



An Audit of Performance in the Analysis of Biological Samples in 1997 SEPA West Region

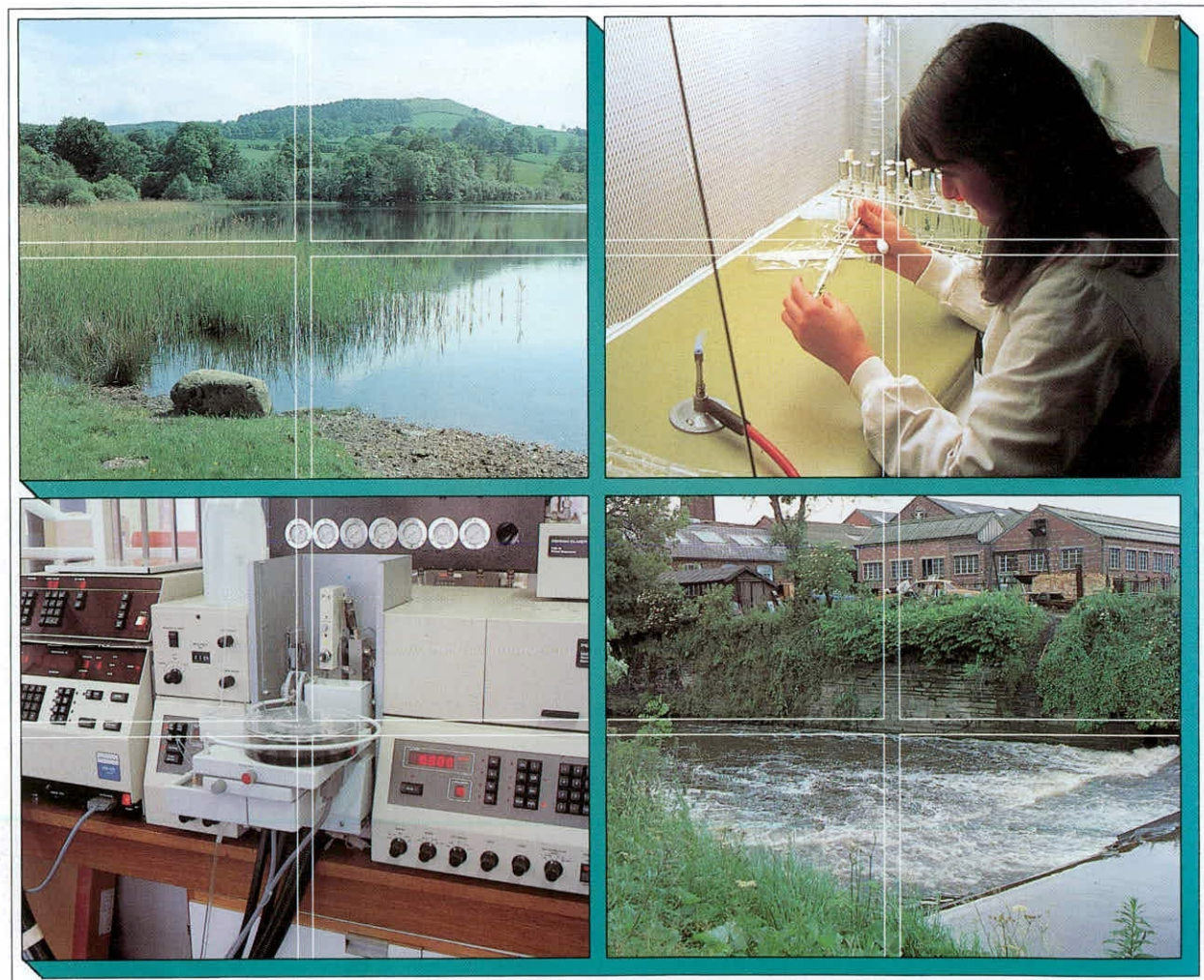
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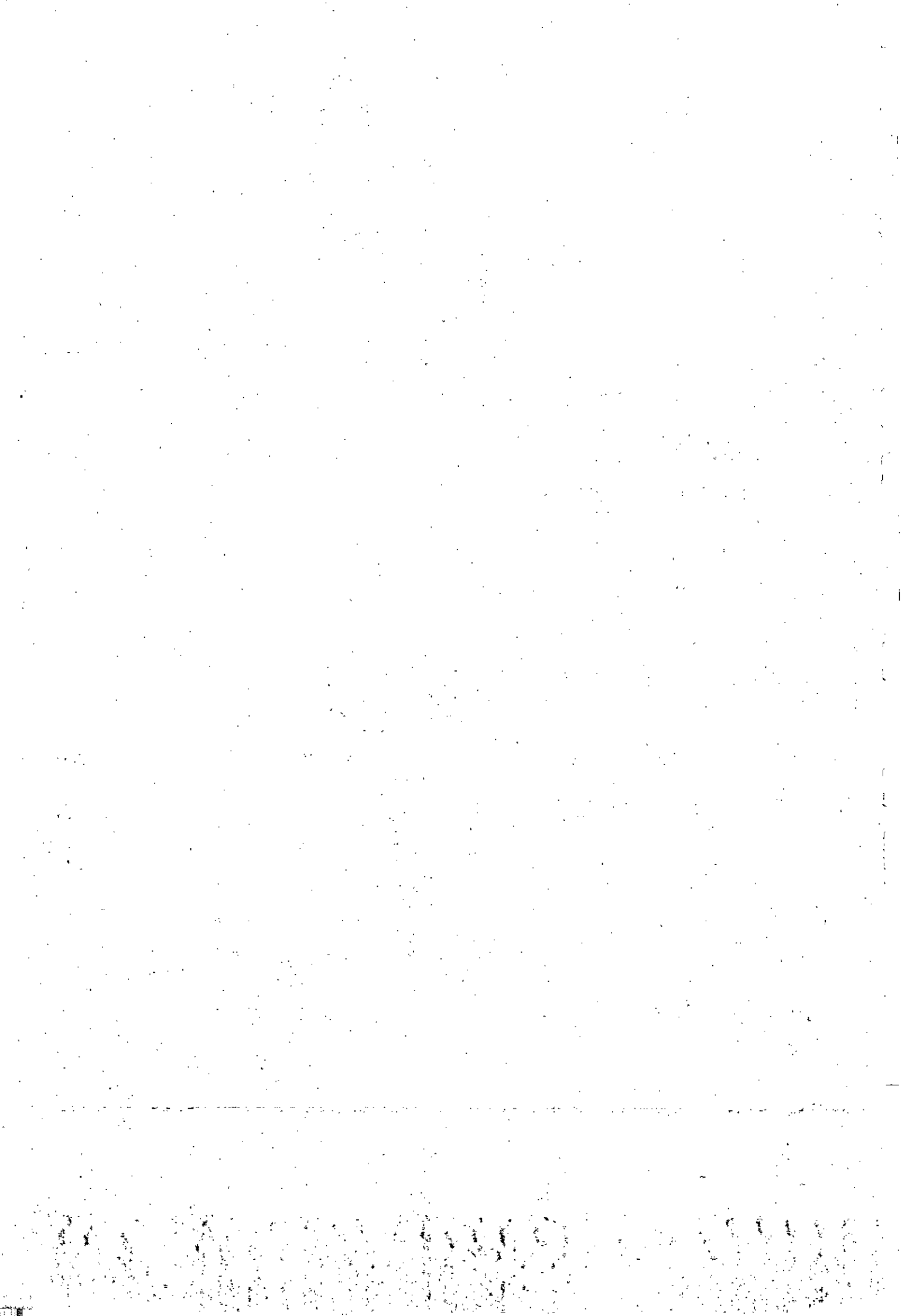
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1. INTRODUCTION

