

EA-Water Quality



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An audit of performance in the
analysis of biological samples in 2000
Environment Agency: Primary Audit

Centre for Ecology and Hydrology

CEH Report Ref: C00158/10

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Research Contractor:
Centre for Ecology and Hydrology

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Statement of Use

Information in this document is to help biologists in the Agency to identify where analytical errors occur so that they can be reduced or eliminated. Data in the tables provide measures of the accuracy of primary data produced in accordance with the standard methods for the River Invertebrate Prediction and Classification System (RIVPACS) and analysed to the level required for the Biological Monitoring Working Party (BMWP)-score system, including General Quality Assessment. Information in this report may be used to determine statistical confidence limits and the statistical significances of differences between biological samples. This includes comparisons of Observed/Expected (O/E) values and quality bands made by the compare module of RIVPACS III+ and the statistical routine CONCLASS used for GQA surveys.

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1. INTRODUCTION

The collection of standard macro-invertebrate samples and their analysis to the level required for the Biological Monitoring Working Party (BMWP) system is the most widely used biological technique for evaluating water quality in the Environment Agency (The Agency). Used with the computer model RIVPACS (River Invertebrate Prediction and Classification System), they are the basis for the Agency's biological classification of water quality, which is used for national General Quality Assessment (GQA) river quality surveys as well as operational requirements, such as Catchment Management Plans and Biological Quality Objectives. These samples are also used for assessing pollution and setting priorities for capital investment. Data from these samples are made available to the public. An independent audit of these biological samples is required to ensure that a high and consistent standard of sorting and identification is maintained, to assess the proficiency of the internal laboratory analytical quality control (AQC) inspectors and to demonstrate the quality of the data to its users.

The 2000 GQA Survey of Rivers was undertaken by the Agency in England and Wales, the Scottish Environment Protection Agency (SEPA) in Scotland and the Industrial Research and Technology Unit (IRTU) in Northern Ireland. Each organisation employed standard collection procedures (Environment Agency 1999a) to ensure that the data collected were compatible with RIVPACS, the computer model developed by the Centre for Ecology and Hydrology (CEH). Each Agency laboratory appointed at least one experienced analyst to act as an internal analytical quality control (AQC) inspector. These inspectors re-sorted a random selection of about 10% of the laboratory's samples. In addition, CEH was contracted to undertake an independent, external audit of the quality of the laboratory analysis of the biological samples. This commission was consistent with the audit performed by IFE for the national River Quality Surveys in 1990 and 1995 and for the routine biological monitoring of freshwater sites each year between 1991 and 1994 and again between 1996 and 1999. The audit for the Agency comprised two elements. The AQC Audit provides a measure of the quality of performance of the AQC inspectors. The Primary Audit provides an independent assessment of the quality of the data, since this was not adjusted for errors identified by the other quality assurance procedures.

This report presents the results of the audit of 520 samples that were sorted and identified by the Agency's primary analysts. The results of the AQC Audit, detailing the quality of the Agency's internal AQC inspections of these samples, are reported separately (Gunn *et al.*, 2001).

2. SAMPLE SELECTION

Samples for audit were selected internally by each of the organisations being monitored. The standard method of selection used by the Agency is described in Environment Agency (1999b). Each Agency laboratory randomly selected for audit 20 samples that had been processed twice (once for primary analysis and once for internal AQC inspection). The biologists processing these samples had no prior knowledge of which samples were to be audited. The precise manner of sample selection, which biologists would be monitored and the number of audit samples from each season, were left to the discretion of the organisation, within the limits of the total number of samples that CEH was contracted to audit.

3. SAMPLE PROCESSING

The normal protocol for Agency biologists was to sort their samples, either live or preserved, within the laboratory. Samples were sorted for the families of macro-invertebrates included in the BMWP system and examples of each scoring taxon were removed. The invertebrates were placed in a vial of preservative (70% industrial alcohol) and the taxa present were recorded on a standard data sheet. The vial of animals and the sorted material were then returned to the sample container and preservative added. Samples for internal AQC analysis were sorted in the same manner as the primary analysis. The AQC inspector's task included confirming the identification of the contents of the vial and the correctness of the data sheet. Any additional taxa found at AQC were to be placed in a separate vial without altering the contents of the primary analyst's vial, although this instruction was not always followed.

Each sample available to CEH for audit should have included:

- i) a data sheet containing a list of the BMWP families found in the sample.
- ii) a vial or vials containing representatives from each family.
- iii) the preserved sample.

When these three elements were present, the sequence of operations at CEH was as follows:

- a) The remainder of the sample was sorted, without reference to the data sheet or to the vial of animals, and the BMWP families identified.
- b) The families contained within the vial(s) were identified.
- c) A comparison was made between the listing of families and those found in the sample by the CEH auditor.
- d) A comparison was made between the listing of families and those identified from the vial(s) by the CEH auditor.
- e) "Losses", "gains" and "omissions" from the original listing of families were noted. In the case of "gains", each additional family was identified, where possible, to species level, in order to clarify any specific repetitive errors. Single representatives of a "gained" taxon were noted as such.
- f) For each "loss" or "gain" the CEH auditor selected a code from a list at the foot of the result sheet to indicate the most likely cause of the error.

Definitions

Losses are taxa recorded as present by the analyst whose quality is being audited, but which were not found in the vial or sample by the auditors. Gains are taxa found in the vial or sample by the auditors, which were not recorded as present by the analyst whose quality is being audited. Omissions are taxa which were recorded as present by the analyst whose quality is being audited, and which the auditors find in the sample, but not in the vial.

Occasionally a sample did not include a vial containing representative examples of the families listed on the data sheet, while some arrived with the vial damaged in transit such that the representative specimens were no longer separated. For these samples, only operations a), c), e) and f) above were appropriate.

Several directives were issued to CEH relating to the treatment of BMWP taxa. Every taxon recorded on the data sheet must be supported by a voucher specimen of that family in the vial (or, for very large specimens, left in the sample). The only exceptions to this rule were the native crayfish, *Austropotamobius pallipes*, the medicinal leech, *Hirudo medicinalis* and the pearl mussel, *Margaritifera margaritifera* (which does not belong to a BMWP family), all of which are protected species. Animals deemed to have been dead at the time of sampling, cast insect skins, pupal exuviae and empty mollusc shells were to be excluded from the listing of families present. Isolated posterior ends of "living" specimens were not acceptable as records of a taxon. In these cases, thorax plus abdomen was deemed acceptable but abdomen only was deemed unacceptable. Terrestrial representatives of BMWP scoring

families were also to be excluded from the audit. For this reason, Clambidae, Chrysomelidae and Curculionidae, which appear in the BMWP list, were excluded for the purposes of the audit since most representatives of these families are, at best, only semi-aquatic. Trichopteran pupae, although not routinely identified by many biologists, were to be included in the listing of families.

4. REPORTING

The results of each sample audit were recorded on a standard report form (see Figs 1 & 2) and sent to the Agency's Project Manager and the appropriate Regional Biologist. For audit samples where a vial of animals was included, the comparison between the listing of families and the taxa found in the vial by CEH was shown in the section of the report form headed "VIAL". Discrepancies could be due to carelessness, misidentifications or errors in completing the data sheet listing the families present. Families not on the listing but found by CEH in the remainder of the sample were entered in the section of the report form headed "SAMPLE" under "Additional BMWP taxa found in sample". For Primary Audit results, this section also includes taxa added by the internal AQC analyst. Taxa recorded here represent families missed by the analyst(s) on sorting the sample. When the families listed as "losses" in the first section of the report form were compared with the full list of families recorded in the sample by CEH, some apparent losses from the vial were offset by the presence of those families in the remainder of the sample. These taxa were therefore listed both as "losses" from the vial and as "gains" from the sample and were neither a net loss nor a net gain. In these cases, the families were marked with an asterisk in both boxes to highlight this fact. Such errors are noted as "omissions" and were generally caused by an analyst forgetting to place an example of the taxon in the vial, although occasionally, when an animal in the vial had been mis-identified that taxon was subsequently found in the sample by the CEH auditor.

Species identifications, state of development (eg adult or larval coleopterans) and the presence of a single representative of a family were recorded in the centre section of the report form.

CEH was asked to interpret each error to provide a possible cause. An error code, selected from a list of options at the foot of each result sheet, was entered against each taxon in the column headed "Presumed cause of error". Where an error was modified by the findings of the internal AQC inspector, a code to indicate this was selected instead (either code 11 or 12).

For those samples in which the vial of animals was damaged or missing, the "VIAL" sections of the report form were not applicable (N/a). Families not on the list but present in the sample were entered in the section under "SAMPLE" and "Additional BMWP taxa found in sample", as before. Families recorded on the list but not found by CEH were indicated in the section headed "BMWP taxa not found in sample."

If the vial of animals had been retained by the sorter, entries in this box could include the sole representative of a family which was removed, a family seen at the site which escaped or was released (without mention being made on the data sheet), inaccurate identification or the wrong family box being ticked on the data sheet.

The final section of the result sheet summarises the audit, giving details of the numbers of "losses", "gains" and "omissions", together with the net effects on BMWP score and the number of scoring taxa.

Figure 1. An example of a Primary Audit result sheet

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: Example	LABORATORY: Example	DATE: 12 April 2000
WATER-COURSE: Beautiful River	PRIMARY ANALYST: XX	AQC ANALYST: YY
SITE: Utopia	CODE: 0001/AQC01	SORT/AQC METHOD: Live/Preserved

RESULTS OF PRIMARY AUDIT

Family name	Presumed cause of error (see footnotes)
<u>VIAL</u>	
<u>BMWP taxa not found in vial</u>	
Planorbidae	12
Terrestrial snail in vial	
Baetidae *	1
Limnephilidae	7
<u>Additional BMWP taxa found in vial</u>	
Lepidostomatidae	7
Lepidostoma hirtum (Fabricius)	
<u>SAMPLE</u>	
<u>BMWP taxa not found in sample</u> (for samples where vial is broken or absent)	
N/a	
<u>Additional BMWP taxa found in sample</u>	
Baetidae *	1
Baetis rhodani (Pictet)	
Hydrophilidae (incl. Hydraenidae)	9
Hydraena gracilis Germar (a) 1 only	
Hydroptilidae	11
Hydroptila sp. (p)	
Psychomyiidae (incl. Ecnomidae)	11
Psychomyia pusilla (Fabricius) 1 only	

SUMMARY OF AUDIT

LOSSES: 2 GAINS: 4 OMISSIONS: 1

NET EFFECTS:
ON BMWP SCORE 19
ON NO. OF TAXA 2

1 No representative of family in vial
2 Alternative terrestrial specimen in vial
3 Posterior end only in vial
4 Empty shell or case or cast skin in vial

5 Specimen dead at time of sampling
6 Taxon in vial but not recorded
7 Mis-identification
8 Typographical error - wrong box ticked

9 Taxon missed in sorting
10 Unexplained error
11 Taxon added in internal AQC
12 Recorded taxon that was rejected by AQC analyst

Omission (*) = Recorded, not in vial but found by CEH in sample (no net loss or gain)

Figure 2. An example of an AQC Audit result sheet

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: Example

LABORATORY: Example

DATE: 12 April 2000

WATER-
COURSE: Beautiful River

PRIMARY
ANALYST: XX

AQC
ANALYST: YY

SITE: Utopia

CODE: 0001/AQC01

SORT/AQC
METHOD: Live/Preserved

RESULTS OF AQC AUDIT

Family name	Presumed cause of error (see footnotes)
<u>VIAL</u>	
<u>BMWP taxa not found in vial</u>	
Baetidae *	1
Limnephilidae	7
<u>Additional BMWP taxa found in vial</u>	
Lepidostomatidae	7
Lepidostoma hirtum (Fabricius)	
<u>SAMPLE</u>	
<u>BMWP taxa not found in sample</u> (for samples where vial is broken or absent)	
N/a	
<u>Additional BMWP taxa found in sample</u>	
Baetidae *	1
Baetis rhodani (Pictet)	
Hydrophilidae (incl. Hydraenidae)	9
Hydraena gracilis Germar (a) 1 only	

SUMMARY OF AUDIT

LOSSES: 1 GAINS: 2 OMISSIONS: 1

NET EFFECTS:
ON BMWP SCORE 8
ON NO. OF TAXA 1

1 No representative of family in vial
2 Alternative terrestrial specimen in vial
3 Posterior end only in vial
4 Empty shell or case or cast skin in vial

5 Specimen dead at time of sampling
6 Taxon in vial but not recorded
7 Mis-identification
8 Typographical error - wrong box ticked

9 Taxon missed in sorting
10 Unexplained error
11 Taxon added in internal AQC
12 Recorded taxon that was rejected by AQC analyst

Omission (*) = Recorded, not in vial but found by CEH in sample (no net loss or gain)

5. RESULTS

The results of the Primary Audit for 2000 for the Agency are presented, region by region, in Tables 1 to 58. A summary of the basic audit results in terms of losses, gains and omissions is followed by the statistics of these regional audit results centered on the target of acceptability of no more than two missed taxa per sample. These data are presented for each analyst, for their area laboratories and for the region as a whole. Then follows information on the net effects of the Primary Audit on the BMWP score and number of scoring taxa. Following this are listings for the region of the taxa missed at family and species levels in the 2000 Primary Audit. Tables 59 and 60 summarise the statistics and net effects of the 2000 Primary Audit for the whole of the Agency. Tables 61 and 62 give listings of all taxa, at family and species levels respectively, missed in sorting by the Agency's primary analysts. Tables 63 and 64 give similar listings of taxa missed 5 times or more for the entire 2000 audit for the whole of the UK. Data for the AQC Audit are presented in a separate report (Gunn *et al*, 2001).

Estimating sample biases for the compare module of RIVPACS III+

The underestimation of the number of BMWP-scoring taxa is termed bias for the purpose of the compare module of RIVPACS III+. An estimate of bias is provided by the net gains (number of gains minus number of losses). The average net gains for each laboratory, Region and the Agency as a whole are listed in Table 60 in the column "mean net effect on no. of taxa". These values may be used directly for RIVPACS. To estimate the bias over a different period to that covered by this audit, it is necessary to refer to the Primary Audit result sheets for individual samples. Note that estimates of bias should be based on the results of at least 20 audited samples. Further instructions are given in Clarke *et al*. (1997).

6. ACKNOWLEDGEMENTS

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AUDIT OF ANGLIAN REGION'S PRIMARY ANALYSTS

Table 1 The 20 samples audited for Central Area of Anglian Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Running Water	Ruxox Bridge	BPM	0	2	0
Alconbury Brook	Grindleys Bridge	BPM	0	4	0
Deanshanger Brook	A422 Bridge	BPM	0	1	0
Old Course Nene	March Town Bridge	EIS	0	3	0
Pophams Eau	Black Sluice	EIS	0	3	0
Rhee	Boot Lane	EIS	2	2	1
Bevills Leam	Chapel Bridge	EIS	0	4	0
Granta	Bourn Bridge	EIS	0	2	0
Sapiston	Euston Bridge A1088	EIS	1	3	0
Wretham Park Stream	B1111 Bridge	EIS	0	0	0
Tuddenham Mill Stream	Tuddenham Mill	EIS	0	4	0
Middle Level Main Drain	Thistle Hill Farm	MAC	0	3	0
Sixteen Foot Drain	Horseways Corner Bridge	MAC	0	1	0
Wissey	Ickburgh Bridge	MAC	0	7	0
Little Ouse	Thetford Staunch	MAC	0	4	0
Willingham Lode	Culvert at Rec Ground	SEH	0	0	1
Cam	Dimmocks Cotes Bridge	SEH	0	2	0
Flood Relief Channel	Saddlebow Bridge	SEH	1	3	0
New River	100 Acre Farm Bridge	SEH	0	2	0
Ouse	Haversham Bridge	SEH	0	1	1

Table 2 The 20 samples audited for Eastern Area of Anglian Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Tiffey	Carlton Forhoe Weir	CFW	1	1	0
Wattisham Watercourse	Badley Bridge	CFW	0	1	0
Bumpstead Brook	Watsoe Bridge	CFW	0	4	0
Stour	Bures Mill	CFW	0	2	0
Ter	Deres Bridge	CFW	0	4	0
Alde	Langham Bridge	CFW	1	1	0
Ant	Tonnage Bridge	CFW	0	1	0
Mardyke	East at Harrow Inn	CFW	0	1	0
Mun	B1145 Bridge	CSA	0	3	0
The Mermaid	Brampton Bridge	CSA	0	2	0
Tas	Shotesham Ford	CSA	0	1	0
Binham Tributary	Binham Ford	CSA	0	0	0
Tenpenny Brook	East of Stable Wood	GFC	0	4	0
Bure	Ingworth	GFC	0	3	0
Spickets Brook	Church Rd Bridge	GFC	1	0	1
Stambourne Brook	A604 Bridge, Gt. Yeldham	GFC	0	2	0
Wensum	Swanton Morley	JHS	0	2	0
Gipping	Bramford Mill	PIM	0	5	1
Stour	Baythorne End	PIM	0	4	0
Blackwater	Greys Mill	PIM	0	2	1

