitive invertebrate taxa. No evidence of pollution caused by sheep dip pesticides was found. Site 4 on the Nant y Ffrwd, a tributary of the Clydach, scored highly in the summer, and whilst still having a reasonable score in the autumn, the BMWP Score had decreased by approximately 40%. This was not thought to be related to sheep dip pesticides as some sensitive taxa were present in high abundance. An added complication at this site was the presence of a minewater discharge a few kilometres upstream.

**Taf Fawr sub-catchment**

Thirteen sites were surveyed in the Taf Fawr catchment in the summer and twelve in the autumn(Fig 3.4.7). High flows prevented sampling on the Taf Fechan at Cefn Coed in the autumn.

All thirteen sites surveyed supported good biological quality in both summer and autumn, with a good diversity of sensitive invertebrate taxa being present. No evidence of pollution caused by sheep dip pesticides was found. The tributary at Llwyn-on Village showed an increase in BMWP score from summer to autumn of approximately 40 percent. It is possible that the site was organically enriched in the summer, as very high abundances of Simuliidae were present.

**Taf Fechan sub-catchment**

Seven sites were surveyed in the Taf Fechan catchment in both summer and autumn (Fig 3.4.7).

Six of the seven sites surveyed supported good biological quality in both summer and autumn, with a diverse representation of sensitive invertebrate taxa. No evidence of pollution caused by sheep dip pesticides was found. The site on the Taf Fechan downstream of Pontsticill reservoir scored well in the summer but low in the winter. The low score at this site was likely to be due to its proximity to the reservoir and the water treatment works, rather than a result of sheep dip pesticides.

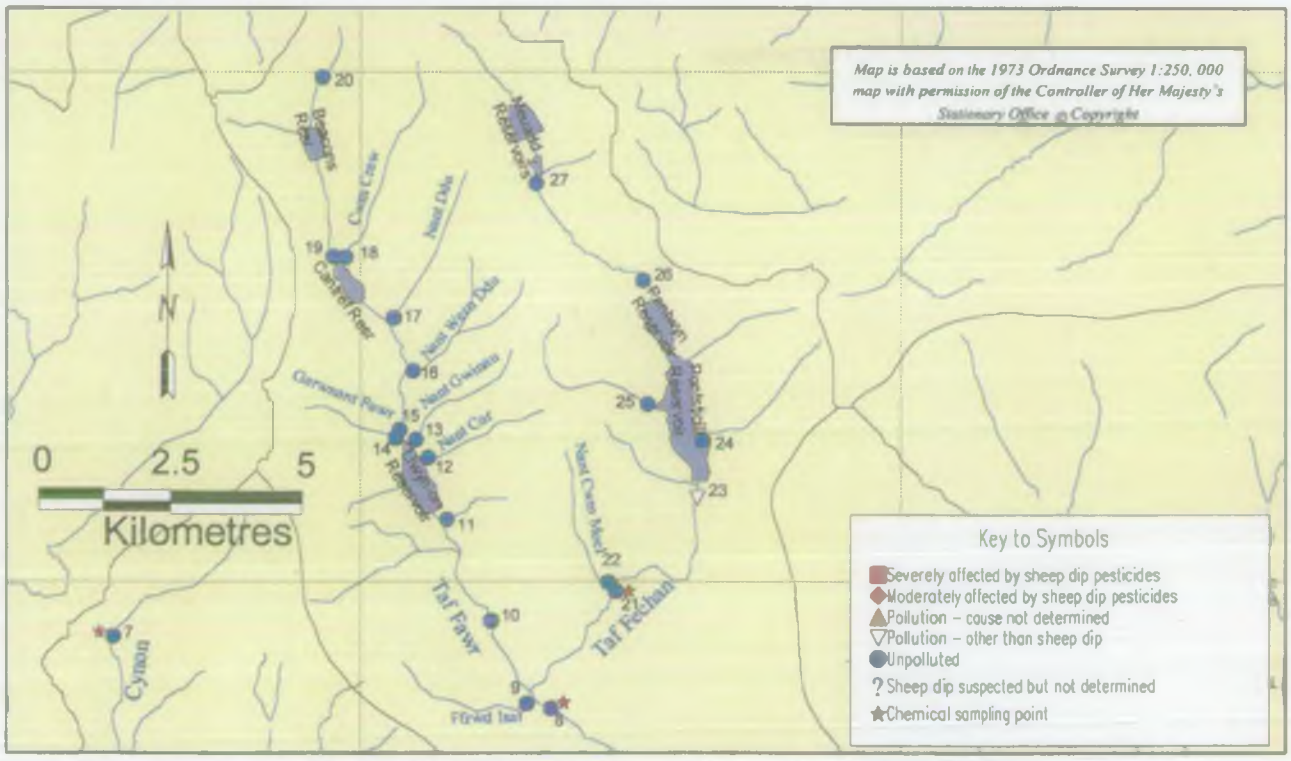



**Figure 3.4.7 Map of Cynon, Taf Fawr and Taf Fechan sub-catchments**

| Site No. | Site description | NGR | BMWP score | |
|---|---|---|---|---|
| | | | Summer | Autumn |
| 7 | Cynon u/s Penderyn | SN 9490 0892 | 92 | 88 |
| 8 | Taff Fawr d/s Cefn Coed | SO 0338 0752 | 67 | |
| 9 | Ffrwd Isaf u/s c.f. Taff Fawr | SO 0030 0760 | 81 | 78 |
| 10 | Taff Fawr d/s Llwyn-on Reservoir | SO 1220 0930 | 70 | 63 |
| 11 | Trib of Taff Fawr at Llwyn-on Village | SO 0140 1120 | 56 | 93 |
| 12 | Nant Car u/s c.f. Taff Fawr | SO 0080 1240 | 73 | 80 |
| 13 | Nant Gwinau u/s c.f. Taff Fawr | SO 0075 1285 | 73 | 68 |
| 14 | Garwnant Fawr u/s Llwyn-on Reservoir | SO 0040 1320 | 72 | 79 |
| 15 | Taff Fawr u/s Llywn-on Reservoir | SO 0050 1330 | 79 | 74 |
| 16 | Nant Wern Ddu u/s c.f. Taff Fawr | SO 0060 1420 | 71 | 76 |
| 17 | Nant Ddu u/s c.f. Taff Fawr | SO 0030 1510 | 93 | 90 |
| 18 | Nant Crew u/s Cantref Reservoir | SN 9945 1635 | 77 | 73 |
| 19 | Taff Fawr u/s Cantref Reservoir | SN 9920 1670 | 114 | 86 |
| 20 | Taff Fawr u/s Brecons Reservoir | SN 9890 1990 | 70 | 89 |
| 21 | Taff Fechan d/s Veynor | SO 0452 0975 | 82 | 71 |
| 22 | Nant Cwm Moel u/s c.f. Taff Fechan | SO 0430 0980 | 95 | 82 |
| 23 | Taff Fechan d/s Pontiscill Reservoir | SO 0600 1160 | 74 | 32 |
| 24 | Trib of Pontiscill Reservoir | SO 0625 1275 | 94 | 72 |
| 25 | Trib of Pontiscill Reservoir | SO 0520 1335 | 96 | 80 |
| 26 | Taff Fechan u/s Pentwyn Reservoir | SO 0480 1620 | 101 | 84 |
| 27 | Taff Fechan d/s Neuadd Reservoir | SO 0300 1780 | 96 | 83 |

**Table 3.4.17 1998 Biological results for the Cynon, Taf Fawr and Taf Fechan sub-catchments**

### 3.4.3.3 Farm visit programme

No farm visits were undertaken.