In 1997 the sampling of aquatic macro-invertebrates for the biological assessment of river quality was carried out throughout the United Kingdom. This task was undertaken by the Environment Agency (EA) in England and Wales, the Scottish Environment Protection Agency (SEPA) in Scotland and the Industrial Research and Technology Unit (IRTU) undertook the work in Northern Ireland.

Each organisation employed standard collection procedures as used in the 1995 General Quality Assessment (GQA) Survey. The sampling strategy was therefore compatible with RIVPACS (River InVertebrate Prediction And Classification System), a computer model developed by the Institute of Freshwater Ecology (IFE). Samples were sorted for the families of macro-invertebrates included in the Biological Monitoring Working Party (BMWP) system. Taxa present were recorded on site data sheets. Although attempts had been made to standardise sample processing and recording techniques, these did vary somewhat from region to region.

In view of the number of staff involved and the variability of sample processing techniques, it was recognised that a quality assurance exercise was necessary to minimise and quantify errors. Each laboratory appointed at least one experienced analyst to act as an internal analytical quality control (AQC) inspector. For most agencies, these inspectors re-sorted about 10% of the laboratory's samples, those samples chosen for re-sorting being selected at random. In addition, IFE was contracted to undertake an independent, external audit of the quality of the laboratory analysis of biological samples for each EA and SEPA region and for IRTU. 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 river sites each year between 1991 and 1994 and again in 1996. Where samples sent to IFE had been subjected to an internal AQC inspection, the audit provided a measure of the quality of performance of the AQC analyst.

This report presents the results of the audit of 20 samples analysed by staff employed by SEPA West Region.

2. SAMPLE SELECTION

Samples for audit were selected internally by each of the agencies being monitored. The number of samples selected for audit varied between the different agencies and the biologists processing these samples had no prior knowledge of which samples were to be audited. Some agencies only sent to IFE samples that had been processed twice. Others adopted a random selection process, whereby some samples had been analysed just once and some had been re-sorted. The 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 agency, within the limits of the total number of samples that IFE was contracted to audit.

3. SAMPLE PROCESSING

The normal protocol for EA, SEPA and IRTU biologists was to sort their samples within the laboratory and to select examples of each scoring taxon within the BMWP system. In most cases, the invertebrates were placed in a vial of preservative (4% formaldehyde solution or 70% industrial alcohol) and the BMWP taxa were listed on a data sheet. The vial of animals and the sorted material were then returned to the sample container and preservative added. Thus, each sample available to IFE for audit should have included:

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

When these three elements were present, the sequence of operations at IFE 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 were identified.
- c) A comparison was made between the listing of families and those found in the sample by IFE.
- d) A comparison was made between the listing of families and those identified from the vial by IFE.
- e) "Losses" or "gains" 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) An error code, selected from a list on the result sheet, was assigned by the IFE auditor for each "loss" or "gain".