Table 3 The 20 samples audited for Northern Area of Anglian Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Lymn/Steeping	Crow's Bridge	CLP	0	0	0
Upper Witham	Easton Park	CLP	0	0	0
Upper Witham	Easton Bridge	CLP	0	1	0
Gwash	Empingham	CLP	2	0	0
Lower Witham	Tattershall Bridge	CLP	0	0	0
Sincil Dyke	Destructor	CLP	0	0	0
Thurlby Main Drain	Tongue End P.S.	CLP	1	2	2
North Brook	Fort Henry Lake Outlet	CLP	0	1	0
Ruskington Brook	u/s R. Sleas	CLP	0	1	0
Rase	u/s Market Rasen STW	IMC	0	2	0
Nene	u/s Broadholme STW	IMC	0	2	0
Lower Witham	Bardney	IMC	0	0	0
Harper's Brook	u/s Brigstock STW	JF	0	1	0
Chelveston Brook	Glebe Farm	JF	0	0	0
Laceby Beck	Manor Top Farm Track	JF	1	2	0
Buck Beck	A1031	JF	1	0	0
Lymn	Partney	JF	0	2	0
Lymn/Steeping	Crows Bridge	JF	1	0	1
Welland (Coronation	B1165 Spalding	RPC	1	1	0
Ise	Geddington	RPC	0	2	0

Table 4 Statistics of the 2000 Primary Audit for Anglian Region

Analyst/Group	n	Mean gains	Standard error	No.samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
Central	20	2.55	0.37	10	50.00	7	2.90	0.37
BPM	3	2.33	0.88	1	33.33	4	2.33	0.88
EIS	8	2.63	0.46	5	62.50	4	3.13	0.55
MAC	4	3.75	1.25	3	75.00	7	3.75	1.25
SEH	5	1.60	0.51	1	20.00	3	2.20	0.49
Eastern	20	2.15	0.33	7	35.00	5	2.45	0.32
CFW	8	1.88	0.48	2	25.00	4	2.13	0.44
CSA	4	1.50	0.65	1	25.00	3	1.50	0.65
GFC	4	2.25	0.85	2	50.00	4	2.75	0.48
JHS	1	2.00	n/a	0	0	2	2.00	n/a
PIM	3	3.67	0.88	2	66.67	5	4.33	0.88
Northern	20	0.85	0.20	0	0	2	1.35	0.28
CLP	9	0.56	0.24	0	0	2	1.11	0.54
IMC	3	1.33	0.67	0	0	2	1.33	0.67
JF	6	0.83	0.40	0	0	2	1.50	0.43
RPC	2	1.50	0.50	0	0	2	2.00	0.00
Anglian Region	60	1.85	0.20	17	28.33	7	2.23	0.20

Table 5 Net effects of the Primary Audit on BMWP score and number of scoring taxa for Anglian Region

Analyst/ Group	n	Mean net effect on BMWP score	Standard error of effect on BMWP score	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	Standard error of effect on no. of taxa	Maximum underestimate of no. of taxa
Central	20	12.85	2.30	40	2.35	0.39	7
BPM	3	11.67	4.18	20	2.33	0.88	4
EIS	8	13.50	3.39	21	2.25	0.56	4
MAC	4	20.50	7.86	40	3.75	1.25	7
SEH	5	6.40	1.86	10	1.40	0.40	2
Eastern	20	11.40	2.04	28	2.00	0.37	5
CFW	8	8.25	2.86	24	1.63	0.56	4
CSA	4	9.75	3.84	18	1.50	0.65	3
GFC	4	13.25	6.76	24	2.00	1.08	4
JHS	1	14.00	n/a	14	2.00	n/a	2
PIM	3	18.67	4.70	28	3.67	0.88	5
Northern	20	2.05	1.25	13	0.50	0.25	2
CLP	9	0.00	1.64	5	0.22	0.32	1
IMC	3	5.67	3.18	11	1.33	0.67	2
JF	6	1.00	2.07	8	0.33	0.49	2
RPC	2	9.00	4.00	13	1.00	1.00	2
Anglian Region	60	8.77	1.25	40	1.62	0.22	7

Table 6 The families missed in sorting by Anglian Region's primary analysts

Family	n	% of Anglian Region's missed families in Primary Audit
Leptoceridae	6	5.83
Hydrophilidae (incl. Hydraenidae)	6	5.83
Ancylidae (incl. Acroloxidae)	6	5.83
Hydroptilidae	6	5.83
Simuliidae	5	4.85
Elmidae	4	3.88
Hydrobiidae (incl. Bithyniidae)	4	3.88
Planariidae (incl. Dugesiidae)	4	3.88
Valvatidae	3	2.91
Limnephilidae	3	2.91
Erpobdellidae	3	2.91
Sphaeriidae	3	2.91
Piscicolidae	3	2.91
Chironomidae	3	2.91
Psychomyiidae (incl. Ecnomidae)	3	2.91
Caenidae	3	2.91
Corixidae	2	1.94
Glossiphoniidae	2	1.94
Goeridae	2	1.94
Haliplidae	2	1.94
Calopterygidae	2	1.94
Dendrocoelidae	2	1.94
Leptophlebiidae	2	1.94
Lymnaeidae	2	1.94
Molannidae	2	1.94
Planorbidae	2	1.94
Hydropsychidae	2	1.94
Tipulidae	2	1.94
Physidae	2	1.94
Oligochaeta	1	0.97
Baetidae	1	0.97
Scirtidae	1	0.97
Rhyacophilidae (incl. Glossosomatidae)	1	0.97
Coenagrionidae	1	0.97
Phryganeidae	1	0.97
Dytiscidae (incl. Noteridae)	1	0.97
Notonectidae	1	0.97
Gyrinidae	1	0.97
Sialidae	1	0.97
Lepidostomatidae	1	0.97
Dryopidae	1	0.97
Total	103	100

Table 7 The species missed in sorting by Anglian Region's primary analysts

Species	n	% of Anglian Region's missed species in Primary Audit
Acroloxus lacustris (L.)	5	4.39
Polycelis nigra group	4	3.51
Potamopyrgus jenkinsi (Smith)	4	3.51
Pisidium sp.	3	2.63
Hydroptila sp.	3	2.63
Simulium (Simulium) ornatum group	3	2.63
Oulimnius sp.	3	2.63
Piscicola geometra (L.)	3	2.63
Mystacides azurea (L.)	2	1.75
Physa fontinalis (L.)	2	1.75
Caenis horaria (L.)	2	1.75
Calopteryx splendens (Harris)	2	1.75
Erpobdella octoculata (L.)	2	1.75
Orthocladiinae	2	1.75
Molanna angustata Curtis	2	1.75
Valvata piscinalis (Muller)	2	1.75
Halipus sp.	2	1.75
Hydropsyche angustipennis (Curtis)	2	1.75
Dendrocoelum lacteum (Muller)	2	1.75
Tipula sp.	2	1.75
Simulium (Boophthora) erythrocephalum (de Geer)	2	1.75
Tinodes waeneri (L.)	2	1.75
Silo sp.	2	1.75
Athripsodes aterrimus (Stephens)	2	1.75
Valvata cristata Muller	2	1.75
Hydraena nigrita Germar	1	0.88
Helophorus (Atracthelophorus) brevipalpis Bedel	1	0.88
Ancylus fluviatilis Muller	1	0.88
Agraylea multipunctata Curtis	1	0.88
Glossiphonia complanata (L.)	1	0.88
Goera pilosa (Fabricius)	1	0.88
Hydraena pulchella Germar	1	0.88
Agraylea sp.	1	0.88
Glossiphonia heteroclita (L.)	1	0.88
Halipus laminatus Schaller	1	0.88
Caenis luctuosa group	1	0.88
Agrypnia pagetana Curtis	1	0.88
Bithynia leachii (Sheppard)	1	0.88
Elmis aenea (Muller)	1	0.88
Dryopidae indet	1	0.88
Cyphon sp.	1	0.88
Chironomini	1	0.88
Hydraena riparia Kugelann	1	0.88
Lymnaea sp.	1	0.88
Baetis scambus group	1	0.88

Table 7 continued

Species	n	% of Anglian Region's missed species in Primary Audit
Bathyomphalus contortus (L.)	1	0.88
Bithynia tentaculata (L.)	1	0.88
Erpobdellidae indet	1	0.88
Oecetis lacustris (Pictet)	1	0.88
Tubificidae	1	0.88
Tanypodinae	1	0.88
Simulium (Nevermannia) lundstromi (Enderlein)	1	0.88
Simulium (Nevermannia) angustitarse group	1	0.88
Sigara (Sigara) sp.	1	0.88
Sialis lutaria (L.)	1	0.88
Rhyacophila dorsalis (Curtis)	1	0.88
Planorbarius corneus (L.)	1	0.88
Paraleptophlebia submarginata (Stephens)	1	0.88
Oulimnius rivularis (Rosenhauer)	1	0.88
Orthotrichia sp.	1	0.88
Ormosia sp.	1	0.88
Limnephilus rhombicus (L.)	1	0.88
Oecetis ochracea (Curtis)	1	0.88
Hydrophilidae	1	0.88
Ochthebius minimus (Fabricius)	1	0.88
Notonecta sp.	1	0.88
Naididae	1	0.88
Micronecta sp.	1	0.88
Lype sp.	1	0.88
Lymnaea truncatula (Muller)	1	0.88
Limnephilus sp.	1	0.88
Limnephilus lunatus Curtis	1	0.88
Leptophlebiidae indet	1	0.88
Lepidostoma hirtum (Fabricius)	1	0.88
Ischnura elegans (Van der Linden)	1	0.88
Hydroporus angustatus Sturm	1	0.88
Orectochilus villosus (Muller)	1	0.88
Total	114	100

AUDIT OF MIDLANDS REGION'S PRIMARY ANALYSTS

Table 8 The 20 samples audited for Upper Severn Area of Midlands Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Bobs Brook	u/s CG STW	01	0	0	1
Morda	u/s Oswestry STW	03	0	1	0
Cain	Llanfechain	07	0	1	0
Snakescroft Brook	u/s Bishops Castle	41	0	2	0
Mad Brook	Beckbury Bridge	41	1	1	0
Stour	Haysech	41	0	2	0
Iwrch	Pont Maes Mochnant	41	0	1	0
Rhaeddr	B 4396	41	1	1	0
Sheinton Brook	Sheinton	48	0	0	0
Burlington Brook	Tong Forge	48	0	0	0
Leigh/Cradley Brook	Leigh	48	0	1	0
Salwarpe	Chapel Bridge	48	2	2	0
Hen Brook	A38	48	0	2	0
Teme	Ashford Carbonnel	400	1	1	0
Severn	Coalport	401	0	3	0
Catshill Tributary	u/s Battlefield Brook	401	0	0	0
Spadesbourne Brook	Bromsgrove	401	0	2	0
Farley Brook	Rock House Inn	401	0	0	0
Nedge Brook	Naird Lane	401	1	0	0
Onny	d/s Craven Arms STW	402	0	3	1

Table 9 The 20 samples audited for Lower Severn Area of Midlands Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Severn	Tewkesbury	11	1	3	0
Avon	Clifton	11	0	1	0
Gran Brook	u/s Mickleton Brook	39	0	1	0
Cannop Brook	Lydney Harbour	39	0	2	0
Radway Brook	Radway	39	1	0	0
Gog Brook	Stratford Road	39	0	2	0
Daniels Brook	Bristol Road	39	0	0	0
Oldberrow Brook	B4480 Bridge	39	0	2	0
Claverdon Brook	Hatton	39	1	0	0
Avon	u/s Rugby	39	0	0	0
Frome	Beards Mill	403	0	1	0
Mill Brook	Hillworth	403	0	3	0
Rains Brook	Kilby	403	0	0	0
Swift	Churchover Sluice	403	0	1	0
Swift	Lutterworth	403	1	1	0
Clifton Brook	R. Avon confluence	403	0	3	0
Hall Brook	Manor Farm	403	0	3	0
Westbury Brook	Westbury	403	0	1	0
Bow Brook	Shell Ford	403	0	3	0
Canley Brook	Coventry Road	403	0	2	0

Table 10 The 20 samples audited for Upper Trent Area of Midlands Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Kingsbury Brook	Kingsbury	03	0	1	0
Pasturefields Dyke	Farley Bridge	03	1	2	0
Anker	Polesworth	03	0	3	0
Dove	Glutton	03	0	4	0
Coombes Brook	Basford	03	0	1	0
Manifold	Ilam	03	0	2	0
Church Eaton Brook	Church Eaton	08	0	7	0
Whiston Brook	Mitton Manor	08	0	2	0
Picknall/Hockley Brook	Woodford	08	0	2	0
Blythe	Blythe Bridge	47	0	6	0
Whitacre Brook	u/s Furnace End WRW	47	0	1	0
Overseal Brook	Netherseal	47	1	2	0
Mease	Stretton Bridge	47	0	3	0
Kingsbury Brook	Kingsbury	47	1	2	0
Scotia Brook	Westport Road	47	0	6	0
Trent	Norton Green	47	0	2	0
Tame	Two Gates Fazeley	47	0	4	0
Scotch Brook	Stone	47	0	2	0
Chitlings Brook	Trent Vale	405	1	0	0
Penmire Brook	Grendon	405	0	1	0

Table 11 The 20 samples audited for Lower Trent Area of Midlands Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Ragdale Brook	Hoby	04	0	4	0
Burton Stather Drain	Confluence	05	0	2	0
Sence	Wigston	06	0	4	0
Sence	Wigston	06	0	2	1
Queniborough Brook	Wreake confluence	50	1	0	0
Twyford Brook	d/s Findern STW	50	1	5	0
Kingston Brook	Kingston on Soar	400	1	2	0
Willow Brook	Soar confluence	400	0	1	0
Cuttail Brook	Salmon Lane	400	1	0	0
Cramfit Brook	Cramfit Bridge	400	0	2	0
Idle	Mattersey	400	1	0	0
Ryton	Scrooby	402	0	1	0
Skegby Brook	B6014	402	0	3	0
Burton Brook	Burton Lazars	402	0	1	0
Day Brook	Basford	402	0	0	0
Nut Brook	Confluence	402	0	0	1
Ashop	Ashop	402	0	0	0
Heage Brook	Ambergate	402	0	0	0
Soar	Claybrooke	402	1	1	0
Noe	Shatton	403	0	1	0

Table 12 Statistics of the 2000 Primary Audit for Midlands Region

Analyst/ Group	n	Mean gains	Standard error	No.samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
U. Severn	20	1.15	0.22	2	10.00	3	1.55	0.27
01	1	0	n/a	0	0	0	1.00	n/a
03	1	1.00	n/a	0	0	1	1.00	n/a
07	1	1.00	n/a	0	0	1	1.00	n/a
41	5	1.40	0.24	0	0	2	1.80	0.20
48	5	1.00	0.45	0	0	2	1.40	0.75
400	1	1.00	n/a	0	0	1	2.00	n/a
401	5	1.00	0.63	1	20.00	3	1.20	0.58
402	1	3.00	n/a	1	100.00	3	4.00	n/a
L. Severn	20	1.45	0.26	5	25.00	3	1.65	0.25
11	2	2.00	1.00	1	50.00	3	2.50	1.50
39	8	0.88	0.35	0	0	2	1.13	0.30
403	10	1.80	0.36	4	40.00	3	1.90	0.35
U. Trent	20	2.65	0.42	7	35.00	7	2.85	0.40
03	6	2.17	0.48	2	33.33	4	2.33	0.49
08	3	3.67	1.67	1	33.33	7	3.67	1.67
47	9	3.11	0.61	4	44.44	6	3.33	0.58
405	2	0.50	0.50	0	0	1	1.00	0.00
L. Trent	20	1.45	0.34	4	20.00	5	1.85	0.35
04	1	4.00	n/a	1	100.00	4	4.00	n/a
05	1	2.00	n/a	0	0	2	2.00	n/a
06	2	3.00	1.00	1	50.00	4	3.50	0.50
50	2	2.50	2.50	1	50.00	5	3.50	2.50
400	5	1.00	0.45	0	0	2	1.60	0.40
402	8	0.75	0.37	1	12.50	3	1.00	0.38
403	1	1.00	n/a	0	0	1	1.00	n/a
Midlands Region	80	1.68	0.17	18	22.50	7	1.98	0.17

Table 13 Net effects of the Primary Audit on BMWP score and number of scoring taxa for Midlands Region

Analyst/ Group	n	Mean net effect on BMWP score	Standard error of effect on BMWP score	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	Standard error of effect on no. of taxa	Maximum underestimate of no. of taxa
U. Severn	20	4.80	1.83	28	0.85	0.25	3
01	1	0	n/a	0	0	n/a	0
03	1	10.00	n/a	10	1.00	n/a	1
07	1	3.00	n/a	3	1.00	n/a	1
41	5	3.60	1.72	8	1.00	0.45	2
48	5	2.80	2.13	11	0.60	0.40	2
400	1	-1.00	n/a	-1	0	n/a	0
401	5	5.80	5.82	28	0.80	0.73	3
402	1	23.00	n/a	23	3.00	n/a	3
L. Severn	20	7.75	1.41	18	1.25	0.29	3
11	2	10.50	5.50	16	1.50	0.50	2
39	8	4.25	2.10	13	0.63	0.46	2
403	10	10.00	1.78	18	1.70	0.40	3
U. Trent	20	13.75	2.73	43	2.45	0.46	7
03	6	9.33	3.28	25	2.00	0.52	4
08	3	22.67	10.49	43	3.67	1.67	7
47	9	16.89	3.65	36	2.89	0.68	6
405	2	-0.50	4.50	4	0	1.00	1
L. Trent	20	6.90	1.99	25	1.15	0.36	4
04	1	25.00	n/a	25	4.00	n/a	4
05	1	10.00	n/a	10	2.00	n/a	2
06	2	16.00	1.00	17	3.00	1.00	4
50	2	9.50	14.50	24	1.50	2.50	4
400	5	3.20	2.73	11	0.40	0.60	2
402	8	4.13	2.23	17	0.63	0.37	3
403	1	3.00	n/a	3	1.00	n/a	1
Midlands Region	80	8.30	1.07	43	1.43	0.18	7