### 3.4.4 Pollution prevention activities

During farm visits farmers were advised to block any drain holes in dipping baths and dilute then spread dip rather than release to soakaway or store in a slurry lagoon. Operation of drainage pens and management of freshly dipped sheep was highlighted together with safe disposal of old containers. Letters and guidance notes were sent to all farms inspected, requesting remedial measures or changes in practice where necessary.

Two mobile contractors were visited and procedures discussed. Pollution prevention guidelines for sheep dipping were supplied.

Sheep dip information boards were displayed at the Royal Welsh Show and the BEAM (Balancing the Environment and Agriculture in the Marches) Summer open day. Staff also attended the Sheep 98 show at Malvern.

Talks were also held in the Elan Valley and Builth Wells for local farming groups to raise awareness of the pollution potential arising from sheep dipping operations.

### 3.4.5 Sewage Treatment Works monitoring

The final effluent from Builth Wells STW was sampled from 8 May until 7 September and Kington STW was sampled from 2 October until 5 November. Cypermethrin was detected at both STWs at levels greater than MAC.

The final effluent from Sennybridge STW was sampled from 6 April until 17 December and Llanfoist STW was sampled from 6 October until 7 December. Organophosphates (diazinon and propetamphos) and cypermethrin were detected at both STWs. A level of 244 ng/l cypermethrin was recorded at Sennybridge STW.

Flumethrin and chlorfenvinphos were not detected at any of the STWs.

Biological monitoring of the Wye upstream and downstream of Builth Wells STW was carried out in the summer only. The sites scored 76 and 79 respectively showing that the macroinvertebrate fauna was unaffected by the STW effluent, despite low concentrations of cypermethrin being recorded in the effluent in samples taken earlier in the year.

Sites on the River Usk upstream and downstream of Sennybridge STW were sampled during August. Good biological quality was recorded both upstream and downstream of the STW, indicating that there was no impact from sheep dip pesticides in the final effluent, on the River Usk. This was despite the fact that the synthetic pyrethroid, cypermethrin, was detected in the effluent earlier in the year.

**Table 3.4.16. Results from sampling Sewage Treatment Works.**

| Site | Date | Diazinon ng/l | Propetamphos ng/l | Cypermethrin ng/l |
|---|---|---|---|---|
| Builth Wells | 08/05/98 | | | 68 |
| | 13/07/98 | | | 1 |
| | 07/09/98 | | | 2 |
| Kington | 02/10/98 | | | 7 |
| | 05/11/98 | | | 1 |
| Abergavenny | 09/10/98 | 25 | | |
| | 14/10/98 | | 10 | |
| | 05/11/98 | 15 | | 1 |
| Sennybridge | 06/04/98 | | | 244 |
| | 13/08/98 | | 13 | |
| | 23/11/98 | 18 | 11 | |
| | 15/12/98 | 15 | | |
| | 17/12/98 | 28 | | |

## 3.4.6 Assessment of sites impacted in 1997

All the sites surveyed had been sampled in the 1997 sheep dip survey when sites on the Colwyn Brook and on the Edw downstream of the Colwyn Brook were found to have been severely or moderately affected by a pollutant, suspected as being a sheep dip pesticide. The scores on the Colwyn Brook and the Edw this summer showed that the fauna had made a good recovery, with one site increasing in score from 15 to 84.

## 3.4.7 South East area recommendations

1. In 1999, site inspections should be focused on specific catchments identified by stream chemistry and poor biology. Particularly the following catchments where a source of pollution was not found: Hydfer, Camddwr and Chwefri.

2. Biological surveys should be undertaken to assess recovery at impacted sites and confirmed pollution incidents ( River Monnow).

3. The impact on sewage treatment of sheep dip chemicals in trade effluents from livestock markets should be assessed in collaboration with DCWW.

4. The introduction of the Groundwater Regulations should be utilised to visit some of the sites of applications for authorisations to assess not only the disposal risk, but also the dip site and management.

5. Mobile contractors should be visited to raise awareness of potential pollution problems.

6. Continue to raise awareness through displays at agricultural shows and talks to farming groups.

7. Resources offered by FER should be utilised to target mobile contractors and high risk sites.

8. Additional catchments could be investigated where no sampling has been carried out to date, but where problems are suspected, for example the upper Lugg and the Ysgir.

# 3.5 A WELSH SYNOPSIS

## 3.5.1 Stream chemistry

### 3.5.1.1 Temporal nature of contamination

A monthly assessment of the proportion of samples that were positive (above the detection level) for each sheep dip pesticide demonstrated temporal patterns (Fig 3.5.1). Few positive results were detected in April, May and June. Diazinon was most frequently found, peaking in July and October, but also detected relatively frequently in August and September. Propetamphos was also found throughout the summer, and peaked in October. The proportion of samples positive for cypermethrin increased from June to October. Overall therefore, the greatest number of positive samples was recorded in October.

This supports the anecdotal evidence from farmers that little dipping was carried out in June/July due to the wet weather, so that the summer dipping was delayed until late July/ August. The majority of dipping was carried out in October and November to afford protection against scab in winter through to lambing time.

### 3.5.1.2 Spatial nature of contamination

Assessment of the records of positive results by area indicated some notable differences (Fig. 3.5.2). Overall 52% of the 107 sites recorded positive results for diazinon, 34% propetamphos, 33% cypermethrin and only 6% flumethrin. No river monitoring sites recorded positive results for chlorfenvinphos, which suggests that usage of this pesticide has virtually ceased.

Diazinon was detected most frequently in sites in South West area, (at 64% of sites), and least frequently in Upper Severn area (at 35% of sites). In contrast cypermethrin was detected least frequently in South West area (at 12% of sites) and most frequently in Upper Severn area (at 46% of sites).