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 IFE 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. Where possible, IFE gave the benefit of doubt to the analyst in cases of the "loss" of Planariidae, specimens of which have been known to disintegrate in preservative. 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 Appendix) and sent to the Quality Control Manager. 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 IFE 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 IFE in the remainder of the sample were entered in the section of the report form headed "SAMPLE" under "Additional BMWP taxa found by IFE". 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 IFE, 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. Such errors are noted as "omissions".

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

IFE 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".

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" : "Additional taxa" as before. Families recorded on the list but not found by IFE were indicated in the section above this. If the vial of animals was 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.

5. RESULTS

The results of the audit for the two SEPA West laboratories are summarised in Tables 1 and 2. Table 3 displays the statistics of these audit results centred around the target of acceptability of no more than two missed taxa per sample. These data are presented for each analyst, for each laboratory and for the Region as a whole. Table 4 presents data for SEPA West for the net effects of the audit on the BMWP score and number of taxa. This table is again based on the target of no more than two missed taxa per sample. The figure of 13 for an acceptable underestimate of BMWP score is based on twice the average score of all taxa in the BMWP listing (excluding Clambidae, Chrysomelidae and Curculionidae, which are excluded from the audit). This average score is 6.57. Table 5 lists, at family level, the taxa missed in sorting by SEPA West's analysts in the 1997 audit. Table 6 lists the species most frequently missed by SEPA West's biologists, as found by the 1997 audit. Tables 7 and 8 list missed taxa at family and species level for all SEPA analysts and Tables 9 and 10 give similar listings for the entire 1997 audit for the whole of the United Kingdom.

6. ACKNOWLEDGEMENTS

Grateful thanks to John Murray-Bligh of EA Thames Region, who provided an invaluable service in the development and implementation of improved methodology and in providing helpful advice throughout.

Table 1 The 4 samples audited for the Dumfries Laboratory of SEPA West

River	Site	Analyst	Losses	Gains	Omissions
Water of Ae	Ae Valley Fish Farm	AB	0	0	0
Caldons Burn	Site 1 (u/s)	BR	0	0	0
Annan	Johnstonebridge S/T	ML	0	0	0
Perceiving Burn	Bankhill S/W	ML	0	0	0

Table 2 The 16 samples audited for the East Kilbride Laboratory of SEPA West

River	Site	Analyst	Losses	Gains	Omissions
Abhainn Srathain	u/s Fish Farm	AM	0	2	0
Leven	Renton	AM	0	7	0
Cameron Burn	Luggie confluence	KA	0	0	0
Ebroch Burn	u/s Stirling Road	KA	0	1	0
Little Eachaig	u/s Dalinlongart Tip	LM	1	1	0
Gryfe	High Mathernock	LM	0	2	0
Bothlin Burn	Muirhead	MC	0	1	0
Avon Water	Haughead	MC	0	2	0
Fyne	A83 Old Bridge	MT	0	0	0
Gower Water	Bransfield Bridge	MT	0	0	0
Clyde	Motherwell Bridge	RW	0	0	0
Irvine	Gatehead	RW	0	1	0
Nell/Feochan	d/s Fish Farm	SC	0	2	0
Glentarsan Burn	d/s Fish Farm	SC	0	1	1
Kittoch Water	B759 Bridge	SD	0	0	0
Ayr	Mainholm Ford	SD	0	0	0

Table 3 Statistics of the 1997 audit results for SEPA West

Analyst/Group	n	Mean gains	Standard error	No samples >2 gains	% samples >2 gains	Highest no. gains	Mean errors (l+g+o)	Standard error
Dumfries	4	0	0	0	0	0	0	0
AB	1	0	0	0	0	0	0	0
BR	1	0	0	0	0	0	0	0
ML	2	0	0	0	0	0	0	0
East Kilbride	16	1.25	0.43	1	6.25	7	1.38	0.44
AM	2	4.50	2.50	1	50.00	7	4.50	2.50
KA	2	0.50	0.50	0	0	1	0.50	0.50
LM	2	1.50	0.50	0	0	2	2.00	0.00
MC	2	1.50	0.50	0	0	2	1.50	0.50
MT	2	0	0	0	0	0	0	0
RW	2	0.50	0.50	0	0	1	0.50	0.50
SC	2	1.50	0.50	0	0	2	2.00	0.00
SD	2	0	0	0	0	0	0	0
SEPA West	20	1.00	0.36	1	5.00	7	1.10	0.37
Whole of SEPA	102	1.57	0.18	19	18.63	8	1.86	0.19

Table 4 Net effects of the audit on BMWP score and number of scoring taxa

Analyst/Group	n	Mean net effect on BMWP score	% samples underestimated by score >13	Maximum underestimate of BMWP score	Mean net effect on no. of taxa	% of samples underestimated by >2 taxa	Maximum underestimate of no. of taxa
Dumfries	4	0	0	0	0	0	0
AB	1	0	0	0	0	0	0
BR	1	0	0	0	0	0	0
ML	2	0	0	0	0	0	0
East Kilbride	16	7.25	18.75	51	1.19	6.25	7
AM	2	31.00	50.00	51	4.50	50.00	7
KA	2	3.50	0	7	0.50	0	1
LM	2	3.50	50.00	15	1.00	0	2
MC	2	7.50	0	8	1.50	0	2
MT	2	0	0	0	0	0	0
RW	2	2.50	0	5	0.50	0	1
SC	2	10.00	50.00	14	1.50	0	2
SD	2	0	0	0	0	0	0
SEPA West	20	5.80	15.00	51	0.95	5.00	7
Whole of SEPA	102	9.85	29.41	57	1.41	17.65	8