Table 14 The families missed in sorting by Midland Region's primary analysts

Family	n	% of Midlands Region's missed families in Primary Audit
Elmidae	10	8.20
Leptoceridae	7	5.74
Simuliidae	7	5.74
Planorbidae	7	5.74
Planariidae (incl. Dugesiidae)	6	4.92
Asellidae	5	4.10
Sphaeriidae	5	4.10
Ancylidae (incl. Acroloxidae)	5	4.10
Psychomyiidae (incl. Ecnomidae)	5	4.10
Valvatidae	5	4.10
Hydrobiidae (incl. Bithyniidae)	4	3.28
Hydroptilidae	4	3.28
Glossiphoniidae	3	2.46
Physidae	3	2.46
Haliplidae	3	2.46
Caenidae	3	2.46
Leuctridae	3	2.46
Ephemerellidae	3	2.46
Gyrinidae	2	1.64
Hydrophilidae (incl. Hydraenidae)	2	1.64
Dendrocoelidae	2	1.64
Calopterygidae	2	1.64
Rhyacophilidae (incl. Glossosomatidae)	2	1.64
Limnephilidae	2	1.64
Nemouridae	2	1.64
Baetidae	2	1.64
Tipulidae	2	1.64
Dytiscidae (incl. Noteridae)	2	1.64
Coenagrionidae	1	0.82
Chironomidae	1	0.82
Chloroperlidae	1	0.82
Sericostomatidae	1	0.82
Erpobdellidae	1	0.82
Goeridae	1	0.82
Scirtidae	1	0.82
Polycentropodidae	1	0.82
Piscicolidae	1	0.82
Leptophlebiidae	1	0.82
Lymnaeidae	1	0.82
Neritidae	1	0.82
Odontoceridae	1	0.82
Gammaridae (incl. Crangonyctidae)	1	0.82
Total	122	100

Table 15 The species missed in sorting by Midlands Region's primary analysts

Species	n	% of Midlands Region's missed species in Primary Audit
Elmis aenea (Muller)	9	7.09
Ancylus fluviatilis Muller	4	3.15
Simulium (Simulium) ornatum group	4	3.15
Pisidium sp.	4	3.15
Polycelis nigra group	3	2.36
Potamopyrgus jenkinsi (Smith)	3	2.36
Lype sp.	3	2.36
Caenis luctuosa group	3	2.36
Ephemerella ignita (Poda)	3	2.36
Asellus aquaticus (L.)	3	2.36
Valvata piscinalis (Muller)	3	2.36
Hydroptila sp.	3	2.36
Valvata cristata Muller	3	2.36
Glossiphonia complanata (L.)	2	1.57
Dendrocoelum lacteum (Muller)	2	1.57
Orectochilus villosus (Muller)	2	1.57
Calopteryx splendens (Harris)	2	1.57
Physa fontinalis (L.)	2	1.57
Mystacides azurea (L.)	2	1.57
Simulium sp.	2	1.57
Bathyomphalus contortus (L.)	2	1.57
Agapetus sp.	2	1.57
Polycelis sp.	2	1.57
Baetis rhodani (Pictet)	2	1.57
Anisus vortex (L.)	2	1.57
Armiger crista (L.)	2	1.57
Asellus meridianus Racovitza	2	1.57
Gyraulus albus (Muller)	1	0.79
Goera pilosa (Fabricius)	1	0.79
Glossiphoniidae indet	1	0.79
Gammarus sp.	1	0.79
Elodes sp.	1	0.79
Athripsodes albifrons (L.)	1	0.79
Brychius elevatus (Panzer)	1	0.79
Dytiscidae	1	0.79
Bithynia sp.	1	0.79
Athripsodes cinereus (Curtis)	1	0.79
Crangonyx pseudogracilis Bousfield	1	0.79
Coenagrionidae indet	1	0.79
Athripsodes sp.	1	0.79
Chloroperla torrentium (Pictet)	1	0.79
Ceraclea dissimilis (Stephens)	1	0.79
Halipus sp.	1	0.79
Leuctra sp.	1	0.79
Athripsodes aterrimus (Stephens)	1	0.79

Table 15 continued

Species	n	% of Midlands Region's missed species in Primary Audit
Sphaeriidae indet	1	0.79
Piscicola geometra (L.)	1	0.79
Planariidae indet	1	0.79
Plectrocnemia sp.	1	0.79
Protonemura praecox (Morton)	1	0.79
Psychomyia pusilla (Fabricius)	1	0.79
Leuctra fusca (L.)	1	0.79
Simulium (Wilhelmia) sp.	1	0.79
Oulimnius sp.	1	0.79
Sphaerium sp.	1	0.79
Theodoxus fluviatilis (L.)	1	0.79
Theromyzon tessulatum (Muller)	1	0.79
Tinodes sp.	1	0.79
Tipulidae indet	1	0.79
Trocheta subviridis Dutrochet	1	0.79
Sericostoma personatum (Spence)	1	0.79
Lymnaea palustris (Muller)	1	0.79
Hydraena sp.	1	0.79
Hygrotus versicolor (Schaller)	1	0.79
Ithytrichia sp.	1	0.79
Acroloxus lacustris (L.)	1	0.79
Leuctra geniculata (Stephens)	1	0.79
Limnephilidae indet	1	0.79
Physa sp.	1	0.79
Limnophila (Eloeophila) sp.	1	0.79
Paraleptophlebia submarginata (Stephens)	1	0.79
Mystacides sp.	1	0.79
Nemoura cambrica group	1	0.79
Ochthebius bicolon Germar	1	0.79
Odontocerum albicorne (Scopoli)	1	0.79
Orthocladiinae	1	0.79
Haliphus wehncke (Gerhardt)	1	0.79
Limnephilus sp.	1	0.79
Total	127	100

AUDIT OF NORTH EAST REGION'S PRIMARY ANALYSTS

Table 16 The 20 samples audited for Dales Area of North East Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Wharfe	Harewood	CJ	0	1	0
Nidd	Walshford Bridge	CJ	0	0	0
Shotton Beck	Shotton	EA	0	0	0
Leven	East Angrove	EA	0	1	0
Cowbridge Beck	d/s Billingham STW	EA	0	0	0
Whitton Beck	Whitton	EA	0	0	0
Tees	Egglestone Abbey	EA	0	0	0
Firgreen Beck	A659 Bridge	GM	0	2	0
Skerne	d/s Winterton Hospital STW	GM	0	2	0
Thornton Beck	Thornton Dale	GM	0	1	0
Dove	Farndale	JB	0	2	0
Aldborough Beck	B6275 Bridge	JB	1	0	0
Oak Beck	Harrowgate	JB	0	0	0
Murk Esk	Grosmont	JB	1	2	0
Hertford	Ganton	JB	0	2	0
Ouse	Acaster Malbis (Airlift)	SW	0	2	0
Wharfe	Otley	SW	0	1	0
Derwent	Bubwith (Sweep)	SW	0	5	0
Swale	Skipton-on-Swale	SW	1	2	0
Collingham Beck	Collingham	SW	0	1	0

Table 17 The 20 samples audited for Northumbria Area of North East Region

River	Site	Primary Analyst	Losses	Gains	Omissions
N. Tyne	Bellingham	AG	0	1	0
Twizell Burn	u/s Hustledown STW	AG	1	4	0
Croxdale Beck	Tursdale House	AG	0	0	0
Twizell Burn	u/s Hustledown STW	AG	0	1	0
Lumley Park Burn	Lumley Castle	AG	0	2	0
Embleton Burn	Embleton	EWS	0	0	0
Derwent	Allensford	EWS	0	3	0
Pont	Foxcourt Lane	EWS	0	1	0
Don	u/s Leam SSO	EWS	1	0	0
Wooler Water	d/s Wooler STW	EWS	0	2	0
Pont	Kirkley Mill	EWS	0	0	0
Roddam Burn	East Lilburn	EWS	0	0	0
Beechburn Beck	Beechburn Farm	FC	0	1	0
Gaunless	u/s Wear, Bishops Palace	FC	0	2	0
Blyth	Belassis	FC	0	5	0
How Burn	u/s Wansbeck	JL	0	1	0
Hartley Burn	Burnfoot	VW	0	1	0
Wallishwalls Burn	u/s confluence R. Derwent	VW	0	2	0
Croxdale Beck	Croxdale House	VW	0	0	0
Blackburn	Midleholme	VW	0	0	0

Table 18 The 20 samples audited for Ridings Area of North East Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Ings & Tetherings Drain	u/s Bird Lane	AH	0	0	0
Bradford Beck	Shipley	AH	0	1	0
Don	Dunford Bridge	AH	1	2	0
Dove	Wombwell Ings	ALH	0	2	0
Silkstone Beck	Pothouse Bridge	AM	0	4	1
Midgelden Brook	By A681	AM	0	3	0
Alverthorpe Beck	Low Laithes Bridge	AM	0	0	0
Smithy Brook	Mitchell Campers	AM	0	0	0
Ramsden Clough	d/s Brownhill Reservoir	AM	0	0	0
Little Don	Crookland Wood	AM	1	1	0
Dearne	d/s Carr Dyke	AM	0	1	0
Foulness	Hasholme Ford Bridge	FD	0	1	0
Watton Beck	Watton Carrs	FD	0	0	0
West Beck	Whinhill Fish Farm	FD	3	0	0
West Beck	The Bottoms	FD	0	0	0
Banks Bottom Dike	u/s Norcroft Bridge	JL	0	1	0
Greasborough Dike	By B6089	KJ	0	2	0
Thick Hollings Dike	d/s David Brown Tractors	KJ	0	0	0
Scout Dike	u/s Ingbirchwith Res.	KJ	0	3	0
Colne	Ashgrove Road	LBS	0	0	0

Table 19 Statistics of the 2000 Primary Audit for North East Region

Analyst/ Group	n	Mean gains	Standard error	No. samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
Dales	20	1.20	0.28	1	5.00	5	1.35	0.29
CJ	2	0.50	0.50	0	0	1	0.50	0.50
EA	5	0.20	0.20	0	0	1	0.20	0.20
GM	3	1.67	0.33	0	0	2	1.67	0.33
JB	5	1.20	0.49	0	0	2	1.60	0.51
SW	5	2.20	0.73	1	20.00	5	2.40	0.75
Northumbria	20	1.30	0.32	3	15.00	5	1.40	0.34
AG	5	1.60	0.68	1	20.00	4	1.80	0.86
EWS	7	0.86	0.46	1	14.29	3	1.00	0.44
FC	3	2.67	1.20	1	33.33	5	2.67	1.20
JL	1	1.00	n/a	0	0	1	1.00	n/a
VW	4	0.75	0.48	0	0	2	0.75	0.48
Ridings	20	1.05	0.28	3	15.00	4	1.35	0.33
AH	3	1.00	0.58	0	0	2	1.33	0.88
ALH	1	2.00	n/a	0	0	2	2.00	n/a
AM	7	1.29	0.61	2	28.57	4	1.57	0.72
FD	4	0.25	0.25	0	0	1	1.00	0.71
JL	1	1.00	n/a	0	0	1	1.00	n/a
KJ	3	1.67	0.88	1	33.33	3	1.67	0.88
LBS	1	0	n/a	0	0	0	0	n/a
N. East Region	60	1.18	0.17	7	11.67	5	1.37	0.18

Table 20 Net effects of the Primary Audit on BMWP score and number of scoring taxa for North East Region

Analyst/ Group	n	Mean net effect on BMWP score	Standard error of effect on BMWP score	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	Standard error of effect on no. of taxa	Maximum underestimate of no. of taxa
Dales	20	6.70	2.15	42	1.05	0.29	5
CJ	2	2.50	2.50	5	0.50	0.50	1
EA	5	2.00	2.00	10	0.20	0.20	1
GM	3	8.67	2.03	12	1.67	0.33	2
JB	5	5.80	3.28	15	0.80	0.58	2
SW	5	12.80	7.34	42	2.00	0.77	5
Northumbria	20	7.35	1.86	31	1.20	0.31	5
AG	5	7.00	1.92	11	1.40	0.51	3
EWS	7	5.43	3.34	18	0.71	0.52	3
FC	3	17.33	7.31	31	2.67	1.20	5
JL	1	5.00	n/a	5	1.00	n/a	1
VW	4	4.25	2.53	10	0.75	0.48	2
Ridings	20	6.00	2.07	29	0.80	0.34	4
AH	3	4.67	3.28	11	0.67	0.33	1
ALH	1	11.00	n/a	11	2.00	n/a	2
AM	7	9.00	4.43	29	1.14	0.63	4
FD	4	-1.25	3.54	6	-0.50	0.87	1
JL	1	5.00	n/a	5	1.00	n/a	1
KJ	3	10.67	5.61	19	1.67	0.88	3
LBS	1	0	n/a	0	0	n/a	0
N. East Region	60	6.68	1.15	42	1.02	0.18	5

Table 21 The families missed by North East Region's primary analysts

Family	n	% of North East Region's missed families in Primary Audit
Hydroptilidae	5	7.81
Hydrophilidae (incl. Hydraenidae)	5	7.81
Nemouridae	4	6.25
Dytiscidae (incl. Noteridae)	3	4.69
Planorbidae	3	4.69
Planariidae (incl. Dugesiidae)	3	4.69
Limnephilidae	3	4.69
Asellidae	2	3.13
Caenidae	2	3.13
Elmidae	2	3.13
Ephemerellidae	2	3.13
Gammaridae (incl. Crangonyctidae)	2	3.13
Heptageniidae	2	3.13
Leptoceridae	2	3.13
Sphaeriidae	2	3.13
Simuliidae	2	3.13
Rhyacophilidae (incl. Glossosomatidae)	2	3.13
Leuctridae	2	3.13
Glossiphoniidae	1	1.56
Taeniopterygidae	1	1.56
Baetidae	1	1.56
Brachycentridae	1	1.56
Sialidae	1	1.56
Sericostomatidae	1	1.56
Hydropsychidae	1	1.56
Scirtidae	1	1.56
Gyrinidae	1	1.56
Hydrobiidae (incl. Bithyniidae)	1	1.56
Psychomyiidae (incl. Ecnomidae)	1	1.56
Ancylidae (incl. Acroloxidae)	1	1.56
Perlodidae	1	1.56
Unionidae	1	1.56
Leptophlebiidae	1	1.56
Erpobdellidae	1	1.56
Total	64	100

Table 22 The species missed by North East Region's primary analysts

Species	n	% of North East Region's missed species in Primary Audit
Hydraena gracilis Germar	4	6.06
Hydroptila sp.	4	6.06
Ephemerella ignita (Poda)	2	3.03
Amphinemura sulcicollis (Stephens)	2	3.03
Nemoura avicularis Morton	2	3.03
Oulimnius sp.	2	3.03
Pisidium sp.	2	3.03
Polycelis nigra group	2	3.03
Potamonectes depressus (Fabricius)	2	3.03
Asellus aquaticus (L.)	2	3.03
Bathyomphalus contortus (L.)	2	3.03
Caenis luctuosa group	2	3.03
Ancylus fluviatilis Muller	1	1.52
Hydropsyche angustipennis (Curtis)	1	1.52
Armiger crista (L.)	1	1.52
Heptageniidae indet	1	1.52
Helophorus (Atracthelophorus) brevipalpis Bedel	1	1.52
Helobdella stagnalis (L.)	1	1.52
Glossosoma sp.	1	1.52
Erpobdellidae indet	1	1.52
Gammarus pulex (L.)	1	1.52
Athripsodes bilineatus (L.)	1	1.52
Baetis rhodani (Pictet)	1	1.52
Leuctra sp.	1	1.52
Brachycentrus subnubilus Curtis	1	1.52
Elodes sp.	1	1.52
Brachyptera risi (Morton)	1	1.52
Gammarus sp.	1	1.52
Planaria torva (Muller)	1	1.52
Simulium (Nevermannia) vernum group	1	1.52
Simulium (Nevermannia) cryophilum group	1	1.52
Sialis lutaria (L.)	1	1.52
Sericostoma personatum (Spence)	1	1.52
Rhyacophila dorsalis (Curtis)	1	1.52
Rhithrogena sp.	1	1.52
Pseudanodonta complanata (Rossmassler)	1	1.52
Potamopyrgus jenkinsi (Smith)	1	1.52
Leptophlebiidae indet	1	1.52
Polycelis sp.	1	1.52
Isoperla grammatica (Poda)	1	1.52
Oxyethira sp.	1	1.52
Oreodytes sanmarkii (Sahlberg)	1	1.52
Orectochilus villosus (Muller)	1	1.52
Mystacides azurea (L.)	1	1.52
Lype sp.	1	1.52

Table 22 continued

Species	n	% of North East Region's missed species in Primary Audit
Limnephilus lunatus Curtis	1	1.52
Limnephilidae indet	1	1.52
Simulium (Simulium) ornatum group	1	1.52
Leuctra geniculata (Stephens)	1	1.52
Potamophylax cingulatus group	1	1.52
Total	66	100