Propetamphos was detected in all areas at between 21% to 46% of sites. Flumethrin was recorded at the least number of sites, peaking at 14% of sites in Northern and Upper Severn areas, and was not recorded at all in South West or South East areas.

### 3.5.1.3 Assessment against EQS MAC limits

On average, only eight samples were taken at each site in the period April to December 1998. Therefore it is not appropriate to report Annual Averages for assessment against Environmental Quality Standard (EQS) limits, so positive results have been assessed against the appropriate Maximum Allowable Concentration (MAC) EQS. No such standard exists for flumethrin.

Thirty-one sites (29%) of the 107 monitored failed the MAC EQS for one or more sheep dip pesticides. Thirteen (12%) failed the MAC EQS for one or more of the OPs and 21 (20%) failed the EQS MAC for cypermethrin.

Some differences are again apparent between the areas, with Upper Severn and Northern areas having the highest incidence of MAC failure by SPs, while MAC failures for OPs were greatest in South West area. In South East area, although 50% of sites recorded positive results for diazinon, none of these exceeded the MAC. However11% of sites in this area exceeded the MAC for propetamphos.

### 3.5.2 Stream biology

Extensive biological surveys were carried out in 65 sub-catchments, with a total of 1432 km covered between a network of 661 sites. This was more than double the length surveyed in 1997. The results showed that at least 126.5km (9%) were known or suspected of being affected by sheep dip.

There was variation between the areas in the total length surveyed, and the length impacted, varying from 19% impacted in Northern area, where 158 km were surveyed, to 5% in South East area, where 610 km were surveyed. These differences were partly due to staff resources and poor weather restricting the surveys, and therefore the work was targeted only at catchments believed to be of highest risk in Northern area.

Surveys also revealed that 34.2km (2%) were impacted by other known causes which included acidification, metal mine run off, and organic pollution from silage and manure. Of an additional 126 km (9%) showing biological impacts, the cause could not be determined due to high river flows preventing survey work being completed, or sites showing signs of recovery following an incident believed to have occurred some weeks or months before the survey. In addition, some of these sites lie in areas believed to be acid sensitive, which may have also contributed to depletion of fauna.

**Table 3.5.1 Summary of biological surveys undertaken in 1998**

| Area | River length surveyed km | River length impacted by sheep dip km | % stream length surveyed impacted by sheep dip | Length impacted but cause not determined km | Length impacted, cause other than sheep dip km |
|---|---|---|---|---|---|
| Upper Severn | 269 | 19.5 | 7 | 7 | 18.5 |
| Northern | 158 | 29.8 | 19 | 26 | .2 |
| South West | 395 | 48.2 | 12 | 93 | 13 |
| South East | 610 | 29 | 5 | 0 | 2.5 |
| **Wales** | **1432** | **126.5** | **9** | **126** | **34.2** |

**Fig 3.5.1 Samples recorded positive for Sheep Dip chemicals**

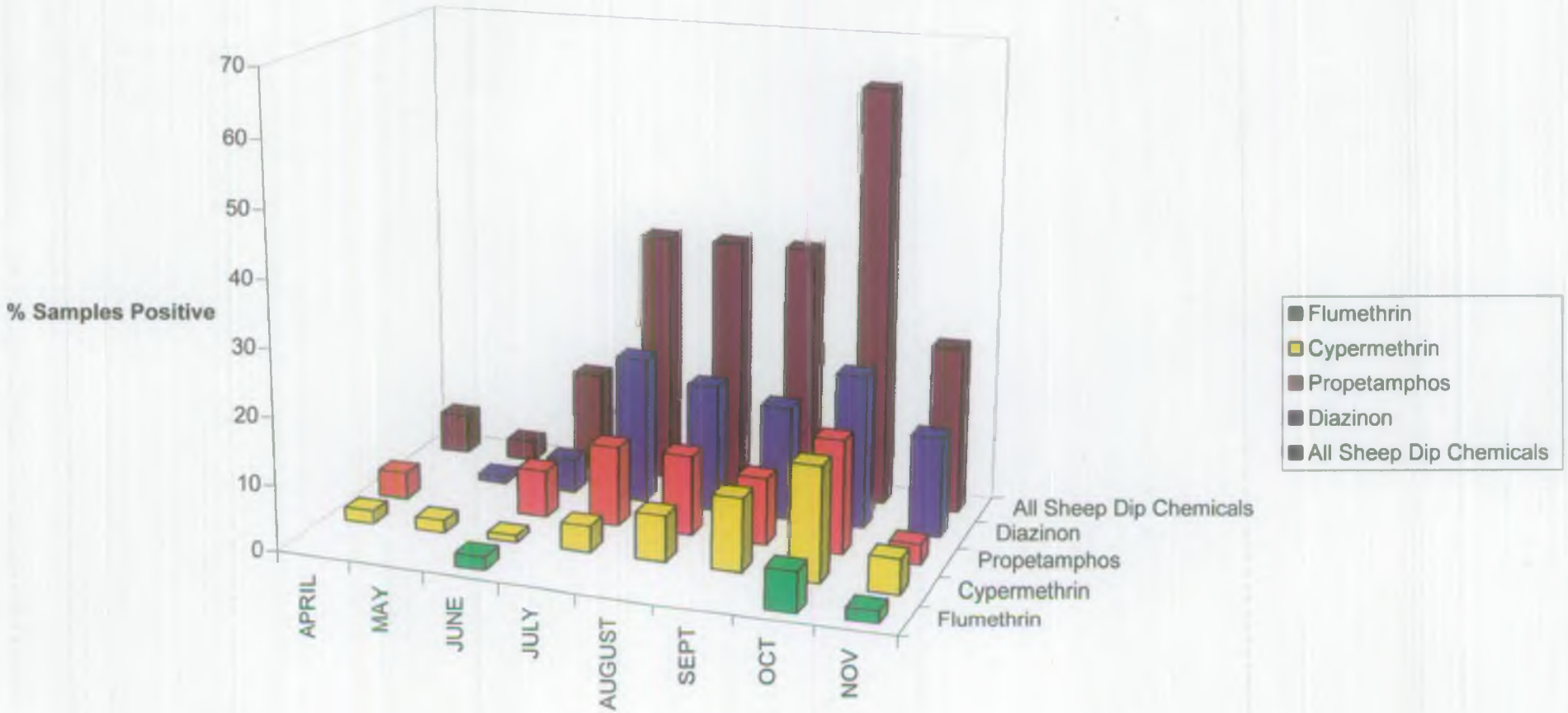
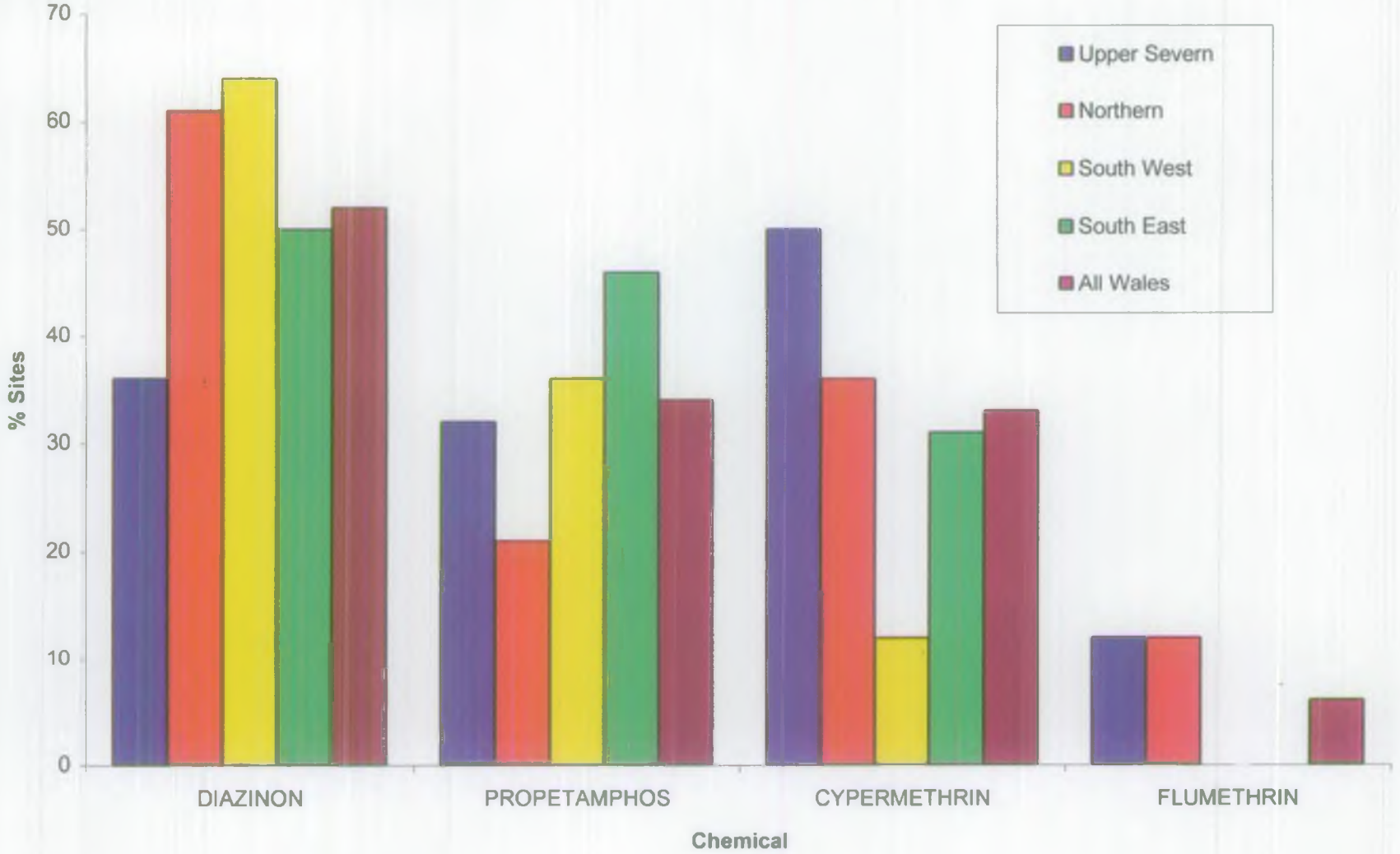