Table 5 The families missed by SEPA West Region's analysts in the 1997 audit

Family	n	% of SEPA West's missed families
Hydrophilidae (incl. Hydraenidae)	2	11.11
Nemouridae	2	11.11
Rhyacophilidae (incl. Glossosomatidae)	2	11.11
Ancylidae (incl. Acroloxidae)	1	5.56
Chironomidae	1	5.56
Elmidae	1	5.56
Gammaridae (incl. Crangonyctidae)	1	5.56
Heptageniidae	1	5.56
Lepidostomatidae	1	5.56
Leptoceridae	1	5.56
Oligochaeta	1	5.56
Planorbidae	1	5.56
Polycentropodidae	1	5.56
Psychomyiidae (incl. Ecnomidae)	1	5.56
Sericostomatidae	1	5.56
TOTAL	18	100

Table 6 The species missed by SEPA West Region's analysts in the 1997 audit

Species	n	% of SEPA East's missed species
Mystacides azurea (L.)	1	4.55
Naididae	1	4.55
Nemoura cinerea (Retzius)	1	4.55
Polycentropodidae indet	1	4.55
Protonemura sp.	1	4.55
Rhithrogena sp.	1	4.55
Sericostoma personatum (Spence)	1	4.55
Lype sp.	1	4.55
Ancylus fluviatilis Muller	1	4.55
Tanytarsini	1	4.55
Rhyacophila sp.	1	4.55
Lumbricidae	1	4.55
Limnius volckmari (Panzer)	1	4.55
Lepidostoma hirtum (Fabricius)	1	4.55
Hydrophilidae indet	1	4.55
Hydraena gracilis Germar	1	4.55
Gammarus pulex (L.)	1	4.55
Ceraclea dissimilis (Stephens)	1	4.55
Athripsodes albifrons (L.)	1	4.55
Agapetus sp.	1	4.55
Tinodes waeneri (L.)	1	4.55
Bathyomphalus contortus (L.)	1	4.55
TOTAL	22	100

Table 8 The families missed by all SEPA's analysts in the 1997 audit

Family	n	% of missed families for SEPA audits
Hydrophilidae (incl. Hydraenidae)	13	8.44
Lepidostomatidae	8	5.19
Nemouridae	8	5.19
Limnephilidae	7	4.55
Sericostomatidae	7	4.55
Sphaeriidae	7	4.55
Hydroptilidae	6	3.90
Leptoceridae	6	3.90
Elmidae	5	3.25
Heptageniidae	5	3.25
Simuliidae	5	3.25
Taeniopterygidae	5	3.25
Ancylidae (incl. Acroloxidae)	4	2.60
Glossiphoniidae	4	2.60
Leptophlebiidae	4	2.60
Leuctridae	4	2.60
Rhyacophilidae (incl. Glossosomatidae)	4	2.60
Chloroperlidae	3	1.95
Dytiscidae (incl. Noteridae)	3	1.95
Ephemerellidae	3	1.95
Perlodidae	3	1.95
Polycentropodidae	3	1.95
Psychomyiidae (incl. Ecnomidae)	3	1.95
Baetidae	2	1.30
Caenidae	2	1.30
Erpobdellidae	2	1.30
Gammaridae (incl. Crangonyctidae)	2	1.30
Goeridae	2	1.30
Haliplidae	2	1.30
Hydrobiidae (incl. Bithyniidae)	2	1.30
Hydropsychidae	2	1.30
Lymnaeidae	2	1.30
Odontoceridae	2	1.30
Planorbidae	2	1.30
Tipulidae	2	1.30
Beraeidae	1	0.65
Chironomidae	1	0.65
Dendrocoelidae	1	0.65
Gerridae	1	0.65
Oligochaeta	1	0.65
Physidae	1	0.65
Planariidae (incl. Dugesiiidae)	1	0.65
Scirtidae	1	0.65

Table 8 continued

Family	n	% of missed families for SEPA audits
Sialidae	1	0.65
Valvatidae	1	0.65
TOTAL	154	100

Table 9 The species missed by all SEPA's analysts in the 1997 audit

Species	n	% of missed species for SEPA audits
Hydraena gracilis Germar	10	6.02
Lepidostoma hirtum (Fabricius)	8	4.82
Sericostoma personatum (Spence)	7	4.22
Pisidium sp.	6	3.61
Hydroptila sp.	4	2.41
Amphinemura sulcicollis (Stephens)	4	2.41
Ancylus fluviatilis Muller	4	2.41
Elmis aenea (Muller)	4	2.41
Limnephilidae indet	4	2.41
Chloroperla torrentium (Pictet)	3	1.81
Ephemerella ignita (Poda)	3	1.81
Glossiphonia complanata (L.)	3	1.81
Hydrophilidae indet	3	1.81
Isoperla grammatica (Poda)	3	1.81
Leptophlebiidae indet	3	1.81
Simulium (Simulium) ornatum group	3	1.81
Taeniopteryx nebulosa (L.)	3	1.81
Rhithrogena sp.	3	1.81
Brachyptera risi (Morton)	2	1.20
Limnius volckmari (Panzer)	2	1.20
Helobdella stagnalis (L.)	2	1.20
Leuctra sp.	2	1.20
Lymnaea peregra (Muller)	2	1.20
Ithytrichia sp.	2	1.20
Caenis rivulorum Eaton	2	1.20
Agabus sp.	2	1.20
Hydropsyche siltalai Dohler	2	1.20
Goera pilosa (Fabricius)	2	1.20
Ecdyonurus sp.	2	1.20
Erpobdella octoculata (L.)	2	1.20
Rhyacophila dorsalis (Curtis)	2	1.20
Athripsodes albifrons (L.)	2	1.20
Lype sp.	2	1.20
Leuctra hippopus (Kempny)	2	1.20
Odontocerum albicorne (Scopoli)	2	1.20
Nemoura cambrica group	2	1.20
Psychomyia pusilla (Fabricius)	2	1.20
Polycentropodidae indet	2	1.20
Athripsodes sp.	2	1.20
Potamopyrgus jenkinsi (Smith)	2	1.20
Drusus annulatus/Ecclisopteryx guttulata	1	0.60
Anabolia nervosa (Curtis)	1	0.60
Agapetus sp.	1	0.60