AUDIT OF NORTH WEST REGION'S PRIMARY ANALYSTS

Table 23 The 20 samples audited for Central Area of North West Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Darwen	Pleasington Fields	BL	0	2	0
Eaves Brook	Park Walk	DL	1	1	0
Wade Brook	ptc Mill Brook	DL	0	0	0
Ribble	Duddle Brook	DL	0	2	1
Keer	u/s Keer Bridge	DL	0	0	0
Pimlico Brook	Princess Ave, d/s Pimlico	DL	0	1	0
Wenning	Keasden Beck	DL	0	0	0
Eller Brook	ptc R.Yarrow	GK	0	1	0
Darwen	u/s Hardman Way	GK	1	2	0
Black Brook	d/s Drummersdale Drive	HFH	0	0	0
Chatburn Beck	d/s Chatburn	JDJ	0	1	1
Alt	ptc Downholland Brook	JDJ	0	1	0
Yarrow	Birkacre	JDJ	0	1	0
Cocker	Ridgy Pool Bridge	JDJ	0	0	0
Alt	ptc Downholland Brook	JDJ	0	1	0
Smithy Brook	Lady Lane u/s A49	KCh	0	0	0
Cunscough Brook	d/s Cunscough Bridge West	KCx	0	0	0
Birk Beck	Birk Beck	KCx	0	1	0
Tun Brook	ptc R.Ribble	KCx	0	2	0
Hunts Brook	d/s Thornton ETW	KCx	1	1	0

Table 24 The 20 samples audited for Northern Area of North West Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Sepulchre Beck	d/s Janet Bridge	AF	0	0	0
Kent	u/s Kendal STW	BJI	0	1	0
Rothay	d/s Grassmere	BJI	0	4	0
Petteril	Stoneyholme	DS	0	6	1
Eden	d/s Grinsdale Church	ES	2	2	1
Dale Beck	NY 613 372	ES	0	1	0
Leith	Cliburn	ES	1	3	0
Wampool	Crofton Bridge	GR	0	1	0
Furnace Gill	NY 024 343	GR	0	0	1
Bampton Beck	NY 275 549	GR	0	1	0
Blumer Beck	ptc R.Derwent	GR	0	0	0
Back Burn	NY 407 732	GR	1	0	0
Eamont	d/s Udford GS	GR	0	0	0
Swindale Beck	NY 686 253	GR	0	0	0
Scale Beck	NY 673 145	GR	0	1	0
Esk	Whahouse Bridge	NTC	0	2	0
Tarn Beck	Tongue House	NTC	0	1	0
Duddon	u/s Duddon Bridge	NTC	0	1	0
Liza	u/s Ennerdale Water	NTC	0	1	0
Brides Beck	ptc Carr Beck	NTC	0	0	0

Table 25 The 20 samples audited for Southern Area of North West Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Wirral Brooks	Arrowe Brook	AG	0	1	0
Hurst Brook	ptc Shelf Brook	AG	1	0	0
Poise Brook	ptc R.Goyt	AG	0	1	0
Gowy	Gowy Bridge	AG	0	0	0
Rowath	ptc R.Sett	AG	0	3	0
Weaver	Saltersford Locks	FD	0	0	0
Weaver	d/s Frodsham Bridge	FD	0	1	0
Ditton Brook	Carr Lane	GM	1	2	1
Kinder	ptc R.Sett	KA	1	3	0
Etherow	Compstall Bridge	KA	0	3	0
Limy Water	u/s Love Clough Textiles	LJ	0	1	0
Croal	Farnworth Recording Station	LJ	0	1	0
Rams Brook	Near Hale Village	LJ	1	0	0
Marsh Brook	ptc Hall Lane Brook	LJ	1	2	0
Irk	PTC Wince Brook	MW	0	2	0
Clatter Brook	ptc Thornton Stream	NR	0	0	0
Timperley Brook	ptc Sinderland Brook	NR	1	1	0
Day Green Stream	B5078 u/s Alsager ETW	RMM	1	0	0
Swettenham Brook	d/s the Mill	RMM	0	0	0
Tame	d/s Readycon Dean Reservoir	RMM	1	6	0

Table 26 Statistics of the 2000 Primary Audit for North West Region

Analyst/ Group	n	Mean gains	Standard error	No.samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
Northern	20	1.25	0.35	3	15.00	6	1.60	0.43
AF	1	0	n/a	0	0	0	0	n/a
BJI	2	2.50	1.50	1	50.00	4	2.50	1.50
DS	1	6.00	n/a	1	100.00	6	7.00	n/a
ES	3	2.00	0.58	1	33.33	3	3.33	1.20
GR	8	0.38	0.18	0	0	1	0.63	0.18
NTC	5	1.00	0.32	0	0	2	1.00	0.32
Central	20	0.85	0.17	0	0	2	1.10	0.23
BL	1	2.00	n/a	0	0	2	2.00	n/a
DL	6	0.67	0.33	0	0	2	1.00	0.52
GK	2	1.50	0.50	0	0	2	2.00	1.00
HFH	1	0	n/a	0	0	0	0	n/a
JDJ	5	0.80	0.20	0	0	1	1.00	0.32
KCh	1	0	n/a	0	0	0	0	n/a
KCx	4	1.00	0.41	0	0	2	1.25	0.48
Southern	20	1.35	0.34	4	20.00	6	1.80	0.39
AG	5	1.00	0.55	1	20.00	3	1.20	0.49
FD	2	0.50	0.50	0	0	1	0.50	0.50
GM	1	2.00	n/a	0	0	2	4.00	n/a
KA	2	3.00	0	2	100.00	3	3.50	0.50
LJ	4	1.00	0.41	0	0	2	1.50	0.50
MW	1	2.00	n/a	0	0	2	2.00	n/a
NR	2	0.50	0.50	0	0	1	1.00	1.00
RMM	3	2.00	2.00	1	33.33	6	2.67	2.19
N. West Region	60	1.15	0.17	7	11.67	6	1.50	0.21

Table 27 Net effects of the Primary Audit on BMWP score and number of scoring taxa for North West Region

Analyst/ Group	n	Mean net effect on BMWP score	Standard error of effect on BMWP score	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	Standard error of effect on no. of taxa	Maximum underestimate of no. of taxa
Northern	20	6.35	2.32	40	1.05	0.35	6
AF	1	0	n/a	0	0	n/a	0
BJI	2	11.00	8.00	19	2.50	1.50	4
DS	1	40.00	n/a	40	6.00	n/a	6
ES	3	5.67	7.54	16	1.00	0.58	2
GR	8	1.88	1.55	8	0.25	0.25	1
NTC	5	6.60	1.89	10	1.00	0.32	2
Central	20	3.55	0.98	13	0.70	0.16	2
BL	1	13.00	n/a	13	2.00	n/a	2
DL	6	1.33	1.69	8	0.50	0.34	2
GK	2	5.00	2.00	7	1.00	0.00	1
HFH	1	0	n/a	0	0	n/a	0
JDJ	5	3.00	0.84	5	0.80	0.20	1
KCh	1	0	n/a	0	0	n/a	0
KCx	4	6.25	2.59	11	0.75	0.48	2
Southern	20	6.50	2.39	41	0.95	0.34	5
AG	5	5.20	3.87	18	0.80	0.66	3
FD	2	1.50	1.50	3	0.50	0.50	1
GM	1	6.00	n/a	6	1.00	n/a	1
KA	2	15.50	7.50	23	2.50	0.50	3
LJ	4	4.50	2.90	10	0.50	0.50	1
MW	1	8.00	n/a	8	2.00	n/a	2
NR	2	0	0.00	0	0	0.00	0
RMM	3	12.67	14.19	41	1.33	1.86	5
N. West Region	60	5.47	1.15	41	0.90	0.17	6

Table 28 The families missed in sorting by North West Region's primary analysts

Family	n	% of North West Region's missed families in Primary Audit
Hydrobiidae (incl. Bithyniidae)	7	11.86
Planariidae (incl. Dugesiidae)	5	8.47
Lepidostomatidae	4	6.78
Baetidae	3	5.08
Psychomyiidae (incl. Ecnomidae)	3	5.08
Lymnaeidae	3	5.08
Chloroperlidae	2	3.39
Hydrophilidae (incl. Hydraenidae)	2	3.39
Ancylidae (incl. Acroloxidae)	2	3.39
Hydropsychidae	2	3.39
Leuctridae	2	3.39
Tipulidae	2	3.39
Physidae	2	3.39
Simuliidae	2	3.39
Halplidae	1	1.69
Asellidae	1	1.69
Caenidae	1	1.69
Sphaeriidae	1	1.69
Ephemerellidae	1	1.69
Erpobdellidae	1	1.69
Gammaridae (incl. Crangonyctidae)	1	1.69
Glossiphoniidae	1	1.69
Leptoceridae	1	1.69
Gyrinidae	1	1.69
Odontoceridae	1	1.69
Scirtidae	1	1.69
Rhyacophilidae (incl. Glossosomatidae)	1	1.69
Planorbidae	1	1.69
Valvatidae	1	1.69
Limnephilidae	1	1.69
Oligochaeta	1	1.69
Goeridae	1	1.69
Total	59	100

Table 29 The species missed in sorting by North West Region's primary analysts

Species	n	% of North West Region's missed species in Primary Audit
Potamopyrgus jenkinsi (Smith)	7	11.48
Polycelis felina (Dalyell)	3	4.92
Chloroperla torrentium (Pictet)	2	3.28
Ancylus fluviatilis Muller	2	3.28
Lepidostoma hirtum (Fabricius)	2	3.28
Tinodes waeneri (L.)	2	3.28
Baetis rhodani (Pictet)	2	3.28
Lymnaea sp.	2	3.28
Polycelis nigra group	2	3.28
Hydraena gracilis Germar	2	3.28
Lepidostomatidae indet	2	3.28
Hydropsyche siltalai Dohler	1	1.64
Hydropsyche angustipennis (Curtis)	1	1.64
Haliphus sp.	1	1.64
Glossiphonia complanata (L.)	1	1.64
Gammarus pulex (L.)	1	1.64
Erpobdella octoculata (L.)	1	1.64
Elodes sp.	1	1.64
Limnophila (Eloeophila) sp.	1	1.64
Caenis sp.	1	1.64
Bithynia tentaculata (L.)	1	1.64
Baetis vernus Curtis	1	1.64
Asellus aquaticus (L.)	1	1.64
Ephemerella ignita (Poda)	1	1.64
Physa fontinalis (L.)	1	1.64
Tubificidae	1	1.64
Tipula sp.	1	1.64
Tinodes unicolor (Pictet)	1	1.64
Simulium (Simulium) ornatum group	1	1.64
Simulium (Nevermannia) cryophilum group	1	1.64
Silo pallipes (Fabricius)	1	1.64
Planorbis sp.	1	1.64
Leuctra sp.	1	1.64
Physa sp.	1	1.64
Leuctra hippopus (Kempny)	1	1.64
Orectochilus villosus (Muller)	1	1.64
Odontocerum albicorne (Scopoli)	1	1.64
Mystacides azurea (L.)	1	1.64
Molophilus sp.	1	1.64
Lymnaea peregra (Muller)	1	1.64
Valvata piscinalis (Muller)	1	1.64
Limnephilus lunatus Curtis	1	1.64
Agapetus sp.	1	1.64
Pisidium sp.	1	1.64
Total	61	100

AUDIT OF SOUTHERN REGION'S PRIMARY ANALYSTS

Table 30 The 20 samples audited for the Hants & Isle of Wight Area of Southern Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Test	Chilbolton	W13	0	4	0
Dun	Dunbridge	W13	0	1	0
Pillhill Brook	u/s Anna Valley Fish Farm	W13	0	0	1
Brownwich Stream	Titchfield	W29	0	0	0
Itchen	Sewards Bridge	W29	0	0	0
Mopley Pond	Stanswood	W30	0	2	0
Walhampton Stream	Lisle Court	W30	0	1	1
Itchen	Easton	W30	0	2	0
Avon	Efford Bridge	W30	0	2	0
Titchfield	Broad Bridge	W32	0	0	0
Bank Stream	Bank	W32	0	0	0
Ober Water	Aldridge Hill	W34	0	6	0
Dever	Sutton Scotney	W34	0	2	3
Brighstone Stream	Brighstone Mill	W34	0	2	2
Dever	Northbrook	W34	0	3	0
Test	Chilbolton	W34	1	4	1
Anton	Fullerton	W35	0	2	0
Warblington Stream No 1	Brook Farm	W35	2	1	0
Palmers Brook	Brock's Copse	W36	1	0	0
Horton Heath Stream	Maddoxford Farm	W36	0	3	0

Table 31 The 20 samples audited for the Kent Area of Southern Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Rother	Boonshill	E2	0	2	0
Cradlebridge Sewer	d/s Woodchurch STW	E2	0	2	0
Great Stour	Godmersham	E6	1	3	0
Great Stour	Shalmsford St	E6	0	3	1
Len	d/s Leeds STW confluence	E11	1	1	0
Len	Lower Runham	E11	1	0	0
Ditton Stream	Ditton	E11	1	2	0
Hammer Stream Trib	Claybridge	E11	0	2	0
Wadhurst Stream	d/s Washwell Lane	E19	0	1	0
Brede	A21 Road Bridge	E19	0	2	0
Doleham Ditch	Doleham Farm	E19	0	3	0
Tillingham	Udimore Road	E19	0	2	0
Grom	d/s Tunbridge Wells STW	E28	0	4	0
Loose Stream	Ivy Mill	E39	0	1	0
Rother	Old Mill Farm	E39	0	3	2
Pippingford Brook Trib	Half Moon Inn	E40	0	0	0
Aylesford Stream	Newtown Road	E40	0	3	0
Bourne	Hamptons Rd Bridge	E41	0	2	0
Tillingham	Chitcombe	E41	0	2	0
Tillingham	100 House Lane	E41	0	2	0

Table 32 The 20 samples audited for the Sussex Area of Southern Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Kird	Kirdford Bridge	AS	1	1	0
Elsted Stream	Dumpford Lane	BK	1	2	0
Arun	Bucks Green	BK	1	2	0
Adur East	d/s Folly Farm Tributary	BK	1	1	0
Herrings Stream	Herrings Bridge	BU	0	4	0
Blakes Gill	u/s Scolliers Bridge	GR	1	1	0
Rother	Durford Bridge	GR	0	3	1
North End Stream	North End	GR	0	2	0
Newmill	d/s Benenden	GR	0	1	0
Uck	Hastingford Bridge	GR	0	2	0
Cuckmere	d/s Knockhatch confluence	GR	0	1	0
Bull	Bull Bridge	JB	0	1	0
Wallington	Spurlings Farm	JB	0	0	0
Arun	New Bridge	PS	0	0	0
Brinsbury Stream	d/s Lake	SE	0	2	0
Rother	Selham Bridge	SE	0	3	0
Newmill Channel	u/s Tenterden STW	SE	0	3	0
Cuckmere	Boship Bridge	VC	0	0	0
Meon	Drayton	VC	0	0	0
Loxwood Stream	Whitebeech Bridge	VC	0	0	0

Table 33 Statistics of the 2000 Primary Audit for Southern Region

Analyst/ Group	n	Mean gains	Standard error	No.samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
Hants & IOW	20	1.75	0.37	5	25.00	6	2.35	0.42
W13	3	1.67	1.20	1	33.33	4	2.00	1.00
W29	2	0	0	0	0	0	0	0
W30	4	1.75	0.25	0	0	2	2.00	0
W32	2	0.00	0	0	0	0	0	0
W34	5	3.40	0.75	3	60.00	6	4.80	0.58
W35	2	1.50	0.50	0	0	2	2.50	0.50
W36	2	1.50	1.50	1	50.00	3	2.00	1.00
Kent	20	2.00	0.23	6	30.00	4	2.35	0.27
E2	2	2.00	0	0	0	2	2.00	0
E6	2	3.00	0	2	100.00	3	4.00	0
E11	4	1.25	0.48	0	0	2	2.00	0.41
E19	4	2.00	0.41	1	25.00	3	2.00	0.41
E28	1	4.00	n/a	1	100.00	4	4.00	n/a
E39	2	2.00	1.00	1	50.00	3	3.00	2.00
E40	2	1.50	1.50	1	50.00	3	1.50	1.50
E41	3	2.00	0	0	0	2	2.00	0
Sussex	20	1.45	0.27	4	20.00	4	1.75	0.30
AS	1	1.00	n/a	0	0	1	2.00	n/a
BK	3	1.67	0.33	0	0	2	2.67	0.33
BU	1	4.00	n/a	1	100.00	4	4.00	n/a
GR	6	1.67	0.33	1	16.67	3	2.00	0.45
JB	2	0.50	0.50	0	0	1	0.50	0.50
PS	1	0	n/a	0	0	0	0	n/a
SE	3	2.67	0.33	2	66.67	3	2.67	0.33
VC	3	0	0	0	0	0	0	0
Southern Region	60	1.73	0.17	15	25.00	6	2.15	0.20

Table 34 Net effects of the Primary Audit on BMWP score and number of scoring taxa for Southern Region