**Fig 3.5.2 Detections of Sheep Dip Chemicals at River Monitoring Sites**



## 3.5.3 Pollution prevention activities and farm visit programme

Of seven hundred farms visited, a total of 348 farms were occupied by sheep farmers using some sort of treatment and were therefore inspected. This is nearly three times the number of farms inspected in 1997. Therefore any comparison of the results should be treated with caution.Visits were carried out in all areas, and were targeted on catchments with known or suspected sheep dipping problems. The actual number of visits in each area varied due to the staff resources available.

### 3.5.3.1 Type of treatment

Organophosphate (OP) dips were used by 44% of farms inspected. Synthetic pyrethroid (SP) dips were used by just over a quarter of farms (28%). The results for 1998 suggest that the use of SPs may be increasing (from 19% in 1997 ) as OPs decrease from 55% in 1997. There is also a slight increase in the use of injections, from 5% to 9%. A new type of treatment method used by some farmers is the use of jetters or showers. These saturate the sheep using a series of high power jets on a pumping system in an enclosed pen. The dip is recirculated to minimise wastage.

**Table 3.5.2 A summary of the use (% frequency), determined by farm visits, of different sheep dipping pesticides across Wales in 1998**

| Type of Treatment | Upper Severn Area (%) | Northern Area (%) | South West Area (%) | South East Area (%) | All Wales (%) |
|---|---|---|---|---|---|
| OP | 39 | 47 | 45 | 46 | 44 |
| SP | 22 | 35 | 30 | 25 | 28 |
| SP & OP | 4 | 0 | 3 | 0 | 2 |
| Injection | 9 | 3 | 8 | 10 | 8 |
| Pour On | 18 | 2 | 8 | 0 | 7 |
| Jetter/Shower | 0 | 10 | 5 | 18 | 6 |
| Don't know | 10 | 3 | 1 | 1 | 5 |

### 3.5.3.2 Structures

In many cases the structures used for sheep dipping were found to be satisfactory. One issue that arose was the use of drainage holes, usually to soakaway, to prevent the bath filling up with rainwater. These were temporarily plugged during dipping operations. Ideally, these drainage holes should be sealed permanently, and steps taken to cover the baths to prevent collection of rainwater, therefore avoiding the need to dispose of contaminated water.

### 3.5.3.3 Storage

The majority of farmers purchased dip only one or two days prior to dipping, and stored it temporarily unsecured. Opened containers were left in the vicinity of the dip in some cases, and used containers were not disposed of properly, posing a risk.

### 3.5.3.4 Awareness

Awareness of the need to dispose of dip safely was generally shown, but the need to keep sheep away from watercourses after dipping was not widely recognised. Also the greater toxicity of SP dips to aquatic life compared to OPs was not always known.

### 3.5.3.5 Disposal of used dip

The majority (79%) of farmers disposed of the used dip to land, either diluted with slurry or water. Soakways were used in a proportion of cases (19%), a practice which is now contrary to advice. The use of direct discharges to watercourses from dip baths has also declined.