Table 9 continued

Species	n	% of missed species for SEPA audits
Dicranota sp.	1	0.60
Dendrocoelum lacteum (Muller)	1	0.60
Crenobia alpina (Dana)	1	0.60
Tipula sp.	1	0.60
Crangonyx pseudogracilis Bousfield	1	0.60
Ceraclea dissimilis (Stephens)	1	0.60
Tinodes waeneri (L.)	1	0.60
Anisus vortex (L.)	1	0.60
Beraea maurus (Curtis)	1	0.60
Athripsodes aterrimus (Stephens)	1	0.60
Athripsodes cinereus (Curtis)	1	0.60
Bathyomphalus contortus (L.)	1	0.60
Baetis sp.	1	0.60
Baetis rhodani (Pictet)	1	0.60
Tanytarsini	1	0.60
Limnephilus lunatus Curtis	1	0.60
Polycentropus flavomaculatus (Pictet)	1	0.60
Phylla fontinalis (L.)	1	0.60
Paraleptophlebia submarginata (Stephens)	1	0.60
Oxyethira sp.	1	0.60
Oreodytes sanmarkii (Sahlberg)	1	0.60
Nemoura cinerea (Retzius)	1	0.60
Nemoura avicularis Morton	1	0.60
Naididae	1	0.60
Mystacides azurea (L.)	1	0.60
Halipus lineatocollis (Marsham)	1	0.60
Lumbricidae	1	0.60
Elodes sp.	1	0.60
Rhyacophila sp.	1	0.60
Valvata piscinalis (Muller)	1	0.60
Sialis lutaria (L.)	1	0.60
Simulium (Nevermannia) cryophilum group	1	0.60
Simulium (Simulium) argyreatum group	1	0.60
Helophorus (Helophorus) obscurus Mulsant	1	0.60
Helophorus (Atracthelophorus) brevipalpis Bedel	1	0.60
Protonemura sp.	1	0.60
Halipus sp.	1	0.60
Gerris (Gerris) lacustris (L.)	1	0.60
Gammarus pulex (L.)	1	0.60
Sphaeriidae indet	1	0.60
Molophilus sp.	1	0.60
TOTAL	166	100

Table 10 Missed families for all samples in the 1997 audit

Family	n	% of missed families in 1997 audit
Hydroptilidae	68	5.75
Elmidae	66	5.58
Hydrophilidae (incl. Hydraenidae)	61	5.16
Planariidae (incl. Dugesiidae)	53	4.48
Leptoceridae	45	3.81
Hydrobiidae (incl. Bithyniidae)	43	3.64
Simuliidae	36	3.05
Lymnaeidae	36	3.05
Planorbidae	36	3.05
Sphaeriidae	34	2.88
Ancylidae (incl. Acroloxidae)	32	2.71
Hydropsychidae	32	2.71
Limnephilidae	32	2.71
Nemouridae	32	2.71
Caenidae	29	2.45
Halplidae	28	2.37
Tipulidae	28	2.37
Psychomyiidae (incl. Ecnomidae)	28	2.37
Asellidae	25	2.12
Ephemerellidae	22	1.86
Lepidostomatidae	22	1.86
Rhyacophilidae (incl. Glossosomatidae)	20	1.69
Valvatidae	19	1.61
Goeridae	18	1.52
Physidae	18	1.52
Scirtidae	17	1.44
Dytiscidae (incl. Noteridae)	17	1.44
Coenagriidae	16	1.35
Leuctridae	16	1.35
Baetidae	15	1.27
Glossiphoniidae	15	1.27
Gammaridae (incl. Crangonyctidae)	13	1.10
Leptophlebiidae	13	1.10
Sericostomatidae	13	1.10
Chironomidae	12	1.02
Erpobdellidae	12	1.02
Heptageniidae	11	0.93
Gerridae	11	0.93
Polycentropodidae	11	0.93
Perlodidae	10	0.85
Gyrinidae	10	0.85
Dendrocoelidae	9	0.76