Analyst/ Group	n	Mean net effect on BMWP score	Standard error of effect on BMWP score	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	Standard error of effect on no. of taxa	Maximum underestimate of no. of taxa
Hants & IOW	20	10.85	2.82	43	1.55	0.39	6
W13	3	11.00	9.07	29	1.67	1.20	4
W29	2	0	0	0	0	0	0
W30	4	11.75	1.11	15	1.75	0.25	2
W32	2	0	0	0	0	0	0
W34	5	21.80	6.09	43	3.20	0.73	6
W35	2	2.00	7.00	9	0.50	1.50	2
W36	2	12.00	15.00	27	1.00	2.00	3
Kent	20	10.95	1.66	22	1.80	0.27	4
E2	2	14.00	1.00	15	2.00	0	2
E6	2	14.50	0.50	15	2.50	0.50	3
E11	4	1.00	3.24	10	0.50	0.65	2
E19	4	12.75	2.25	19	2.00	0.41	3
E28	1	22.00	n/a	22	4.00	n/a	4
E39	2	11.00	4.00	15	2.00	1.00	3
E40	2	8.00	8.00	16	1.50	1.50	3
E41	3	15.67	2.60	20	2.00	0	2
Sussex	20	8.95	1.86	26	1.20	0.29	4
AS	1	0	n/a	0	0	n/a	0
BK	3	10.33	3.33	17	0.67	0.33	1
BU	1	26.00	n/a	26	4.00	n/a	4
GR	6	12.50	2.69	24	1.50	0.43	3
JB	2	2.50	2.50	5	0.50	0.50	1
PS	1	0	n/a	0	0	n/a	0
SE	3	14.00	3.79	20	2.67	0.33	3
VC	3	0	0	0	0	0	0
Southern Region	60	10.25	1.24	43	1.52	0.18	6

Table 35 The families missed in sorting by Southern Region's primary analysts

Family	n	% of Southern Region's missed families in Primary Audit
Leptoceridae	10	10.00
Hydroptilidae	7	7.00
Coenagrionidae	5	5.00
Hydrophilidae (incl. Hydraenidae)	5	5.00
Hydrobiidae (incl. Bithyniidae)	4	4.00
Elmidae	4	4.00
Planariidae (incl. Dugesiidae)	4	4.00
Piscicolidae	4	4.00
Sericostomatidae	4	4.00
Valvatidae	3	3.00
Lepidostomatidae	3	3.00
Simuliidae	3	3.00
Lymnaeidae	3	3.00
Goeridae	3	3.00
Gyrinidae	3	3.00
Caenidae	3	3.00
Ancylidae (incl. Acroloxidae)	2	2.00
Tipulidae	2	2.00
Beraeidae	2	2.00
Ephemerellidae	2	2.00
Planorbidae	2	2.00
Leptophlebiidae	2	2.00
Nemouridae	2	2.00
Rhyacophilidae (incl. Glossosomatidae)	2	2.00
Psychomyiidae (incl. Ecnomidae)	2	2.00
Haliplidae	2	2.00
Asellidae	1	1.00
Baetidae	1	1.00
Scirtidae	1	1.00
Corixidae	1	1.00
Dytiscidae (incl. Noteridae)	1	1.00
Sphaeriidae	1	1.00
Phryganeidae	1	1.00
Ephemeridae	1	1.00
Erpobdellidae	1	1.00
Gammaridae (incl. Crangonyctidae)	1	1.00
Odontoceridae	1	1.00
Dryopidae	1	1.00
Total	100	100

Table 36 The species missed in sorting by Southern Region's primary analysts

Species	n	% of Southern Region's missed species in Primary Audit
Hydroptila sp.	6	5.61
Mystacides azurea (L.)	5	4.67
Potamopyrgus jenkinsi (Smith)	4	3.74
Piscicola geometra (L.)	4	3.74
Sericostoma personatum (Spence)	4	3.74
Valvata cristata Muller	3	2.80
Hydraena gracilis Germar	3	2.80
Ephemerella ignita (Poda)	2	1.87
Caenis luctuosa group	2	1.87
Orectochilus villosus (Muller)	2	1.87
Hydraena riparia Kugelann	2	1.87
Beraeodes minutus (L.)	2	1.87
Ischnura elegans (Van der Linden)	2	1.87
Athripsodes sp.	2	1.87
Lepidostoma hirtum (Fabricius)	2	1.87
Ancylus fluviatilis Muller	2	1.87
Habrophlebia fusca (Curtis)	2	1.87
Pyrrhosoma nymphula (Sulzer)	2	1.87
Polycelis nigra group	2	1.87
Oulimnius tuberculatus (Muller)	2	1.87
Simulium (Nevermannia) vernal group	2	1.87
Silo pallipes (Fabricius)	2	1.87
Caenis rivulorum Eaton	1	0.93
Rhyacophila sp.	1	0.93
Ephemerella danica Muller	1	0.93
Enallagma cyathigerum (Charpentier)	1	0.93
Elodes sp.	1	0.93
Elmis aenea (Muller)	1	0.93
Dugesia tigrina (Girard)	1	0.93
Dugesia polychroa group	1	0.93
Dryopidae indet	1	0.93
Deronectes latus (Stephens)	1	0.93
Erpobdella octoculata (L.)	1	0.93
Coenagrion puella group	1	0.93
Gyraulus albus (Muller)	1	0.93
Brychius elevatus (Panzer)	1	0.93
Baetis muticus (L.)	1	0.93
Simulium (Simulium) ornatum group	1	0.93
Athripsodes bilineatus (L.)	1	0.93
Asellus aquaticus (L.)	1	0.93
Armiger crista (L.)	1	0.93
Antocha vitripennis (Meigen)	1	0.93
Tinodes waeneri (L.)	1	0.93
Agapetus sp.	1	0.93
Crenobia alpina (Dana)	1	0.93

Table 36 continued

Species	n	% of Southern Region's missed species in Primary Audit
Lepidostomatidae indet	1	0.93
Oecetis testacea (Curtis)	1	0.93
Oecetis lacustris (Pictet)	1	0.93
Odontocerum albicorne (Scopoli)	1	0.93
Nemurella picteti Klapalek	1	0.93
Nemoura cinerea (Retzius)	1	0.93
Mystacides nigra (L.)	1	0.93
Micronecta sp.	1	0.93
Lype sp.	1	0.93
Lymnaea sp.	1	0.93
Lymnaea peregra (Muller)	1	0.93
Gammarus pulex (L.)	1	0.93
Limnebius truncatellus (Thunberg)	1	0.93
Hydraena sp.	1	0.93
Oxyethira sp.	1	0.93
Ithytrichia sp.	1	0.93
Phryganea grandis group	1	0.93
Pilaria (Pilaria) sp.	1	0.93
Adicella reducta (McLachlan)	1	0.93
Pisidium sp.	1	0.93
Halipus sp.	1	0.93
Gyrinus urinator Illiger	1	0.93
Oulimnius sp.	1	0.93
Goera pilosa (Fabricius)	1	0.93
Lymnaea palustris (Muller)	1	0.93
Total	107	100

AUDIT OF SOUTH WEST REGION'S PRIMARY ANALYSTS

Table 37 The 20 samples audited for Cornwall Area of South West Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Fal	d/s Trelice Bridge	DS	0	0	0
Trebant Water	East Trencreek	DS	0	0	0
Crinnis Stream	upstream adits	JMB	0	3	0
River Fal	d/s Melbur Plant leat CP3/1	JMB	0	0	0
Par River	Luxulyan Bridge	JMB	0	0	0
Burn	u/s Tavy	JMB	0	0	0
Tory Brook	Portworthy Bridge	JMB	0	0	0
Silverbridge Lake	Brixton	JMB	0	2	0
Carnon	Bissoe Bridge	JMB	0	1	0
Mylor Creek	Mylor Bridge	JMB	0	1	0
Deer	Deer Bridge	LD	0	0	0
Marazion	Nancledra	LD	0	1	0
Penberth Stream	Penberth Bridge	LD	0	0	0
Camel	Pencarrow Bridge	LD	0	0	0
Trevellas Stream	upstream Trevellas Cove	TG	0	1	0
Stannon Stream	Trecarne	TG	0	0	0
St Lawrence Stream	u/s Pendewey Bridge	TG	0	1	0
Newlyn East Stream	Rosecliston	TG	0	0	0
Issey Brook	Mellingey	TG	0	0	0
Canworthy Water	u/s R.Ottery	TG	0	1	0

Table 38 The 20 samples audited for Devon Area of South West Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Heddon Stream	d/s Trentishoe confluence	AD	1	1	0
Mole	North Molton	AD	0	0	0
Clapton Stream	Clapton	AD	0	0	0
North Brook	North Brook Park	AD	0	0	0
Scotley Brook	u/s Teign	AD	0	0	0
East Wilder	The Vicarage	AD	0	0	0
Offwell Brook	d/s Offwell Footbridge	AG	0	0	0
Taw	Sticklepath	AG	0	2	0
Taw	Umberleigh	AG	0	1	0
Molland Yeo	Bish Mill	AG	1	1	0
Langtree Lake	Servis Farm	AG	0	0	0
Taw	Chenson	AJH	0	1	0
Rye Stream	Loxhore Cross	APH	0	1	0
Northlew Stream	Northlew	APH	0	1	0
Otter	u/s Hoe More Farm Bridge	APH	0	0	0
Lowman	d/s A376 Bridge	APH	1	0	0
Exe	u/s Halfpenny Bridge	APH	0	2	0
Dalch	u/s Calves Bridge	TA	0	3	0
Polly Brook	d/s A376 Bridge	TA	1	4	0
Weaver	u/s B3181 Bridge	TA	1	3	0

Table 39 The 20 samples audited for North Wessex Area of South West Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Kilve Street	Rectory Br, Kilve	AB	0	0	0
Norton Sub Hamdon	d/s Manor Farm	AB	0	0	0
Wootton Courtney Stream	Wootton Courtney	AB	0	0	0
Wellhams Brook	Nr Martock	IN	1	1	0
Bristol Avon	Limpley Stoke	IN	0	2	0
Tone	Greenham	IN	0	1	0
Yeo	Sherborne STW	IN	0	6	0
Little Avon	Charfield	JF	0	1	0
Worton Stream	d/s Urchfont STW	JF	0	0	0
Axe	u/s of Ford	JF	0	1	0
Boyd	Golden Valley	JS	0	3	0
Bydemill Brook	u/s Corsham STW	JS	0	1	0
Conygre Brook	Priston Mill	JS	0	0	0
Marden	Buckhill	JS	0	2	0
Brinkworth Brook	Brinkworth	JS	0	0	0
Nunney Brook	Vallis Farm	WO	0	2	0
Brue/Sheppey	Woodford	WO	0	1	0
Somerset Frome	u/s Oldford Creamery	WO	0	0	0
Maiden Bradley Brook	Highcruft Farm	WO	0	1	0
Portbury Ditch	u/s Bridge	WO	0	0	0

Table 40 The 20 samples audited for South Wessex Area of South West Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Chitterne	Codford St Mary	BJJ	0	0	0
Nadder	d/s Tisbury	BJJ	0	2	0
Devils Brook	Dewlish	CMH	0	2	0
Hooke	Hooke	CMH	0	2	0
Piddle	Piddlehinton	CMH	0	1	0
Ashfield Water	Burton	CMH	0	1	0
Eastern Avon	u/s Scales Bridge	CMH	0	1	0
Hants Avon	Durrington	CMH	0	0	0
Brit	Oxbridge	CMH	0	1	0
Nadder	Panters Bridge	CMH	0	0	0
Shreen Water	Colesbrook	CMH	0	0	0
Wylfe	Quidhampton	CMH	0	0	0
Ripley Brook	Court Farm	CMH	0	0	0
Char	Whitchurch Canonorum	LC	0	0	0
Wylfe	Steeple Langford	LC	0	0	0
Western Avon	u/s Etchilhampton	LC	0	1	0
Frome	East Stoke	LC	0	0	0
Wylfe	Boreham	LC	0	1	0
Ashford Water	d/s Fordingbridge	MP	0	0	0
Stour	Wyndham Farm	PRH	0	2	0

Table 41 Statistics of the 2000 Primary Audit for South West Region

Analyst/Group	n	Mean gains	Standard error	No.samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
Cornwall	20	0.55	0.18	1	5.00	3	0.55	0.18
DS	2	0	0	0	0	0	0	0
JMB	8	0.88	0.40	1	12.50	3	0.88	0.40
LD	4	0.25	0.25	0	0	1	0.25	0.25
TG	6	0.50	0.22	0	0	1	0.50	0.22
Devon	20	1.00	0.27	3	15.00	4	1.25	0.32
AD	6	0.17	0.17	0	0	1	0.33	0.33
AG	5	0.80	0.37	0	0	2	1.00	0.45
AJH	1	1.00	n/a	0	0	1	1.00	n/a
APH	5	0.80	0.37	0	0	2	1.00	0.32
TA	3	3.33	0.33	3	100.00	4	4.00	0.58
N. Wessex	20	1.10	0.32	2	10.00	6	1.15	0.33
AB	3	0	0	0	0	0	0	0
IN	4	2.50	1.19	1	25.00	6	2.75	1.11
JF	3	0.67	0.33	0	0	1	0.67	0.33
JS	5	1.20	0.58	1	20.00	3	1.20	0.58
WO	5	0.80	0.37	0	0	2	0.80	0.37
S. Wessex	20	0.70	0.18	0	0	2	0.70	0.18
BJJ	2	1.00	1.00	0	0	2	1.00	1.00
CMH	11	0.73	0.24	0	0	2	0.73	0.24
LC	5	0.40	0.24	0	0	1	0.40	0.24
MP	1	0	n/a	0	0	0	0	n/a
PRH	1	2.00	n/a	0	0	2	2.00	n/a
S. West Region	80	0.84	0.12	6	7.50	6	0.91	0.13

Table 42 Net effects of the Primary Audit on BMWP score and number of scoring taxa for South West Region

Analyst/ Group	n	Mean net effect on BMWP score	Standard error of effect on BMWP score	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	Standard error of effect on no. of taxa	Maximum underestimate of no. of taxa
Cornwall	20	4.40	1.48	20	0.55	0.18	3
DS	2	0	0	0	0	0	0
JMB	8	6.88	3.13	20	0.88	0.40	3
LD	4	2.50	2.50	10	0.25	0.25	1
TG	6	3.83	1.83	10	0.50	0.22	1
Devon	20	5.15	1.67	18	0.75	0.25	3
AD	6	0	0	0	0	0	0
AG	5	4.00	3.42	16	0.60	0.40	2
AJH	1	5.00	n/a	5	1.00	n/a	1
APH	5	4.80	2.85	12	0.60	0.51	2
TA	3	18.00	0	18	2.67	0.33	3
N. Wessex	20	6.05	1.78	24	1.05	0.33	6
AB	3	0	0	0	0	0	0
IN	4	11.00	4.93	24	2.25	1.31	6
JF	3	2.67	1.45	5	0.67	0.33	1
JS	5	9.20	5.07	23	1.20	0.58	3
WO	5	4.60	2.04	10	0.80	0.37	2
S. Wessex	20	4.95	1.41	20	0.70	0.18	2
BJJ	2	7.50	7.50	15	1.00	1.00	2
CMH	11	4.36	1.58	15	0.73	0.24	2
LC	5	3.20	2.06	10	0.40	0.24	1
MP	1	0	n/a	0	0	n/a	0
PRH	1	20.00	n/a	20	2.00	n/a	2
S. West Region	80	5.14	0.78	24	0.76	0.12	6

Table 43 The families missed in sorting by South West Region's primary analysts

Family	n	% of South West Region's missed families in Primary Audit
Leptoceridae	7	10.94
Planariidae (incl. Dugesiidae)	7	10.94
Hydrophilidae (incl. Hydraenidae)	4	6.25
Simuliidae	3	4.69
Asellidae	2	3.13
Caenidae	2	3.13
Chloroperlidae	2	3.13
Hydrobiidae (incl. Bithyniidae)	2	3.13
Hydropsychidae	2	3.13
Lepidostomatidae	2	3.13
Valvatidae	2	3.13
Leptophlebiidae	2	3.13
Leuctridae	2	3.13
Odontoceridae	2	3.13
Sphaeriidae	2	3.13
Psychomyiidae (incl. Ecnomidae)	2	3.13
Sericostomatidae	2	3.13
Hydroptilidae	2	3.13
Goeridae	1	1.56
Tipulidae	1	1.56
Beraeidae	1	1.56
Calopterygidae	1	1.56
Sialidae	1	1.56
Cordulegastridae	1	1.56
Corixidae	1	1.56
Dytiscidae (incl. Noteridae)	1	1.56
Lymnaeidae	1	1.56
Gyrinidae	1	1.56
Planorbidae	1	1.56
Ancylidae (incl. Acroloxidae)	1	1.56
Physidae	1	1.56
Nemouridae	1	1.56
Dendrocoelidae	1	1.56
Total	64	100

Table 44 The species missed in sorting by South West Region's primary analysts

Species	n	% of South West Region's missed species in Primary Audit
Hydraena gracilis Germar	3	4.41
Polycelis sp.	3	4.41
Asellus aquaticus (L.)	2	2.94
Chloroperla torrentium (Pictet)	2	2.94
Odontocerum albicorne (Scopoli)	2	2.94
Valvata cristata Muller	2	2.94
Pisidium sp.	2	2.94
Mystacides azurea (L.)	2	2.94
Adicella reducta (Mclachlan)	2	2.94
Caenis rivulorum Eaton	2	2.94
Potamopyrgus jenkinsi (Smith)	2	2.94
Sericostoma personatum (Spence)	2	2.94
Hydroptila sp.	2	2.94
Hydropsyche siltalai Dohler	2	2.94
Simulium (Simulium) ornatum group	2	2.94
Tinodes waeneri (L.)	2	2.94
Helophorus (Helophorus) obscurus Mulsant	1	1.47
Dugesia polychroa group	1	1.47
Dendrocoelum lacteum (Muller)	1	1.47
Corixidae	1	1.47
Habrophlebia fusca (Curtis)	1	1.47
Cordulegaster boltonii (Donovan)	1	1.47
Calopteryx splendens (Harris)	1	1.47
Leuctra fusca (L.)	1	1.47
Beraeodes minutus (L.)	1	1.47
Athripsodes cinereus (Curtis)	1	1.47
Athripsodes bilineatus (L.)	1	1.47
Armiger crista (L.)	1	1.47
Antocha vitripennis (Meigen)	1	1.47
Ancylus fluviatilis Muller	1	1.47
Ceraclea dissimilis (Stephens)	1	1.47
Orectochilus villosus (Muller)	1	1.47
Simulium (Nevermannia) angustitarse group	1	1.47
Silo pallipes (Fabricius)	1	1.47
Sialis lutaria (L.)	1	1.47
Polycelis nigra group	1	1.47
Polycelis felina (Dalyell)	1	1.47
Planariidae indet	1	1.47
Physa sp.	1	1.47
Lepidostoma hirtum (Fabricius)	1	1.47
Oreodytes sanmarkii (Sahlberg)	1	1.47
Hippeutis complanatus (L.)	1	1.47
Nemoura sp.	1	1.47
Mystacides nigra (L.)	1	1.47
Lymnaea peregra (Muller)	1	1.47
Leuctra hippopus (Kempny)	1	1.47