**Table 3.5.3 Disposal methods**

| Disposal Method | Upper Severn Area (%) | Northern Area (%) | South West Area (%) | South East Area (%) | All Wales % |
|---|---|---|---|---|---|
| Soakaway | 18 | 19 | 21 | 10 | 19 |
| Landspreading | 82 | 73 | 76 | 86 | 79 |
| Off-site Disposal | 0 | 2 | 2 | 4 | 1 |
| Direct Discharge | 0 | 6 | 1 | 0 | 1 |

### 3.5.3.5 Overall risk assessment

Overall 16% of farms visited that treated sheep were found to be at a high risk of polluting a watercourse. This appears to be an improvement on 1997 when 26% of farms were of high risk. Those at medium risk had also declined from 30% to 24%, and hence low risk sites had increased from 44% to 60 %. Northern area had the highest proportion of high risk sites, at 21%, but South West area had a high proportion of medium risk sites, at 32% such that there was only 52% of sites of low risk in this area. South East area had the greatest proportion of low risk sites, 72%.

**Table 3.5.4 Risk assessment of 348 farms inspected in Wales in 1998.**

| Area | Farms visited | Number high risk | % high risk | Number medium risk | % medium risk | Number low risk | % low risk |
|---|---|---|---|---|---|---|---|
| Upper Severn area | 127 | 20 | 16 | 31 | 24 | 76 | 60 |
| Northern area | 58 | 12 | 21 | 9 | 15 | 37 | 64 |
| South West area | 111 | 18 | 16 | 36 | 32 | 57 | 52 |
| South East area | 52 | 6 | 11 | 9 | 17 | 37 | 72 |
| **Wales** | **348** | **56** | **16** | **85** | **24** | **207** | **60** |

### 3.5.3.5 Pollution prevention activities

In addition to farm visits, opportunities to raise awareness amongst sheep farmers were utilised. These included articles in the farming press, and wider press releases, and exhibitions at agricultural shows, such as the Royal Welsh and Sheep 98, as well as local shows. Talks were given to farming groups and training board groups, and guidance was made available through markets and veterinary surgeries. Liaison with other organisations, such as HSE, and the National Trust, was also useful.

## 3.5.4 Sewage Treatment Works monitoring

Eight sewage treatment works (STWs) were selected for effluent monitoring for sheep dip pesticides. Following initial results, four further works were also sampled in the autumn. Of these, positive results for sheep dip pesticides were recorded at eleven STWs. Nine of the STWs had significant levels on at least one sampling occasion, the highest being 3880 ng/l for diazinon and 244 ng/l cypermethrin. Downstream monitoring was not carried out, so it is not known what levels were present in the receiving water following dilution of the effluent . One positive result for chlorfenvinphos was recorded. The one STW where sheep dip chemicals were not recorded in 1998, had had positive results in 1997. This was expected, as a former sheep pelt fellmongery business discharging trade effluent to the works had changed to a cattle hide tanning operation during 1998.

## 3.5.5 Assessment of sites impacted in 1997

Some biological surveys were also carried out in catchments that were severely impacted by sheep dip pesticides in 1997. In the case of the Edw in South East area recovery was good. Biological monitoring in the Sawdde catchment in 1997 established that 1.6 km of the Afon-Clydach and 0.7 km of the Nant Maesadda had been severely affected by leakage of Cypermethrin into the Nant Maesadda. Follow-up monitoring in May and August 1998 indicated that the macroinvertebrate fauna had recovered from the incident. An assessment of salmonid distribution and growth rates in August 1998 was unable to detect any decreased productivity in the stream length affected.

However on the Twrch in Northern area surveys showed that recovery had not been complete due to other suspected incidents relating to sheep dip. In Upper Severn area, it was found that all but three of the declines had completely recovered, namely the Afon Llwydiarth, the Mochdre Brook at Bryn Daddlau and the Afon Garnw. Recovery was observed in the main watercourse s, but not in the minor tributaries nearer the sources of the pollution. In some cases the watercourses that have not recovered or recovered slowly were impacted by sheep dip spread to land or put to soakaway.

# 4.0 POLLUTION INCIDENTS 1998

Seventeen substantiated pollution incidents were recorded in 1998, sixteen of these were detected during biological surveys. Of these eleven were directly attributable to synthetic pyrethroid dips, one was organophosphate dip, and one was both. The exact cause of the sheep dip pollution in the remaining four cases could not be confirmed. Full details are given in Table 4.2

**Table 4.1 A summary of statistics from pollution incidents in Wales in 1998**

| Category | | Total | Percentage |
|---|---|---|---|
| **Method of detection** | Public complaint | 1 | 6 |
| | Biological survey | 16 | 94 |
| **Type of dipper** | Permanent | 10 | 59 |
| | Mobile | 1 | 6 |
| | Pour on | 1 | 6 |
| | Unknown | 5 | 29 |
| **Sheep dip Chemical** | Organophosphate | 1 | 6 |
| | Synthetic Pyrethroid | 11 | 65 |
| | Both | 1 | 6 |
| | Unknown | 4 | 23 |
| **Cause** | Structural failure | 1 | 6 |
| | Overflow following dipping | 1 | 6 |
| | Soakaway | 3 | 18 |
| | Runoff from sheep holding area | 3 | 18 |
| | Sheep entering watercourse | 1 | 6 |
| | Runoff following land spreading | 2 | 11 |
| | Disposal of containers | 1 | 6 |
| | Unknown | 5 | 29 |
| **Length of river affected** | < 1km | 2 | 11 |
| | 1-1.99km | 2 | 11 |
| | 2-4.99km | 10 | 60 |
| | 5-9.99km | 3 | 18 |

# Table 4.2 CONFIRMED SHEEP DIP RELATED INCIDENTS FOR WALES - 1998

| DATE | AREA | RIVER | IMPACT | SEVERITY | SOURCE | POLLUTANT |
|---|---|---|---|---|---|---|
| 5/2/98 | Upper Severn | Afon Einion | Biological survey highlighted invertebrate kill in stream for 4km. | 2 | Source traced to dip bath that had been drained down over steeply sloping field in direction of stream. | SP – Cypermethrin |
| 23/7/98 | Northern | Dwr Ial – trib of R Clwyd | Noticeable impact on biology for 5 km | 2 | Cause was a sub surface soakaway which was in an underdrained field. The soakaway was in close proximity to the land drain which then discharged to a slow flowing ditch which subsequently entered the stream. | SP – Cypermethrin |
| 31/7/98 | South West | Nant Gorffin – trib of Upper Teifi | Reduced biological quality over 3.32km in the Nant Gorffen | 3 | Unknown, probably incorrect disposal of sheep dip. | Not determined |
| 6/8/98 | Upper Severn | Afon Abel, tributary of Afon Cain | Reduced biological quality over 4km of river | 2 | Bath containing sheep dip emptied to soakaway in field containing many springs. Spring became contaminated which then entered watercourse. | SP – Cypermethrin Flumethrin |
| 7/8/98 | Upper Severn | Afon Hirnant | Reduced biological quality over 3km of river | 2 | Deterioration in biology due to overflow from dip bath on sloping ground to small tributary. Cause due to lack of effective retaining walls. Improvements agreed with farmer. | SP – Cypermethrin |
| 17/8/98 | South East | R Monnow & tributary | Impact 500m of trib and 1.5km of R Monnow | 2 | Poorly constructed ,maintained and managed dip. | SP - Cypermethrin |
| 2/9/98 | Upper Severn | Tributary of Afon Garnu | Decline in biology over 0.5km of river | 3 | Sheep walking through ford post dipping was the suspected cause of decline in sensitive invertebrate life in stream. | SP – Cypermethrin |