Table 10 continued

Family	n	% of missed families in 1997 audit
Piscicolidae	9	0.76
Taeniopterygidae	8	0.68
Corixidae	8	0.68
Odontoceridae	8	0.68
Beraeidae	7	0.59
Calopterygidae	7	0.59
Dryopidae	7	0.59
Sialidae	7	0.59
Oligochaeta	7	0.59
Hydrometridae	5	0.42
Chloroperlidae	5	0.42
Ephemeridae	4	0.34
Brachycentridae	4	0.34
Libellulidae	2	0.17
Notonectidae	2	0.17
Molannidae	2	0.17
Unionidae	1	0.08
Phryganeidae	1	0.08
Philopotamidae	1	0.08
Nepidae	1	0.08
Pleidae	1	0.08
Corophiidae	1	0.08
Total	1182	100

Table 11

Missed species for all samples in the 1997 audit

Species	n	% of missed species in 1997 audit
Hydroptila sp.	49	3.90
Potamopyrgus jenkinsi (Smith)	40	3.18
Elmis aenea (Muller)	38	3.02
Hydraena gracilis Germar	34	2.70
Pisidium sp.	28	2.23
Polycelis nigra group	26	2.07
Lymnaea peregra (Muller)	26	2.07
Asellus aquaticus (L.)	23	1.83
Ephemerella ignita (Poda)	22	1.75
Ancylus fluviatilis Muller	22	1.75
Limnephilidae indet	19	1.51
Mystacides azurea (L.)	18	1.43
Caenis rivulorum Eaton	18	1.43
Lepidostoma hirtum (Fabricius)	18	1.43
Simulium (Simulium) ornatum group	18	1.43
Hydropsyche siltalai Dohler	17	1.35
Haliplus sp.	16	1.27
Limnius volckmari (Panzer)	15	1.19
Ithytrichia sp.	15	1.19
Polycelis felina (Dalyell)	14	1.11
Physa fontinalis (L.)	13	1.03
Sericostoma personatum (Spence)	13	1.03
Tinodes waeneri (L.)	13	1.03
Elodes sp.	13	1.03
Lype sp.	12	0.95
Gyraulus albus (Muller)	12	0.95
Valvata piscinalis (Muller)	12	0.95
Glossiphonia complanata (L.)	12	0.95
Oulimnius sp.	11	0.87
Orectochilus villosus (Muller)	10	0.79
Helophorus (Atrachelophorus) brevipalpis Bedel	10	0.79
Dendrocoelum lacteum (Muller)	9	0.72
Dicranota sp.	9	0.72
Piscicola geometra (L.)	9	0.72
Coenagriidae indet	9	0.72
Nemurella picteti Klapalek	9	0.72
Oulimnius tuberculatus (Muller)	9	0.72
Valvata cristata Muller	9	0.72
Bathyomphalus contortus (L.)	8	0.64
Odontocerum albicorne (Scopoli)	8	0.64
Orthoclaadiinae	8	0.64
Hydropsyche sp.	8	0.64

Table 11 continued

Species	n	% of missed species in 1997 audit
<i>Isoperla grammatica</i> (Poda)	8	0.64
<i>Agapetus</i> sp.	8	0.64
<i>Anisus vortex</i> (L.)	8	0.64
<i>Goera pilosa</i> (Fabricius)	7	0.56
<i>Gammarus pulex</i> (L.)	7	0.56
<i>Erpobdellidae</i> indet	7	0.56
<i>Nemoura avicularis</i> Morton	7	0.56
<i>Caenis luctuosa</i> group	7	0.56
<i>Amphinemura sulcicollis</i> (Stephens)	7	0.56
<i>Dugesia polychroa</i> group	7	0.56
<i>Armiger crista</i> (L.)	7	0.56
<i>Dryops</i> sp.	7	0.56
<i>Sialis lutaria</i> (L.)	7	0.56
<i>Calopteryx splendens</i> (Harris)	7	0.56
<i>Rhyacophila dorsalis</i> (Curtis)	7	0.56
<i>Acroloxus lacustris</i> (L.)	6	0.48
<i>Baetis rhodani</i> (Pictet)	6	0.48
<i>Lymnaea truncatula</i> (Muller)	6	0.48
<i>Hydropsyche angustipennis</i> (Curtis)	6	0.48
<i>Agabus</i> sp.	6	0.48
<i>Athripsodes bilineatus</i> (L.)	6	0.48
<i>Helobdella stagnalis</i> (L.)	6	0.48
<i>Agraylea multipunctata</i> Curtis	6	0.48
<i>Dugesia tigrina</i> (Girard)	6	0.48
<i>Oxyethira</i> sp.	6	0.48
<i>Athripsodes aterrimus</i> (Stephens)	5	0.40
<i>Tipula</i> (<i>Yamatotipula</i>) <i>montium</i> group	5	0.40
<i>Athripsodes</i> sp.	5	0.40
<i>Erpobdella octoculata</i> (L.)	5	0.40
<i>Silo pallipes</i> (Fabricius)	5	0.40
<i>Oreodytes sanmarkii</i> (Sahlberg)	5	0.40
<i>Gerris</i> (<i>Gerris</i>) <i>lacustris</i> (L.)	5	0.40
<i>Sphaeriidae</i> indet	5	0.40
<i>Tipula</i> sp.	5	0.40
<i>Antocha vitripennis</i> (Meigen)	5	0.40
<i>Chloroperla torrentium</i> (Pictet)	5	0.40
<i>Leuctra fusca</i> (L.)	5	0.40
<i>Hydraena riparia</i> Kugelann	5	0.40
<i>Rhithrogena</i> sp.	5	0.40
<i>Paraleptophlebia</i> sp.	5	0.40
<i>Hydrometra stagnorum</i> (L.)	5	0.40
<i>Leuctra geniculata</i> (Stephens)	4	0.32
<i>Leuctra hippopus</i> (Kempny)	4	0.32