Table 44 continued

Species	n	% of South West Region's missed species in Primary Audit
Leuctra geniculata (Stephens)	1	1.47
Lepidostomatidae indet	1	1.47
Ithytrichia sp.	1	1.47
Paraleptophlebia submarginata (Stephens)	1	1.47
Total	68	100

AUDIT OF THAMES REGION'S PRIMARY ANALYSTS

Table 45 The 20 samples audited for the Frimley Laboratory of Thames Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Green Level Dyke	Mulberry Way	307	0	2	0
Blackwater	Frimley Bridges	307	0	3	0
Cove Brook	B3014 Farnborough	307	0	2	0
Blackwater	d/s Sandhurst	307	0	3	0
Mole	Stoke D'Abernon	307	0	1	0
Wey (N)	d/s Bentley STW	307	0	4	0
Oakhanger Stream	Oakhanger	317	0	1	0
Wey (S)	Hammer Vale	317	0	1	0
Bourne	u/s Thames	317	0	2	0
Thames	d/s Boulter's Weir	317	0	5	0
Whitewater	Heckfield	317	0	2	0
Maidenhead Ditch	Hibbert Rd, Bray	317	0	1	0
Blackwater	Frimley Bridges	317	0	2	0
Pettys Brook	d/s Long Copse Ditch	MJW	0	2	0
Farnham Park Tributary	u/s Wey	MJW	0	1	1
Cranleigh Waters	u/s Collins Brook	MJW	0	1	0
Wey (N)	u/s Caker Stream	MJW	0	1	0
Wey (N)	Fielder's Court	MJW	1	1	0
Wandle	Beddington Park	TJ	0	2	0
Mole	Wick Farm, Horley	TJ	1	3	0

Table 46 The 20 samples audited for the Hatfield Laboratory of Thames Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Small Lee	u/s Turkey Brook	DJL	0	2	0
Gade	d/s Cassiobury Park	EIS	1	2	0
Brent/GUC	Trumpeters Way	JE	0	2	0
Cripsey Brook	Delved Bridge	KLG	0	2	0
Tykes Water	u/s Colne	KLG	0	4	0
Ingrebourne	A12 Roadbridge	KLG	0	3	0
Brent	d/s Barnhill Rd	KLG	0	1	0
New Years Green Bourne	u/s Frays	KLG	0	6	0
Colne/GUC	Coppermill Lane	KLG	0	3	1
Rom/Beam	A125, Hornchurch	KLG	0	1	1
Salmons Brook	u/s Montague Rd	KLG	0	3	0
Wraysbury	Staines Moor	KLG	0	1	0
Chess	u/s Chesham STW	RHC	0	1	0
Hartsbourne	Hampermill Rd	RHC	0	1	0
Dollis Brook	Bell Lane	RHC	0	0	0
Dukes	River Gardens	RHC	0	2	0
Hartsbourne	Hampermill Lane	RHC	1	3	0
GUC	Horsenden Lane South	RHC	1	1	0
Rib	Westmill	RHC	0	0	0
Ver	u/s Colne	RHC	0	1	0

Table 47 The 20 samples audited for the Wallingford Laboratory of Thames Region

River	Site	Primary Analyst	Losses	Gains	Omissions
Shill Brook	Fishers Bridge	001	1	3	0
Thames	Waterhay Bridge	001	2	1	0
Thame	u/s Eythrope	001	0	0	0
Harcourt Brook	u/s Limb Brook	001	0	1	0
Tramroad Ditch	Wooton Underwood	001	0	1	0
Showells Brook	Crawley	002	0	4	1
Kenet	Stitchcombe Mill	003	0	7	0
Enborne	Ford, Thornton Road	003	1	1	1
Ecchinswell Brook	A339 Headley	003	1	7	0
Kencot Brook	B4020, Alvescot	004	0	1	1
Dorn	u/s Glyme at Wooton	004	0	3	0
Cornwell Brook	Kingham	004	1	2	0
South Marston Brook	Nightingale Lane	004	0	0	0
Scotsgrove Brook	Scotsgrove Mill	005	0	4	0
Milton Ditch	Great Milton Road	005	0	6	0
Chacombe Brook	u/s Cherwell	005	0	5	0
Farthinghoe Stream	u/s Cherwell	005	0	6	0
Hornton Stream	Horley	005	0	1	0
Coln	G.S. Bibury	005	0	3	0
Coln	Withington	006	0	3	0

Table 48 Statistics of the 2000 Primary Audit for Thames Region

Analyst/ Group	n	Mean gains	Standard error	No.samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
Frimley	20	2.00	0.25	5	25.00	5	2.15	0.25
307	6	2.50	0.43	3	50.00	4	2.50	0.43
317	7	2.00	0.53	1	14.29	5	2.00	0.53
MJW	5	1.20	0.20	0	0	2	1.60	0.24
TJ	2	2.50	0.50	1	50.00	3	3.00	1.00
Hatfield	20	1.95	0.32	6	30.00	6	2.20	0.34
DJL	1	2.00	n/a	0	0	2	2.00	n/a
EIS	1	2.00	n/a	0	0	2	3.00	n/a
JE	1	2.00	n/a	0	0	2	2.00	n/a
KLG	9	2.67	0.55	5	55.56	6	2.89	0.54
RHC	8	1.13	0.35	1	12.50	3	1.38	0.46
Wallingford	20	2.95	0.51	11	55.00	7	3.40	0.50
001	5	1.20	0.49	1	20.00	3	1.80	0.73
002	1	4.00	n/a	1	100.00	4	5.00	n/a
003	3	5.00	2.00	2	66.67	7	6.00	1.53
004	4	1.50	0.65	1	25.00	3	2.00	0.71
005	6	4.17	0.79	5	83.33	6	4.17	0.79
006	1	3.00	n/a	1	100.00	3	3.00	n/a
Thames Region	60	2.30	0.22	22	36.67	7	2.58	0.23

Table 49 Net effects of the Primary Audit on BMWP score and number of scoring taxa for Thames Region

Analyst/ Group	n	Mean net effect on BMWP score	Standard error of effect on BMWP score	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	Standard error of effect on no. of taxa	Maximum underestimate of no. of taxa
Frimley	20	10.60	1.34	25	1.90	0.26	5
307	6	13.67	2.33	21	2.50	0.43	4
317	7	12.29	2.56	25	2.00	0.53	5
MJW	5	5.60	1.17	10	1.00	0.32	2
TJ	2	8.00	0	8	2.00	0	2
Hatfield	20	9.90	1.85	30	1.80	0.33	6
DJL	1	11.00	n/a	11	2.00	n/a	2
EIS	1	4.00	n/a	4	1.00	n/a	1
JE	1	14.00	n/a	14	2.00	n/a	2
KLG	9	14.11	3.16	30	2.67	0.55	6
RHC	8	5.25	1.88	12	0.88	0.30	2
Wallingford	20	14.70	3.06	37	2.65	0.54	7
001	5	2.20	2.71	9	0.60	0.51	2
002	1	32.00	n/a	32	4.00	n/a	4
003	3	23.33	11.72	37	4.33	2.19	7
004	4	8.00	4.26	20	1.25	0.63	3
005	6	21.83	4.36	36	4.17	0.79	6
006	1	18.00	n/a	18	3.00	n/a	3
Thames Region	60	11.73	1.28	37	2.12	0.23	7

Table 50 The families missed in sorting by Thames Region's primary analysts

Family	n	% of Thames Region's missed families in Primary Audit
Planariidae (incl. Dugesiidae)	10	7.69
Limnephilidae	8	6.15
Hydroptilidae	8	6.15
Caenidae	7	5.38
Valvatidae	6	4.62
Leptoceridae	6	4.62
Elmidae	6	4.62
Psychomyiidae (incl. Ecnomidae)	5	3.85
Simuliidae	5	3.85
Ancylidae (incl. Acroloxidae)	5	3.85
Lymnaeidae	5	3.85
Planorbidae	4	3.08
Dendrocoelidae	4	3.08
Hydrobiidae (incl. Bithyniidae)	4	3.08
Baetidae	4	3.08
Asellidae	4	3.08
Dytiscidae (incl. Noteridae)	4	3.08
Hydrophilidae (incl. Hydraenidae)	3	2.31
Hydropsychidae	3	2.31
Glossiphoniidae	2	1.54
Tipulidae	2	1.54
Sphaeriidae	2	1.54
Nemouridae	2	1.54
Hydrometridae	2	1.54
Beraeidae	1	0.77
Sialidae	1	0.77
Calopterygidae	1	0.77
Coenagrionidae	1	0.77
Corixidae	1	0.77
Scirtidae	1	0.77
Piscicolidae	1	0.77
Lepidostomatidae	1	0.77
Ephemerellidae	1	0.77
Leptophlebiidae	1	0.77
Goeridae	1	0.77
Gyrinidae	1	0.77
Haliplidae	1	0.77
Heptageniidae	1	0.77
Oligochaeta	1	0.77
Molannidae	1	0.77
Libellulidae	1	0.77
Leuctridae	1	0.77
Physidae	1	0.77
Total	130	100

Table 51 The species missed in sorting by Thames Region's primary analysts

Species	n	% of Thames Region's missed species in Primary Audit
Polycelis nigra group	7	4.83
Caenis luctuosa group	7	4.83
Hydroptila sp.	7	4.83
Mystacides azurea (L.)	5	3.45
Limnephilidae indet	5	3.45
Valvata cristata Muller	4	2.76
Elmis aenea (Muller)	4	2.76
Dendrocoelum lacteum (Muller)	4	2.76
Lype sp.	3	2.07
Lymnaea truncatula (Muller)	3	2.07
Potamopyrgus jenkinsi (Smith)	3	2.07
Valvata piscinalis (Muller)	3	2.07
Asellus aquaticus (L.)	3	2.07
Acroloxus lacustris (L.)	3	2.07
Ancylus fluviatilis Muller	3	2.07
Gyraulus albus (Muller)	2	1.38
Glossiphonia complanata (L.)	2	1.38
Ithytrichia sp.	2	1.38
Hydropsyche angustipennis (Curtis)	2	1.38
Hydrometra stagnorum (L.)	2	1.38
Dugesia polychroa group	2	1.38
Hydraena riparia Kugelann	2	1.38
Cloeon dipterum (L.)	2	1.38
Lymnaea peregra (Muller)	2	1.38
Baetis vernus Curtis	2	1.38
Oulimnius sp.	2	1.38
Tinodes waeneri (L.)	2	1.38
Simulium (Simulium) ornatum group	2	1.38
Armiger crista (L.)	2	1.38
Pisidium sp.	2	1.38
Platambus maculatus (L.)	2	1.38
Polycelis felina (Dalyell)	2	1.38
Simulium (Eusimulium) aureum group	2	1.38
Asellus meridianus Racovitza	2	1.38
Antocha vitripennis (Meigen)	1	0.69
Heptagenia sulphurea (Muller)	1	0.69
Helophorus (Atracthelophorus) brevipalpis Bedel	1	0.69
Haliplus sp.	1	0.69
Halesus radiatus (Curtis)	1	0.69
Coenagrionidae indet	1	0.69
Glyptotaelius pellucidus (Retzius)	1	0.69

Table 51 continued

Species	n	% of Thames Region's missed species in Primary Audit
<i>Calopteryx splendens</i> (Harris)	1	0.69
<i>Esolus parallelepipedus</i> (Muller)	1	0.69
<i>Ephemerella ignita</i> (Poda)	1	0.69
<i>Elodes</i> sp.	1	0.69
<i>Bathyomphalus contortus</i> (L.)	1	0.69
<i>Beraeodes minutus</i> (L.)	1	0.69
<i>Bithynia tentaculata</i> (L.)	1	0.69
<i>Athripsodes bilineatus</i> (L.)	1	0.69
<i>Oecetis testacea</i> (Curtis)	1	0.69
Tubificidae	1	0.69
<i>Tipula</i> sp.	1	0.69
<i>Simulium</i> (Nevermannia) angustitarse group	1	0.69
<i>Simulium</i> (Boophthora) erythrocephalum (de Geer)	1	0.69
<i>Silo pallipes</i> (Fabricius)	1	0.69
<i>Sialis lutaria</i> (L.)	1	0.69
<i>Riolus subviolaceus</i> (Muller)	1	0.69
<i>Piscicola geometra</i> (L.)	1	0.69
<i>Physa</i> sp.	1	0.69
<i>Paraleptophlebia submarginata</i> (Stephens)	1	0.69
<i>Oulimnius tuberculatus</i> (Muller)	1	0.69
Libellulidae indet	1	0.69
<i>Orectochilus villosus</i> (Muller)	1	0.69
<i>Hydropsyche siltalai</i> Dohler	1	0.69
<i>Nemurella picteti</i> Klapalek	1	0.69
<i>Nemoura</i> sp.	1	0.69
Naididae	1	0.69
<i>Molanna angustata</i> Curtis	1	0.69
<i>Micropterna sequax</i> McLachlan	1	0.69
<i>Micronecta</i> sp.	1	0.69
<i>Lymnaea stagnalis</i> (L.)	1	0.69
<i>Lymnaea</i> sp.	1	0.69
<i>Limnephilus lunatus</i> Curtis	1	0.69
<i>Leuctra</i> sp.	1	0.69
Lepidostomatidae indet	1	0.69
<i>Ilybius fuliginosus</i> (Fabricius)	1	0.69
<i>Oreodytes sanmarkii</i> (Sahlberg)	1	0.69
Total	145	100

AUDIT OF PRIMARY ANALYSTS FOR WALES

Table 52 The 20 samples audited for Northern Area of Wales

River	Site	Primary Analyst	Losses	Gains	Omissions
Afon Erch	Aber Erch	358	1	4	0
Afon Caseg	Braichmelyn	358	0	5	0
Pill Brook	Gwernesney	358	0	1	0
Afon Morwynion	Carrog	359	0	2	0
Afon Dulas	u/s Crewi	359	1	3	0
Monks Ditch	Ford Farm	359	2	4	0
Afon Seiont	Pont y Gromlech	360	0	1	0
Afon Hesbin	Eyarth Hesbin	360	0	0	0
Olway Brook	Llandenny	360	0	3	0
Afon Caledffrwd	u/s Brynrefail	376	0	5	0
Afon Llafar	Pont y Llafar	376	0	2	0
Afon Merddwr	Pentre Foelas	377	0	1	0
Shell Brook	u/s Kilhendre Brook	377	1	2	0
Hiraeth Lyn	Ty Gwyn Pont Newydd	385	0	0	1
Afon Llyfnant	Caerhedy	385	0	4	0
Afon Llynor	Hendwr	385	0	3	0
Teirw	u/s Ceiriog	385	0	3	0
Merddwr	Pentrefoelas	385	0	1	0
Builth Dulas Brook	u/s Builth Road STW	385	1	0	0
Alyn	Gwersyllt Park	385	0	1	0

Table 53 The 20 samples audited for South Eastern Area of Wales

River	Site	Primary Analyst	Losses	Gains	Omissions
Llwyd	Pontnewynydd	370	0	0	1
Ely	St Fagans	375	1	4	0
Kinnersley Brook	Kinley	381	0	0	0
Wye	Ross on Wye	381	1	2	0
Lugg	Whitton	381	0	1	0
Rhiangoll	Pont-y-Bryn-Hurt	381	0	0	0
Taff	d/s Radyr Weir	381	1	0	0
Dowlais	d/s Tregurnog Farm	381	1	2	0
Sirhowy	Pont Gwaithyrhaearn	381	0	1	0
Ffrud Oer	Plas y Coed	381	0	1	0
Usk	d/s Cilieni	383	1	4	0
Ely	Near Bryn Farm	383	0	0	0
Usk	Llanellen	383	0	2	0
Llwyd	u/s Cwmavon	383	0	0	0
Myddlyn	Ystrad Barwig	383	0	1	0
How Caple Brook	Alfords Mill	383	0	0	0
Trothy	Dingestow	383	0	2	0
Taf Bargoed	Tir-Tan	383	0	0	0
Taff	Ynysangharad Park	386	1	4	0
Pinsley Brook	Shobdon Marsh	AC	0	3	0