| DATE | AREA | RIVER | IMPACT | SEVERITY | SOURCE | POLLUTANT |
|---|---|---|---|---|---|---|
| 22/9/98 | Upper Severn | Afon Trannon | Reduction in invertebrate life over 4km of river | 2 | Suspected contamination of stream with sheep dip causing reduction in invertebrate life. Unable to trace source. | Unknown |
| 24/9/98 | Upper Severn | Nant Menial, a tributary of Afon Banwy | Invertebrate mortality over 0.5km | 3 | Contamination of watercourse caused by pour-on and injection chemical containers found in and beside stream. SP pour-on treatment used. | SP – Alphamethrin<br>Flumethrin<br>High cis-Cypermethrin |
| 25/9/98 | Upper Severn | Cynllaith, a tributary of Afon Tanat | Severe deterioration in biological quality over .7km | 2 | Dip washed into stream via drain from mobile dipping operation on farm yard. | SP – Cypermethrin |
| 15/10/98 | Upper Severn | Afon Rhaeadr | Biological decline over 3km of river | 2 | Suspected discharge of sheep dip to stream via soakaway on farm. However, unable to pinpoint source with certainty. | Unknown |
| 15/10/98 | Upper Severn | Llwydiarth Brook | Decline in biological life over 2km of river | 2 | Contamination of watercourse with dip from farm. Probable source, sheep draining onto hardcore holding area, with culverted watercourse running underneath. | SP – Cypermethrin |
| 15/10/98 | Upper Severn | Llwydiarth Brook | Decline in biological life over 2.5km of river | 2 | Decline in biology of stream reported. Probable cause traced to sheep walking through stream and possibly land spreading of dip entering land drains. | SP – Cypermethrin<br>Flumethrin |
| 16/11/98 | South West | River Cothi & tributary | Biological impact for 1.25km | 3 | Run off from sheep collecting yard drains to stream. Dip chemicals found in soil and sediment samples. | SP – Diazinon<br>Cypermethrin<br>Flumethrin |
| 16/11/98 | South West | River Cothi | Biological impact for 2.5km | 3 | Suspected cause is run off after landspreading of used dip. Cypermethrin in soil and sediment. | SP - Cypermethrin |

| DATE | AREA | RIVER | IMPACT | SEVERITY | SOURCE | POLLUTANT |
|---|---|---|---|---|---|---|
| 16/11/98 | South West | River Cothi headwaters | Biological impact for 3.75km | 3 | Suspected cause is run off from a dip facility close to the stream plus dipped sheep passing through river. Diazinon in soil adjacent to river. | OP - Diazinon |
| 25/11/98 | South West | Nanty Blanau – trib of R Twrch, | Biological impact for 8.0km | 3 | Two tributaries affected by two dipping sites belonging to the same farm. Cause and exact pollutant not found | Not determined |

# 5.0 NATIONAL ENVIRONMENT AGENCY ACTION PLAN

In addition to the work undertaken in Wales, a National Action plan, covering England and Wales, has been undertaken in 1998. This was initiated to address the fact that controls available to the Agency to minimise the environmental impact by sheep dipping activities have been very limited. The Groundwater Regulations, commencing in January 1999, and the prospect of "Works Notices" under the Water Resources Act 1991, should greatly help, but not resolve the situation.

Aware that improved controls would not be available until 1999 and that the Agency needed to be seen to be acting positively during 1998, a six-point action plan was developed to co-ordinate actions nationally in 1998 and to help gain full benefit from future controls.

## 5.1 Improving controls and notification procedures

A major problem is lack of any provision for the Agency to be informed of the location of sheep dipping facilities. With some farmers not dipping sheep themselves, many can deny having such facilities, which are difficult to locate, so seriously reducing the efficiency of Agency investigations. As an example, of 244 visits in the EAW South West area in 1998, only 111 dips could be located.

MAFF and Welsh Office were both lobbied unsuccessfully to provide information on the locations of sheep dips. Whilst the Groundwater Regulations 1998 improve overall controls, they do not include this key provision. This shortcoming was highlighted in a progress report in December to the Secretariat of the Government's Official Group on OPs, when outlining progress with our Sheep Dip Strategy, so positioning the Agency to lobby more effectively in 1999.

## 5.2 Reducing the need for treatment of sheep

The National Sheep Association (NSA) co-operated in jointly promoting better flock management as a "win-win-win" – less infestation for the sheep, reduced need for farmers to dip and less dip for disposal to the environment. Whilst this can only be a partial solution, there is evidence that farmers may be dipping sheep less frequently and this approach will be developed further as part of the "Sheep Dip Strategy".

## 5.3 Reducing the toxicity of used dip

Two manufacturers (of the most widely used OP and SP compounds) have provided sufficient details of low cost on-farm treatment methods that indicate that they significantly reduce overall toxicity to the environment. English Nature and Countryside Council for Wales are both supportive. Wider use of these specific methods will be encouraged during 1999. However, this does not remove the need for proper disposal.

## 5.4 Improving written guidance to farmers

The Agency has gained general support, including helpfully from the farming unions, to develop a comprehensive Code of Practice for the protection of the environment. This will now be developed as a key output from the "Sheep Dip Strategy".

## 5.5 Improving awareness of the environmental dangers from sheep dipping and promoting measures to reduce the risks

The Agency conducted a successful campaign, working more closely with the farming unions and NSA, including all four groups openly supporting the Agency in condemning bad practice at the national "Sheep 98" in July. There is strong evidence that farmers are now more aware of these risks, especially with SP dips.

## 5.6 Develop an overall Agency Sheep Dip Strategy

Using the ADAS report P170, A Strategic Review of Sheep Dipping, the Agency consulted widely on a series of proposals. Following wide support and comment the Strategy has been published in March 1999.