Table 11 continued

Species	n	% of missed species in 1997 audit
<i>Ischnura elegans</i> (Van der Linden)	4	0.32
<i>Athripsodes cinereus</i> (Curtis)	4	0.32
<i>Baetis vernus</i> Curtis	4	0.32
Hydrophilidae indet	4	0.32
<i>Brachycentrus subnubilus</i> Curtis	4	0.32
<i>Brachyptera risi</i> (Morton)	4	0.32
<i>Haliphus fluviatilis</i> Aube	4	0.32
<i>Ceraclea dissimilis</i> (Stephens)	4	0.32
Ancylidae indet	4	0.32
<i>Ecdyonurus</i> sp.	4	0.32
<i>Beraea maurus</i> (Curtis)	4	0.32
<i>Sigara</i> (<i>Sigara</i>) sp.	4	0.32
Tubificidae	4	0.32
<i>Platambus maculatus</i> (L.)	4	0.32
Tanypodinae	4	0.32
<i>Taeniopteryx nebulosa</i> (L.)	4	0.32
<i>Polycentropus flavomaculatus</i> (Pictet)	4	0.32
<i>Psychomyia pusilla</i> (Fabricius)	4	0.32
<i>Simulium</i> (<i>Nevermannia</i>) <i>cryophilum</i> group	4	0.32
Scirtidae indet	4	0.32
<i>Lymnaea stagnalis</i> (L.)	4	0.32
<i>Silo nigricornis</i> (Pictet)	4	0.32
<i>Crangonyx pseudogracilis</i> Bousfield	3	0.24
<i>Caenis horaria</i> (L.)	3	0.24
<i>Helophorus</i> (<i>Helophorus</i>) <i>obscurus</i> Mulsant	3	0.24
<i>Pyrrhosoma nymphula</i> (Sulzer)	3	0.24
<i>Cloeon dipterum</i> (L.)	3	0.24
<i>Habrophlebia fusca</i> (Curtis)	3	0.24
<i>Crunoecia irrorata</i> (Curtis)	3	0.24
<i>Glossosoma</i> sp.	3	0.24
Polycentropodidae indet	3	0.24
<i>Ephemera danica</i> Muller	3	0.24
<i>Gammarus</i> sp.	3	0.24
<i>Physa</i> sp.	3	0.24
<i>Esolus parallelepipedus</i> (Muller)	3	0.24
<i>Haliphus lineatocollis</i> (Marshall)	3	0.24
<i>Simulium</i> (<i>Eusimulium</i>) <i>aureum</i> group	3	0.24
<i>Adicella reducta</i> (McLachlan)	3	0.24
<i>Limnephilus lunatus</i> Curtis	3	0.24
Leptophlebiidae indet	3	0.24
<i>Leuctra</i> sp.	3	0.24
<i>Nemoura cambrica</i> group	3	0.24

Table 11 continued

Species	n	% of missed species in 1997 audit
Simulium (Boophthora) erythrocephalum (de Geer)	3	0.24
Simulium (Wilhelmia) sp.	3	0.24
Athripsodes albifrons (L.)	3	0.24
Simulium (Simulium) argyreatum group	3	0.24
Cyrnus trimaculatus (Curtis)	2	0.16
Asellus meridianus Racovitza	2	0.16
Protonemura praecox (Morton)	2	0.16
Crenobia alpina (Dana)	2	0.16
Ecclisopteryx guttulata (Pictet)	2	0.16
Anisus sp.	2	0.16
Tanytarsini	2	0.16
Protonemura meyeri (Pictet)	2	0.16
Brychius elevatus (Panzer)	2	0.16
Corixidae indet	2	0.16
Beraeodes minutus (L.)	2	0.16
Protonemura sp.	2	0.16
Simulium (Wilhelmia) equinum (L.)	2	0.16
Simulium (Nevermannia) angustitarse group	2	0.16
Chironomini	2	0.16
Rhyacophila sp.	2	0.16
Baetis scambus group	2	0.16
Riolus subviolaceus (Muller)	2	0.16
Polycentropus sp.	2	0.16
Silo sp.	2	0.16
Sigara sp.	2	0.16
Bithynia tentaculata (L.)	2	0.16
Athripsodes albifrons/bilineatus	2	0.16
Ochthebius bicolon Germar	2	0.16
Libellulidae indet	2	0.16
Lumbricidae	2	0.16
Molanna angustata Curtis	2	0.16
Molophilus sp.	2	0.16
Mystacides nigra/longicornis	2	0.16
Naididae	2	0.16
Nemoura cinerea (Retzius)	2	0.16
Notonecta sp.	2	0.16
Hippeutis complanatus (L.)	2	0.16
Oecetis lacustris (Pictet)	2	0.16
Helius sp.	2	0.16
Haliphus wehncke (Gerhardt)	2	0.16
Paraleptophlebia submarginata (Stephens)	2	0.16
Perlodes microcephala (Pictet)	2	0.16