Table 54 The 20 samples audited for South Western Area of Wales

River	Site	Primary Analyst	Losses	Gains	Omissions
Lash	Aberlash RB	361	0	2	0
Upper Clydach	u/s Nant y Gasseg	361	0	2	0
Llynfell	Upper Cwmtwrch	361	0	0	0
Nant Gwys	Cwmtwrch	361	0	3	0
Dafen	Glyngwernan	361	1	3	0
Tawe	u/s Trebanos STW	361	0	1	0
Llynfell	Cwmlllynfell	361	0	1	0
Llanddowror Brook	In Village	361	0	1	0
Teifi	d/s Strata Florida WTW	362	0	2	0
Neath	u/s Nant Pergwm	362	0	1	0
Hengwm	d/s Hyddgen	362	0	0	0
Afon Llechwedd Mawr	u/s Nant-y-Moch Reservoir	362	0	0	0
Nant-y-Cerdin	Cwmfecin	380	0	4	0
Llynfi	Pandy Park	380	0	2	0
Syfywry	u/s Rosebush WTW	380	0	3	0
Clydach	Neath Abbey	380	0	3	0
Ystwyth	Esgair-Wen Bridge	380	0	0	0
Tywi	Fish Trap @ Brianne	387	0	0	0
Gwendraeth Fawr	Ponthenri Road Bridge	W27	0	5	0
Gwendraeth Fawr	Pontyberem Road Bridge	W27	1	2	0

Table 55 Statistics of the 2000 Primary Audit for Wales

Analyst/ Group	n	Mean gains	Standard error	No.samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
Northern	20	2.25	0.36	9	45.00	5	2.60	0.39
358	3	3.33	1.20	2	66.67	5	3.67	1.33
359	3	3.00	0.58	2	66.67	4	4.00	1.15
360	3	1.33	0.88	1	33.33	3	1.33	0.88
376	2	3.50	1.50	1	50.00	5	3.50	1.50
377	2	1.50	0.50	0	0	2	2.00	1.00
385	7	1.71	0.61	3	42.86	4	2.00	0.49
S. Eastern	20	1.35	0.33	4	20.00	4	1.70	0.39
370	1	0	n/a	0	0	0	1.00	n/a
375	1	4.00	n/a	1	100.00	4	5.00	n/a
381	8	0.88	0.30	0	0	2	1.25	0.41
383	8	1.13	0.52	1	12.50	4	1.25	0.62
386	1	4.00	n/a	1	100.00	4	5.00	n/a
AC	1	3.00	n/a	1	100.00	3	3.00	n/a
S. Western	20	1.75	0.32	6	30.00	5	1.85	0.34
361	8	1.63	0.37	2	25.00	3	1.75	0.45
362	4	0.75	0.48	0	0	2	0.75	0.48
380	5	2.40	0.68	3	60.00	4	2.40	0.68
387	1	0	n/a	0	0	0	0	n/a
W27	2	3.50	1.50	1	50.00	5	4.00	1.00
Wales	60	1.78	0.20	19	31.67	5	2.05	0.22

Table 56 Net effects of the Primary Audit on BMWP score and number of scoring taxa for Wales

Analyst/ Group	n	Mean net effect on BMWP score	Standard error of effect on BMWP score	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	Standard error of effect on no. of taxa	Maximum underestimate of no. of taxa
Northern	20	14.05	2.78	42	1.95	0.36	5
358	3	22.67	10.48	42	3.00	1.15	5
359	3	10.00	3.51	17	2.00	0.00	2
360	3	10.67	7.45	25	1.33	0.88	3
376	2	25.00	8.00	33	3.50	1.50	5
377	2	7.50	0.50	8	1.00	0.00	1
385	7	12.29	5.10	27	1.57	0.69	4
S. Eastern	20	6.60	1.82	25	1.05	0.28	3
370	1	0	n/a	0	0	n/a	0
375	1	25.00	n/a	25	3.00	n/a	3
381	8	3.25	1.37	7	0.50	0.27	1
383	8	4.88	2.05	15	1.00	0.42	3
386	1	22.00	n/a	22	3.00	n/a	3
AC	1	20.00	n/a	20	3.00	n/a	3
S. Western	20	11.35	2.53	40	1.65	0.32	5
361	8	9.88	2.17	17	1.50	0.33	3
362	4	5.25	3.54	15	0.75	0.48	2
380	5	19.40	6.55	40	2.40	0.68	4
387	1	0	n/a	0	0	n/a	0
W27	2	15.00	16.00	31	3.00	2.00	5
Wales	60	10.67	1.43	42	1.55	0.19	5

Table 57 The families missed in sorting by Wales' primary analysts

Family	n	% of Wales' missed families in Primary Audit
Sphaeriidae	7	7.29
Caenidae	6	6.25
Leptoceridae	5	5.21
Goeridae	5	5.21
Hydroptilidae	5	5.21
Nemouridae	5	5.21
Hydrophilidae (incl. Hydraenidae)	4	4.17
Chloroperlidae	4	4.17
Dytiscidae (incl. Noteridae)	4	4.17
Psychomyiidae (incl. Ecnomidae)	4	4.17
Limnephilidae	4	4.17
Ancylidae (incl. Acroloxidae)	4	4.17
Leptophlebiidae	4	4.17
Scirtidae	3	3.13
Lepidostomatidae	3	3.13
Hydrobiidae (incl. Bithyniidae)	3	3.13
Tipulidae	3	3.13
Ephemerellidae	2	2.08
Rhyacophilidae (incl. Glossosomatidae)	2	2.08
Leuctridae	2	2.08
Asellidae	2	2.08
Calopterygidae	2	2.08
Sericostomatidae	1	1.04
Piscicolidae	1	1.04
Dryopidae	1	1.04
Physidae	1	1.04
Elmidae	1	1.04
Heptageniidae	1	1.04
Glossiphoniidae	1	1.04
Perlodidae	1	1.04
Gyrinidae	1	1.04
Odontoceridae	1	1.04
Lymnaeidae	1	1.04
Polycentropodidae	1	1.04
Erpobdellidae	1	1.04
Total	96	100

Table 58 The species missed in sorting by Wales' primary analysts

Species	n	% of Wales' missed species in Primary Audit
Pisidium sp.	6	6.06
Caenis rivulorum Eaton	5	5.05
Hydroptila sp.	4	4.04
Silo pallipes (Fabricius)	4	4.04
Ancylus fluviatilis Muller	4	4.04
Hydraena gracilis Germar	4	4.04
Dicranota sp.	3	3.03
Oreodytes sanmarkii (Sahlberg)	3	3.03
Limnephilidae indet	3	3.03
Chloroperla torrentium (Pictet)	3	3.03
Potamopyrgus jenkinsi (Smith)	3	3.03
Elodes sp.	2	2.02
Adicella reducta (Mclachlan)	2	2.02
Hydrocyphon deflexicollis (Muller)	2	2.02
Asellus aquaticus (L.)	2	2.02
Lype sp.	2	2.02
Habrophlebia fusca (Curtis)	2	2.02
Paraleptophlebia submarginata (Stephens)	2	2.02
Ephemerella ignita (Poda)	2	2.02
Lepidostoma hirtum (Fabricius)	2	2.02
Psychomyia pusilla (Fabricius)	2	2.02
Elmis aenea (Muller)	1	1.01
Calopteryx sp.	1	1.01
Ecdyonurus sp.	1	1.01
Glossiphonia complanata (L.)	1	1.01
Athripsodes sp.	1	1.01
Helichus substriatus (Muller)	1	1.01
Chloroperla tripunctata (Scopoli)	1	1.01
Caenis pusilla Navas	1	1.01
Amphinemura sulcicollis (Stephens)	1	1.01
Calopteryx splendens (Harris)	1	1.01
Isoperla grammatica (Poda)	1	1.01
Erpobdellidae indet	1	1.01
Oecetis testacea (Curtis)	1	1.01
Silo sp.	1	1.01
Sericostoma personatum (Spence)	1	1.01
Rhyacophila sp.	1	1.01
Rhyacophila dorsalis (Curtis)	1	1.01
Protonemura meyeri (Pictet)	1	1.01
Potamophylax cingulatus group	1	1.01
Potamonectes depressus (Fabricius)	1	1.01
Polycentropus kingi Mclachlan	1	1.01
Piscicola geometra (L.)	1	1.01
Physa sp.	1	1.01
Leuctra inermis Kempny	1	1.01

Table 58 continued

Species	n	% of Wales' missed species in Primary Audit
Orectochilus villosus (Muller)	1	1.01
Lepidostomatidae indet	1	1.01
Odontocerum albicorne (Scopoli)	1	1.01
Nemurella picteti Klapalek	1	1.01
Nemoura cambrica group	1	1.01
Nemoura avicularis Morton	1	1.01
Mystacides azurea (L.)	1	1.01
Lymnaea sp.	1	1.01
Limnius volckmari (Panzer)	1	1.01
Sphaeriidae indet	1	1.01
Limnephilidae	1	1.01
Leuctra fusca (L.)	1	1.01
Oxyethira sp.	1	1.01
Total	99	100

SUMMARY OF PRIMARY AUDIT FOR ENVIRONMENT AGENCY

Table 59 Statistics of the 2000 Primary Audit for each Agency laboratory

Region/Area	n	Mean gains	Standard error	No.samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
Anglian Region	60	1.85	0.20	17	28.33	7	2.23	0.20
Central	20	2.55	0.37	10	50.00	7	2.90	0.37
Eastern	20	2.15	0.33	7	35.00	5	2.45	0.32
Northern	20	0.85	0.20	0	0	2	1.35	0.28
Midlands Region	80	1.68	0.17	18	22.50	7	1.98	0.17
Upper Severn	20	1.15	0.22	2	10.00	3	1.55	0.27
Lower Severn	20	1.45	0.26	5	25.00	3	1.65	0.25
Upper Trent	20	2.65	0.42	7	35.00	7	2.85	0.40
Lower Trent	20	1.45	0.34	4	20.00	5	1.85	0.35
N. East Region	60	1.18	0.17	7	11.67	5	1.37	0.18
Dales	20	1.20	0.28	1	5.00	5	1.35	0.29
Northumbria	20	1.30	0.32	3	15.00	5	1.40	0.34
Ridings	20	1.05	0.28	3	15.00	4	1.35	0.33
N. West Region	60	1.15	0.17	7	11.67	6	1.50	0.21
Northern	20	1.25	0.35	3	15.00	6	1.60	0.43
Central	20	0.85	0.17	0	0	2	1.10	0.23
Southern	20	1.35	0.34	4	20.00	6	1.80	0.39
Southern Region	60	1.73	0.17	15	25.00	6	2.15	0.20
Hants & I.O.W.	20	1.75	0.37	5	25.00	6	2.35	0.42
Kent	20	2.00	0.23	6	30.00	4	2.35	0.27
Sussex	20	1.45	0.27	4	20.00	4	1.75	0.30
S. West Region	80	0.84	0.12	6	7.50	6	0.91	0.13
Cornwall	20	0.55	0.18	1	5.00	3	0.55	0.18
Devon	20	1.00	0.27	3	15.00	4	1.25	0.32
North Wessex	20	1.10	0.32	2	10.00	6	1.15	0.33
South Wessex	20	0.70	0.18	0	0	2	0.70	0.18
Thames Region	60	2.30	0.22	22	36.67	7	2.58	0.23
Frimley	20	2.00	0.25	5	25.00	5	2.15	0.25
Hatfield	20	1.95	0.32	6	30.00	6	2.20	0.34
Wallingford	20	2.95	0.51	11	55.00	7	3.40	0.50
Wales	60	1.78	0.20	19	31.67	5	2.05	0.22
Northern	20	2.25	0.36	9	45.00	5	2.60	0.39
South Eastern	20	1.35	0.33	4	20.00	4	1.70	0.39
South Western	20	1.75	0.32	6	30.00	5	1.85	0.34
Whole of Agency	520	1.54	0.06	111	21.35	7	1.82	0.07
Contractors								
Gloria Tapia	20	1.75	0.37	5	25.00	6	2.20	0.44
Dave Leeming	3	2.00	0	0	0	2	2.00	0
Unicomarine	15	1.53	0.60	4	26.67	7	1.67	0.67

Table 60 Net effects of the 2000 Primary Audit on BMWP score and no. of scoring taxa for each Agency lab.

Analyst/ Group	n	Mean net effect on BMWP score	Standard error of effect on BMWP score	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	Standard error of effect on no. of taxa	Maximum underestimate of no. of taxa
Anglian	60	8.77	1.25	40	1.62	0.22	7
Central	20	12.85	2.30	40	2.35	0.39	7
Eastern	20	11.40	2.04	28	2.00	0.37	5
Northern	20	2.05	1.25	13	0.50	0.25	2
Midlands	80	8.30	1.07	43	1.43	0.18	7
U. Severn	20	4.80	1.83	28	0.85	0.25	3
L. Severn	20	7.75	1.41	18	1.25	0.29	3
U. Trent	20	13.75	2.73	43	2.45	0.46	7
L. Trent	20	6.90	1.99	25	1.15	0.36	4
North East	60	6.68	1.15	42	1.02	0.18	5
Dales	20	6.70	2.15	42	1.05	0.29	5
Northumbria	20	7.35	1.86	31	1.20	0.31	5
Ridings	20	6.00	2.07	29	0.80	0.34	4
North West	60	5.47	1.15	41	0.90	0.17	6
Northern	20	6.35	2.32	40	1.05	0.35	6
Central	20	3.55	0.98	13	0.70	0.16	2
Southern	20	6.50	2.39	41	0.95	0.34	5
Southern	60	10.25	1.24	43	1.52	0.18	6
Hants & I.O.W.	20	10.85	2.82	43	1.55	0.39	6
Kent	20	10.95	1.66	22	1.80	0.27	4
Sussex	20	8.95	1.86	26	1.20	0.29	4
South West	80	5.14	0.78	24	0.76	0.12	6
Cornwall	20	4.40	1.48	20	0.55	0.18	3
Devon	20	5.15	1.67	18	0.75	0.25	3
N. Wessex	20	6.05	1.78	24	1.05	0.33	6
S. Wessex	20	4.95	1.41	20	0.70	0.18	2
Thames	60	11.73	1.28	37	2.12	0.23	7
Frimley	20	10.60	1.34	25	1.90	0.26	5
Hatfield	20	9.90	1.85	30	1.80	0.33	6
Wallingford	20	14.70	3.06	37	2.65	0.54	7
Wales	60	10.67	1.43	42	1.55	0.19	5
Northern	20	14.05	2.78	42	1.95	0.36	5
S. Eastern	20	6.60	1.82	25	1.05	0.28	3
S. Western	20	11.35	2.53	40	1.65	0.32	5
Whole of Agency	520	8.25	0.42	43	1.34	0.07	7
Contractors							
Gloria Tapia	20	8.85	2.27	35	1.35	0.36	5
Dave Leeming	3	9.00	2.65	13	2.00	0	2
Unicomarine	15	7.87	3.37	41	1.40	0.53	6

Table 61 The families missed in sorting by the Agency's Primary Analysts

Family	n	% of Agency's missed families in Primary Audit
Leptoceridae	44	5.96
Planariidae (incl. Dugesiidae)	39	5.28
Hydroptilidae	37	5.01
Hydrophilidae (incl. Hydraenidae)	31	4.20
Hydrobiidae (incl. Bithyniidae)	29	3.93
Caenidae	27	3.66
Simuliidae	27	3.66
Elmidae	27	3.66
Ancylidae (incl. Acroloxidae)	26	3.52
Psychomyiidae (incl. Ecnomidae)	25	3.39
Sphaeriidae	23	3.12
Limnephilidae	21	2.85
Planorbidae	20	2.71
Valvatidae	20	2.71
Asellidae	17	2.30
Dytiscidae (incl. Noteridae)	16	2.17
Lymnaeidae	16	2.17
Nemouridae	16	2.17
Tipulidae	14	1.90
Goeridae	14	1.90
Lepidostomatidae	14	1.90
Leptophlebiidae	13	1.76
Leuctridae	12	1.63
Baetidae	12	1.63
Gyrinidae	11	1.49
Ephemerellidae	11	1.49
Glossiphoniidae	10	1.36
Piscicolidae	10	1.36
Hydropsychidae	10	1.36
Rhyacophilidae (incl. Glossosomatidae)	10	1.36
Physidae	10	1.36
Dendrocoelidae	9	1.22
Scirtidae	9	1.22
Chloroperlidae	9	1.22
Haliplidae	9	1.22
Sericostomatidae	9	1.22
Coenagrionidae	8	1.08
Calopterygidae	8	1.08
Erpobdellidae	8	1.08
Odontoceridae	6	0.81
Corixidae	5	0.68
Gammaridae (incl. Crangonyctidae)	5	0.68
Beraeidae	4	0.54
Chironomidae	4	0.54
Sialidae	4	0.54

Table 61 continued

Family	n	% of Agency's missed families in Primary Audit
Heptageniidae	4	0.54
Molannidae	3	0.41
Dryopidae	3	0.41
Oligochaeta	3	0.41
Polycentropodidae	2	0.27
Phryganeidae	2	0.27
Perlodidae	2	0.27
Hydrometridae	2	0.27
Brachycentridae	1	0.14
Neritidae	1	0.14
Ephemeridae	1	0.14
Libellulidae	1	0.14
Cordulegastridae	1	0.14
Unionidae	1	0.14
Taeniopterygidae	1	0.14
Notonectidae	1	0.14
Total	738	100