The Action Plan for 1999 will be the implementation of this Strategy.

## 5.7 Monitoring in other regions

Monitoring has also been undertaken on a similar basis to Wales in NorthWest, North East and South West Regions of the Environment Agency.

# 6.0 CONCLUSIONS

## 6.1 Stream chemistry

Direct comparison of 1997 and 1998 data is not possible due to changes in detection levels, monitoring regimes and weather conditions. It is likely that the results for SPs have been influenced by changing detection levels, as it was believed that the presence of SPs was under represented in Environment Agency Wales sites in 1997. Sampling frequencies were reduced in 1998 to enable more sites to be covered, and many of the sampling points were selected lower down the catchments, affording greater dilution. Due to a relatively wet spring, and a very wet autumn, river levels were generally higher in 1998, leading to dilution of pesticides. However the wet weather may also have washed pesticides into watercourses.

The presence of sheep dip pesticides was found to be widespread, with 75 % of the 107 river sites monitored giving positive results. Overall 52% of the 107 sites recorded positive results for diazinon, 34% propetamphos, 33% cypermethrin and only 6% flumethrin. In 1997, the incidence of positive records for the OPs diazinon and propetamphos was 95% and 64% respectively, while that for SPs was 23% for cypermethrin, and 23% for flumethrin . No positive results were recorded for chlorfenvinphos at river sites suggesting that this pesticide, which is no longer authorised, was now not being used. Therefore it is no longer necessary to monitor for this chemical.

The impact of weather on the timing of dipping was reflected in the monitoring results. Dipping was delayed and did not occur in June/July. However, dipping was then carried out right through the autumn, some quite late due to the poor weather, in order to protect sheep through to lambing time. Few positive results were recorded in April, May and June, but numbers increased in July and August, peaking in October, and continuing right through to December.

Thirty-one sites ( 29%) of the 107 monitored failed the MAC EQS for one or more sheep dip pesticides. 13 (12%) failed the MAC EQS for one or more of the OPs and 21 (20%) failed the EQS MAC for cypermethrin. In 1997, 49 % of 39 sites failed the MAC for one or more sheep dip pesticides, but the majority of these were due to OPs rather than SPs.

## 6.2 Stream biology

Extensive biological surveys were carried out in 65 sub-catchments, with a total of 1432 km covered by a network of 661 sites, more than double the length surveyed in 1997. The results showed that atleast 126.5km (9%) were known or suspected of being affected by sheep dip pesticides. In 1997, 679km were surveyed, and 5% was known or suspected of being impacted by sheep dip. In 1998 biological surveys were better targeted in catchments using chemical results from 1997 and 1998, which may account for some of the increase. The 1998 survey represented approximately 10% of the high risk areas, and therefore the results suggest that up to 1200km of upland watercourses could potentially be affected by sheep dip.

In addition, a further 11% of river length surveyed in 1998 showed signs of biological impacts from sources. Known causes included acidification, abandoned metal mine sites, and organic pollution from silage and manure for 2% of lengths affected. In other cases (9%) the cause could not be determined due to high river flows preventing survey work being completed, or sites showing signs of recovery following an incident believed to have occurred some weeks or months before the survey.

Therefore, a significant finding of the 1998 survey is that 20% of the upland watercourses surveyed showed signs of impoverished biological fauna due to pollution. Of this 9% was suspected as being due to sheep dip pesticides, 2% other known causes, but an additional 9% could not be attributed to any of these. Although high river flows may have masked the impacts in some cases due to difficulties in sampling, the results suggest that even in wet years, when dilution in watercourses is higher, sheep dip pesticides can still have a significant environmental impact.

As reported in 1997, the method of sampling and interpreting biological scores may under report the full extent of impact as it does not enable moderate impacts to be identified. The toxicological effects of sheep dip pesticides in the field under different conditions of water chemistry may also be a factor.

## 6.3 Pollution prevention activities and farm visits

Seven hundred properties were visited as part of the 1998 Pollution prevention campaign. Of these 348 were occupied by sheep farmers using some form of treatment, and were inspected accordingly. This is nearly three times the number inspected in 1997. Therefore comparison of the results should be treated with caution. Farm visits could be better targeted if better information was available on the location of dips, or those known to stock sheep. About half of the properties visited were found not to require a full inspection.

In 1998, organophosphate (OP) dips were used on 44% of farms inspected (55% in 1997). Synthetic pyrethroid (SP) dips were used on just over a quarter of farms (28%) (19% in 1997). In jections or pour-ons were used by 9% of farmers. A new type of treatment method used by some farmers is the use of jetters or showers (6%).

Awareness amongst farmers of the risks of sheep dipping, and particularly the need for safe disposal was generally good. Fewer sites overall were found to be of high risk compared to 1997 (16 % cf 26%) and well over half (60%) were considered to be low risk. More farmers were found to dispose of used dip to land (80 % cf 70%). Also fewer farmers disposed of used dip to soakaway or direct discharge (19% cf 25%).

In some cases the need to dispose of pesticide containers properly, and the risks associated with allowing recently dipped sheep to have access to watercourses was not recognised. Also the greater toxicity of SP dips to aquatic life is not always known, due to the misapprehension that as it is safer for operators it is also safer for the environment.

The use of jetters or showers, which reduce the volume of dip used, appears to be increasing. The risks of this activity, in terms of locating the equipment, management of sheep and disposal of spent dip are still high, and pollution prevention guidance specific to this method is needed.

The campaign was also targeted at mobile dipping contractors, who are being employed more frequently by farmers. Although some contractors did discuss their operations when approached by the Agency, some operators did not, and greater efforts should be made in future to target these.

## 6.4 Sewage Treatment Works monitoring

Positive results for sheep dip pesticides were recorded at eleven out of twelve Sewage Treatment Works (STWs) monitored. Nine of the STWs had significant levels on at least one sampling occasion, the highest being 3880 ng/l for diazinon, and 244 ng/l cypermethrin. Downstream monitoring was not carried out, so it is not known what levels were present in the receiving water following dilution of the effluent. However, these results suggest that further monitoring should be carried out to assess the environmental significance of these results.

## 6.5 Resurveys of 1997 impacted sites

Resurveys at sites which suffered sheep dip pollution in 1997 showed that in the majority of cases recovery of the invertebrate fauna was good. Where recovery had not occurred, this was attributed to further incidents within the catchment, or possibly longer term impacts associated with disposal of used dip to inappropriate land or soakaway, or residual contamination of soil or sediments.

Only one survey included fisheries monitoring, and an assessment of salmonid distributions and growth rates was unable to detect any decreased productivity. Further fisheries investigations are recommended at those sites where biological recovery has not been complete.

## 6.6 Pollution Incidents

Seventeen substantiated pollution incidents were recorded in 1998: sixteen of these were detected during biological surveys. Of these eleven were directly attributable to synthetic pyrethroid dips and dipping activities. In addition one was due to organophosphate dip, and one was due to both. The exact cause of the sheep dip pollution in the remaining four cases could not be confirmed.

## 6.7 Summary

The aim of the 1998 monitoring programme was two-fold :

i) to establish whether the results of 1997 survey were representative of a larger proportion of upland sites in Wales;

ii) to use chemical and biological monitoring to target pollution prevention activities in catchments indicated to be at high risk

Overall the results of the 1998 survey have confirmed that pollution by sheep dip pesticides is widespread in upland Wales. Water quality monitoring and usage as indicated by farmers suggest a downward trend in the use of OP dips, and an upward trend in the use of SP dips. Substantiated incidents confirmed to be due to sheep dip were all but one due to SP dips. As SP dips are around 100 times more toxic to aquatic life than OP dips, this may provide some explanation for the increase in the proportion of river length impacted as indicated by biological monitoring.

Pollution prevention visits suggest that although awareness of the risks associated with sheep dipping is increasing amongst farmers, practices have not changed sufficiently to allay concerns. Sewage Treatment Works have been identified as potential point sources of sheep dip pesticides which also need to be minimised.

# 7.0 RECOMMENDATIONS

1) Resources should continue to be committed to this issue in a targeted way. Those catchments identified as suffering from the impacts of sheep dip pesticides should be prioritised within the area Environment Protection teams for further biological investigations and pollution prevention visits. Water quality monitoring could also be used at selected sites, for six months from June to November to cover the peak dipping periods.

2) Background water quality monitoring for authorised sheep dip pesticides should be carried out at key sites as part of the regional pesticide monitoring programme. Analysis for chlorfenvinphos could be discontinued.

3) Monitoring should be carried out at selected Sewage Treatment Works in a prioritised way to provide data for consenting purposes and impact assessment. Policy on this issue needs to be clarified at a national level. This issue should be brought to the attention of the relevant sewerage undertakers and site operators, in order that they can establish the source of the pesticides and take appropriate remedial action.

4) The biological data sets collected in 1997 and 1998 could be used to develop the assessment techniques to allow greater confidence in the interpretation of the biological survey results, particularly for moderately impacted sites.

5) Further investigations should be carried out in catchments suffering form the biological impacts of unknown pollution to determine the cause subject to resource availability.

6) The recovery of impacted sites or sites suffering from repeated incidents, should be further monitored, particularly where recovery has been slow, and the potential long-term impacts of reduced food sources on fish populations investigated. Sediment samples could be taken to establish if the continued presence of sheep dip pesticides is inhibiting recovery.

7) Pollution prevention visits should be continued, and opportunities to work with other organisations, such as ADAS, National Trust, National Parks, and HSE should be maximised. Mobile dip and shower/jetter operators should also be targeted. Also better information is still required to target farms actually treating sheep.

8) The introduction of the Groundwater Regulations 1998 will provide an opportunity to identify and visit sites of applications for disposal authorisations. The benefits of site visits should be maximised by assessing dipping and handling facilities, as well as disposal risk.

9) The Regulations and the provision for Prohibition Notices will provide opportunities to prevent dipping and disposal activities if the correct authorisations are not in place, or if there is a high risk of pollution. These should be used where appropriate.

10) Awareness campaigns at national and local level should be continued through attendance at shows, media coverage, and talks to farmers groups. Agency staff in Water Management functions who carry out field visits in sheep rearing areas routinely should also be encouraged to participate in raising awareness during site visits.

11) Recommendations from 1997 and 1998 reports of national significance should be incorporated within the Agency Strategy for Sheep Dip Action Plan.

# APPENDIX

# ENVIRONMENT AGENCY
# POLLUTION PREVENTION VISIT - SHEEP DIPPING OPERATIONS

FILE REFERENCE _____

ASIANTAETH YR AMGYLCHEDD
ENVIRONMENT AGENCY

1. Site Details

Occupier & Site Address

Name: _____

Address: _____

_____

_____

Tel (Inc STD Code) _____

2.
Owners Address

Name _____

Address: _____

_____

_____

_____

Tel: _____ Contact: _____

3.
Date of Visit: _____

Duration on Site: _____Hrs_____Mins

Inspected By: _____

Form Checked (PCO): _____ Date: _____

Follow up required yes ☐ No ☐

Re-visit date: _____/_____/_____

Letter Required: Yes ☐ No ☐

Letter Sent: _____/_____/_____

4. Catchment

NGR of Dip Site (8 Figs) _____

PROXIMITY TO W/COURSE? _____m

5. Discharge Found? Yes ☐ No ☐

Discharge Point NGR (8 Figs) _____

6. Risk to Groundwaters? Yes ☐ No ☐

Abstractions at risk: _____

_____

_____

Risk Status High ☐ Medium ☐ Low ☐

7. Risk to Surface Waters? Yes ☐ No ☐

Details: _____

_____

Risk Status : High ☐ Medium ☐ Low ☐

8. STRUCTURE OF DIP TANK

PERMANENT SITE

MATERIAL?

BRICK ☐
CONCRETE ☐
GRP ☐
PLASTIC ☐
STEEL ☐
OTHER ☐
(PLEASE SPECIFY)

Roof over dip Yes ☐ No ☐

Does structure appear to be in good state of repair? Yes ☐ No ☐

Presence of drain hole?
Yes ☐ No ☐

Risk Status:
High ☐ Medium ☐ Low ☐

9.
COLLECTING/DRAINOFF AREAS

Permeable Floor ☐ Impermeable Floor ☐

Draining apron diversion when not in use?
Yes ☐ No ☐

Drain off Returned to Dip Yes ☐ No ☐

Capacity of Drain off Pen? (No. sheep) _____

Drain off Period _____ minutes

Risk of leakage by splashing Yes ☐ No ☐

Age of 'Permanent' Dip Tank

| | | | |
|---|---|---|---|
| 1 - 5 yrs | ☐ | 15 - 20 yrS | ☐ |
| 5 - 10yrs | ☐ | 20 - 25 yrs | ☐ |
| 10-15 yrs | ☐ | > 25 | ☐ |

10. Pesticide Usage

Type of Dip O/P ☐ S/P ☐

Product name(s) _____

Pesticide Storage

Quantity used? _____ litres

Volume stored? _____ litres

Locked Store ☐ Unlocked Store ☐

Risk Status : High ☐ Medium ☐ Low ☐

Operator awareness of pollution risk

High ☐ Medium ☐ Low ☐

# 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 ☐