Table 62 The species missed in sorting by the Agency's Primary Analysts

Species	n	% of Agency's missed species in Primary Audit
Hydroptila sp.	29	3.68
Potamopyrgus jenkinsi (Smith)	27	3.43
Pisidium sp.	21	2.67
Polycelis nigra group	21	2.67
Mystacides azurea (L.)	19	2.41
Ancylus fluviatilis Muller	18	2.29
Elmis aenea (Muller)	16	2.03
Hydraena gracilis Germar	16	2.03
Caenis luctuosa group	15	1.91
Simulium (Simulium) ornatum group	14	1.78
Asellus aquaticus (L.)	14	1.78
Valvata cristata Muller	14	1.78
Lype sp.	11	1.40
Ephemerella ignita (Poda)	11	1.40
Limnephilidae indet	10	1.27
Orectochilus villosus (Muller)	10	1.27
Piscicola geometra (L.)	10	1.27
Acroloxus lacustris (L.)	9	1.14
Oulimnius sp.	9	1.14
Dendrocoelum lacteum (Muller)	9	1.14
Sericostoma personatum (Spence)	9	1.14
Silo pallipes (Fabricius)	9	1.14
Valvata piscinalis (Muller)	9	1.14
Tinodes waeneri (L.)	9	1.14
Lepidostoma hirtum (Fabricius)	8	1.02
Chloroperla torrentium (Pictet)	8	1.02
Caenis rivulorum Eaton	8	1.02
Armiger crista (L.)	7	0.89
Calopteryx splendens (Harris)	7	0.89
Glossiphonia complanata (L.)	7	0.89
Elodes sp.	7	0.89
Hydropsyche angustipennis (Curtis)	6	0.76
Halipus sp.	6	0.76
Polycelis felina (Dalyell)	6	0.76
Lymnaea sp.	6	0.76
Polycelis sp.	6	0.76
Lepidostomatidae indet	6	0.76
Paraleptophlebia submarginata (Stephens)	6	0.76
Odontocerum albicorne (Scopoli)	6	0.76
Bathyomphalus contortus (L.)	6	0.76
Oreodytes sanmarkii (Sahlberg)	6	0.76
Ithytrichia sp.	5	0.64
Physa fontinalis (L.)	5	0.64
Baetis rhodani (Pictet)	5	0.64
Habrophlebia fusca (Curtis)	5	0.64

Table 62 continued

Species	n	% of Agency's missed species in Primary Audit
Physa sp.	5	0.64
Hydraena riparia Kugelann	5	0.64
Adicella reducta (Mclachlan)	5	0.64
Lymnaea peregra (Muller)	5	0.64
Limnephilus lunatus Curtis	4	0.51
Leuctra sp.	4	0.51
Lymnaea truncatula (Muller)	4	0.51
Dugesia polychroa group	4	0.51
Athripsodes bilineatus (L.)	4	0.51
Hydropsyche siltalai Dohler	4	0.51
Asellus meridianus Racovitza	4	0.51
Athripsodes sp.	4	0.51
Tipula sp.	4	0.51
Beraeodes minutus (L.)	4	0.51
Erpobdella octoculata (L.)	4	0.51
Agapetus sp.	4	0.51
Gyraulus albus (Muller)	4	0.51
Sialis lutaria (L.)	4	0.51
Amphinemura sulcicollis (Stephens)	3	0.38
Antocha vitripennis (Meigen)	3	0.38
Micronecta sp.	3	0.38
Athripsodes aterrimus (Stephens)	3	0.38
Molanna angustata Curtis	3	0.38
Goera pilosa (Fabricius)	3	0.38
Baetis vernus Curtis	3	0.38
Bithynia tentaculata (L.)	3	0.38
Leuctra fusca (L.)	3	0.38
Dicranota sp.	3	0.38
Ischnura elegans (Van der Linden)	3	0.38
Erpobdellidae indet	3	0.38
Gammarus pulex (L.)	3	0.38
Helophorus (Atrachelophorus) brevipalpis Bedel	3	0.38
Leuctra geniculata (Stephens)	3	0.38
Simulium (Nevermannia) angustitarse group	3	0.38
Psychomyia pusilla (Fabricius)	3	0.38
Oecetis testacea (Curtis)	3	0.38
Silo sp.	3	0.38
Simulium (Boophthora) erythrocephalum (de Geer)	3	0.38
Orthocladinae	3	0.38
Rhyacophila dorsalis (Curtis)	3	0.38
Potamonectes depressus (Fabricius)	3	0.38
Nemurella picteti Klapalek	3	0.38
Oulimnius tuberculatus (Muller)	3	0.38
Simulium (Nevermannia) verum group	3	0.38
Oxyethira sp.	3	0.38

Table 62 continued

Species	n	% of Agency's missed species in Primary Audit
Nemoura avicularis Morton	3	0.38
Tubificidae	3	0.38
Cloeon dipterum (L.)	2	0.25
Planariidae indet	2	0.25
Hydraena sp.	2	0.25
Naididae	2	0.25
Hydrocyphon deflexicollis (Muller)	2	0.25
Gammarus sp.	2	0.25
Leptophlebiidae indet	2	0.25
Platambus maculatus (L.)	2	0.25
Pyrrhosoma nymphula (Sulzer)	2	0.25
Dryopidae indet	2	0.25
Hydrometra stagnorum (L.)	2	0.25
Coenagrionidae indet	2	0.25
Potamophylax cingulatus group	2	0.25
Ceraclea dissimilis (Stephens)	2	0.25
Simulium (Eusimulium) aureum group	2	0.25
Caenis horaria (L.)	2	0.25
Brychius elevatus (Panzer)	2	0.25
Simulium (Nevermannia) cryophilum group	2	0.25
Simulium sp.	2	0.25
Athripsodes cinereus (Curtis)	2	0.25
Sphaeriidae indet	2	0.25
Anisus vortex (L.)	2	0.25
Rhyacophila sp.	2	0.25
Limnephilus sp.	2	0.25
Oecetis lacustris (Pictet)	2	0.25
Leuctra hippopus (Kempny)	2	0.25
Isoperla grammatica (Poda)	2	0.25
Lymnaea palustris (Muller)	2	0.25
Mystacides nigra (L.)	2	0.25
Nemoura cambrica group	2	0.25
Nemoura sp.	2	0.25
Limnophila (Eloeophila) sp.	2	0.25
Brachycentrus subnubilus Curtis	1	0.13
Brachyptera risi (Morton)	1	0.13
Notonecta sp.	1	0.13
Ochthebius bicolon Germar	1	0.13
Caenis pusilla Navas	1	0.13
Caenis sp.	1	0.13
Lymnaea stagnalis (L.)	1	0.13
Limnius volckmari (Panzer)	1	0.13
Chironomini	1	0.13
Sigara (Sigara) sp.	1	0.13
Chloroperla tripunctata (Scopoli)	1	0.13

Table 62 continued

Species	n	% of Agency's missed species in Primary Audit
<i>Limnephilus rhombicus</i> (L.)	1	0.13
<i>Coenagrion puella</i> group	1	0.13
<i>Ochthebius minimus</i> (Fabricius)	1	0.13
<i>Cordulegaster boltonii</i> (Donovan)	1	0.13
Corixidae	1	0.13
<i>Calopteryx</i> sp.	1	0.13
<i>Athripsodes albifrons</i> (L.)	1	0.13
<i>Mystacides</i> sp.	1	0.13
<i>Trocheta subviridis</i> Dutrochet	1	0.13
<i>Agraylea multipunctata</i> Curtis	1	0.13
<i>Agraylea</i> sp.	1	0.13
<i>Agrypnia pagetana</i> Curtis	1	0.13
Tipulidae indet	1	0.13
<i>Tinodes unicolor</i> (Pictet)	1	0.13
<i>Tinodes</i> sp.	1	0.13
<i>Theromyzon tessulatum</i> (Muller)	1	0.13
<i>Bithynia</i> sp.	1	0.13
Tanypodinae	1	0.13
<i>Crangonyx pseudogracilis</i> Bousfield	1	0.13
<i>Sphaerium</i> sp.	1	0.13
<i>Molophilus</i> sp.	1	0.13
<i>Micropterna sequax</i> Mclachlan	1	0.13
<i>Baetis muticus</i> (L.)	1	0.13
<i>Simulium</i> (Wilhelmia) sp.	1	0.13
<i>Baetis scambus</i> group	1	0.13
<i>Nemoura cinerea</i> (Retzius)	1	0.13
<i>Simulium</i> (Nevermannia) <i>lundstromi</i> (Enderlein)	1	0.13
<i>Riolus subviolaceus</i> (Muller)	1	0.13
<i>Bithynia leachii</i> (Sheppard)	1	0.13
<i>Theodoxus fluviatilis</i> (L.)	1	0.13
Heptageniidae indet	1	0.13
<i>Crenobia alpina</i> (Dana)	1	0.13
<i>Plectrocnemia</i> sp.	1	0.13
<i>Halesus radiatus</i> (Curtis)	1	0.13
<i>Halipus laminatus</i> Schaller	1	0.13
<i>Oulimnius rivularis</i> (Rosenhauer)	1	0.13
<i>Halipus wehncke</i> (Gerhardt)	1	0.13
<i>Helichus substriatus</i> (Muller)	1	0.13
<i>Helobdella stagnalis</i> (L.)	1	0.13
<i>Planorbis</i> sp.	1	0.13
<i>Polycentropus kingi</i> Mclachlan	1	0.13
<i>Heptagenia sulphurea</i> (Muller)	1	0.13
<i>Orthotrichia</i> sp.	1	0.13
<i>Hippeutis complanatus</i> (L.)	1	0.13
<i>Planorbarius corneus</i> (L.)	1	0.13

Table 62 continued

Species	n	% of Agency's missed species in Primary Audit
Hydraena nigrita Germar	1	0.13
Hydraena pulchella Germar	1	0.13
Ilybius fuliginosus (Fabricius)	1	0.13
Hygrotus versicolor (Schaller)	1	0.13
Phryganea grandis group	1	0.13
Hydrophilidae	1	0.13
Hydroporus angustatus Sturm	1	0.13
Planaria torva (Muller)	1	0.13
Helophorus (Helophorus) obscurus Mulsant	1	0.13
Ephemera danica Muller	1	0.13
Cyphon sp.	1	0.13
Pilaria (Pilaria) sp.	1	0.13
Deronectes latus (Stephens)	1	0.13
Limnephilidae	1	0.13
Limnebius truncatellus (Thunberg)	1	0.13
Dugesia tigrina (Girard)	1	0.13
Dytiscidae	1	0.13
Ecdyonurus sp.	1	0.13
Rhithrogena sp.	1	0.13
Gyrinus urinator Illiger	1	0.13
Enallagma cyathigerum (Charpentier)	1	0.13
Glossiphonia heteroclita (L.)	1	0.13
Oecetis ochracea (Curtis)	1	0.13
Pseudanodonta complanata (Rossmassler)	1	0.13
Protonemura praecox (Morton)	1	0.13
Esolus parallelepipedus (Muller)	1	0.13
Protonemura meyeri (Pictet)	1	0.13
Leuctra inermis Kempny	1	0.13
Ormosia sp.	1	0.13
Glossiphoniidae indet	1	0.13
Glossosoma sp.	1	0.13
Glyptotaelius pellucidus (Retzius)	1	0.13
Libellulidae indet	1	0.13
Total	787	100

MISSED TAXA FOR ALL SAMPLES IN THE 2000 AUDIT

Table 63 Families missed 5 times or more for all samples in the 2000 Audit

Family	n	% of missed families in 2000 audit
Hydroptilidae	74	5.85
Planariidae (incl. Dugesiidae)	71	5.61
Hydrophilidae (incl. Hydraenidae)	66	5.21
Leptoceridae	62	4.90
Hydrobiidae (incl. Bithyniidae)	51	4.03
Caenidae	49	3.87
Simuliidae	46	3.63
Elmidae	45	3.55
Nemouridae	42	3.32
Ancylidae (incl. Acroloxidae)	40	3.16
Psychomyiidae (incl. Ecnomidae)	39	3.08
Limnephilidae	38	3.00
Sphaeriidae	38	3.00
Lymnaeidae	34	2.69
Dytiscidae (incl. Noteridae)	29	2.29
Planorbidae	29	2.29
Valvatidae	27	2.13
Tipulidae	25	1.97
Goeridae	25	1.97
Leuctridae	24	1.90
Asellidae	24	1.90
Leptophlebiidae	22	1.74
Lepidostomatidae	21	1.66
Ephemerellidae	20	1.58
Rhyacophilidae (incl. Glossosomatidae)	20	1.58
Halplidae	19	1.50
Baetidae	18	1.42
Hydropsychidae	17	1.34
Physidae	17	1.34
Piscicolidae	17	1.34
Scirtidae	16	1.26
Chloroperlidae	15	1.18
Dendrocoelidae	14	1.11
Glossiphoniidae	14	1.11
Sericostomatidae	14	1.11
Gyrinidae	13	1.03
Calopterygidae	12	0.95
Erpobdellidae	12	0.95
Coenagrionidae	11	0.87
Odontoceridae	9	0.71
Gammaridae (incl. Crangonyctidae)	8	0.63
Taeniopterygidae	7	0.55
Sialidae	7	0.55
Heptageniidae	7	0.55
Chironomidae	6	0.47
Beraeidae	6	0.47

Table 63 continued

Family	n	% of missed families in 2000 audit
Corixidae	6	0.47
Dryopidae	5	0.39
Polycentropodidae	5	0.39
Oligochaeta	5	0.39
Molannidae	5	0.39

Table 64 Species missed 5 times or more for all samples in the 2000 Audit

Species	n	% of missed species in 2000 audit
Hydroptila sp.	54	4.04
Potamopyrgus jenkinsi (Smith)	47	3.52
Hydraena gracilis Germar	38	2.84
Polycelis nigra group	36	2.69
Pisidium sp.	32	2.39
Ancylus fluviatilis Muller	29	2.17
Caenis luctuosa group	28	2.09
Mystacides azurea (L.)	28	2.09
Elmis aenea (Muller)	28	2.09
Simulium (Simulium) ornatum group	23	1.72
Ephemerella ignita (Poda)	20	1.50
Limnephilidae indet	20	1.50
Caenis rivulorum Eaton	19	1.42
Asellus aquaticus (L.)	19	1.42
Silo pallipes (Fabricius)	18	1.35
Valvata cristata Muller	18	1.35
Piscicola geometra (L.)	17	1.27
Oulimnius sp.	16	1.20
Lype sp.	15	1.12
Lymnaea peregra (Muller)	15	1.12
Tinodes waeneri (L.)	15	1.12
Dendrocoelum lacteum (Muller)	14	1.05
Chloroperla torrentium (Pictet)	14	1.05
Sericostoma personatum (Spence)	14	1.05
Haliplus sp.	13	0.97
Ithytrichia sp.	13	0.97
Valvata piscinalis (Muller)	13	0.97
Elodes sp.	13	0.97
Orectochilus villosus (Muller)	12	0.90
Acroloxus lacustris (L.)	12	0.90
Lepidostoma hirtum (Fabricius)	12	0.90
Lymnaea sp.	11	0.82
Oreodytes sanmarkii (Sahlberg)	11	0.82
Polycelis felina (Dalyell)	11	0.82
Calopteryx splendens (Harris)	10	0.75
Armiger crista (L.)	10	0.75
Polycelis sp.	10	0.75
Odontocerum albicorne (Scopoli)	9	0.67
Glossiphonia complanata (L.)	9	0.67
Paraleptophlebia submarginata (Stephens)	9	0.67
Physa sp.	9	0.67
Amphinemura sulcicollis (Stephens)	9	0.67
Lepidostomatidae indet	9	0.67
Rhyacophila dorsalis (Curtis)	8	0.60
Hydraena riparia Kugelann	8	0.60
Habrophlebia fusca (Curtis)	8	0.60

Table 64 continued

Species	n	% of missed species in 2000 audit
Hydropsyche angustipennis (Curtis)	8	0.60
Bathyomphalus contortus (L.)	8	0.60
Dicranota sp.	8	0.60
Lymnaea truncatula (Muller)	8	0.60
Nemoura avicularis Morton	7	0.52
Sialis lutaria (L.)	7	0.52
Nemurella picteti Klapalek	7	0.52
Baetis rhodani (Pictet)	7	0.52
Asellus meridianus Racovitza	7	0.52
Physa fontinalis (L.)	7	0.52
Gyraulus albus (Muller)	7	0.52
Leuctra sp.	7	0.52
Leuctra fusca (L.)	6	0.45
Tipula sp.	6	0.45
Oxyethira sp.	6	0.45
Psychomyia pusilla (Fabricius)	6	0.45
Erpobdella octoculata (L.)	6	0.45
Adicella reducta (McLachlan)	6	0.45
Agapetus sp.	6	0.45
Brachyptera risi (Morton)	6	0.45
Sphaeriidae indet	6	0.45
Helophorus (Atracthelophorus) brevipalpis Bedel	6	0.45
Limnephilus lunatus Curtis	6	0.45
Nemoura sp.	5	0.37
Protonemura meyeri (Pictet)	5	0.37
Simulium (Nevermannia) angustitarse group	5	0.37
Dugesia polychroa group	5	0.37
Oecetis testacea (Curtis)	5	0.37
Antocha vitripennis (Meigen)	5	0.37
Athripsodes bilineatus (L.)	5	0.37
Erpobdellidae indet	5	0.37
Leuctra hippopus (Kempny)	5	0.37
Athripsodes sp.	5	0.37
Silo sp.	5	0.37
Coenagrionidae indet	5	0.37
Molanna angustata Curtis	5	0.37
Bithynia tentaculata (L.)	5	0.37
Beraeodes minutus (L.)	5	0.37
Hydropsyche siltalai Dohler	5	0.37