Table 11 continued

Species	n	% of missed species in 1997 audit
Gerris (Gerris) sp.	2	0.16
Gerris (Gerris) gibbifer Schummel	2	0.16
Physa acuta group	2	0.16
Gerris sp.	2	0.16
Ephemera sp.	1	0.08
Enchytraeidae	1	0.08
Baetis sp.	1	0.08
Diamesinae	1	0.08
Laccobius (Macrolaccobius) sinuatus/striatulus	1	0.08
Laccobius sp.	1	0.08
Lasiocephala basalis/Lepidostoma hirtum	1	0.08
Lymnaea sp.	1	0.08
Lymnaea palustris (Muller)	1	0.08
Lumbriculidae	1	0.08
Simulium sp.	1	0.08
Phagocata vitta (Duges)	1	0.08
Anodonta cygnea (L.)	1	0.08
Ochthebius minimus (Fabricius)	1	0.08
Leuctra inermis Kempny	1	0.08
Anisus leucostoma (Millet)	1	0.08
Plea leachi McGregor & Kirkaldy	1	0.08
Limonia sp.	1	0.08
Anacaena globulus (Paykull)	1	0.08
Anacaena bipustulata (Marsham)	1	0.08
Anabolia nervosa (Curtis)	1	0.08
Tinodes assimilis/machlachlani	1	0.08
Tipula (Acutipula) maxima/fulvipennis	1	0.08
Tipula (Tipula) paludosa Meigen	1	0.08
Limnephilus marmoratus Curtis	1	0.08
Agabus didymus (Olivier)	1	0.08
Limnephilus politus/rhombicus	1	0.08
Sphaerium sp.	1	0.08
Helophorus (Meghelophorus) grandis Illiger	1	0.08
Drusus annulatus/Ecclisopteryx guttulata	1	0.08
Gyrinus sp.	1	0.08
Corophium lacustre Vanhoffen	1	0.08
Haliplidae indet	1	0.08
Pedicia (Pedicia) rivosa (L.)	1	0.08
Prodiamesinae	1	0.08
Chloroperla tripunctata (Scopoli)	1	0.08
Potamophylax rotundipennis (Brauer)	1	0.08
Potamophylax latipennis (Curtis)	1	0.08

Table 11 continued

Species	n	% of missed species in 1997 audit
Oreodytes septentrionalis (Sahlberg)	1	0.08
Wormaldia sp.	1	0.08
Hydropsychidae indet	1	0.08
Glossiphonia heteroclita (L.)	1	0.08
Caenis pusilla Navas	1	0.08
Heptagenia lateralis (Curtis)	1	0.08
Heptagenia sulphurea (Muller)	1	0.08
Glyphotaelius pellucidus (Retzius)	1	0.08
Planaria torva (Muller)	1	0.08
Limnephilus sp.	1	0.08
Dytiscidae indet	1	0.08
Bithynia leachii (Sheppard)	1	0.08
Nepa cinerea L.	1	0.08
Beraea pullata (Curtis)	1	0.08
Ecnomus tenellus (Rambur)	1	0.08
Hydropsyche pellucidula (Curtis)	1	0.08
Phryganea sp.	1	0.08
Centroptilum luteolum (Muller)	1	0.08
Total	1258	100

APPENDIX

Results of individual sample audits

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: Dumfries

DATE: 28/01/98

WATER-
COURSE: Water of Ae

PRIMARY
ANALYST: AB

AQC
ANALYST:

SITE: Ae Valley Fish Farm

CODE:

SORT/AQC
METHOD: Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0

GAINS 0

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

1 No representative of family in vial

5 Specimen dead at time of sampling

9 Taxon missed in sorting

2 Alternative terrestrial specimen in vial

6 Taxon in vial but not recorded

10 Unexplained error

3 Posterior end only in vial

7 Mis-identification

11 Taxon added in internal AQC

4 Empty shell or case or cast skin in vial

8 Typographical error - wrong box ticked

12 Recorded taxon that was rejected by AQC analyst

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

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: Dumfries

DATE: 20/01/98

WATER-

COURSE: Caldots Burn

PRIMARY

ANALYST: BR

AQC

ANALYST:

SITE: Site 1 (w/s)

CODE:

SORT/AQC

METHOD: Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0

GAINS 0

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: Dumfries

DATE: 07/08/97

WATER-
COURSE: Annan

PRIMARY
ANALYST: ML

AQC
ANALYST:

SITE: Johnstonebridge S/T

CODE:

SORT/AQC
METHOD: Not known

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0 GAINS 0 OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

- 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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: Dumfries

DATE: 31/10/97

WATER-
COURSE: Perceiving Burn

PRIMARY
ANALYST: ML

AQC
ANALYST:

SITE: Bankhill S/W

CODE:

SORT/AQC
METHOD: Not known

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0

GAINS 0

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

1 No representative of family in vial

5 Specimen dead at time of sampling

9 Taxon missed in sorting

2 Alternative terrestrial specimen in vial

6 Taxon in vial but not recorded

10 Unexplained error

3 Posterior end only in vial

7 Mis-identification

11 Taxon added in internal AQC

4 Empty shell or case or cast skin in vial

8 Typographical error - wrong box ticked

12 Recorded taxon that was rejected by AQC analyst

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

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 25/06/97

WATER-
COURSE: Abhainn Srathain

PRIMARY
ANALYST: AM

AQC
ANALYST:

SITE: u/s Fish Farm

CODE: 97/543

SORT/AQC
METHOD: Preserved/Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Oligochaeta	9
Lumbricidae	
Naididae	
Heptageniidae	9
Rhithrogena sp. 1 only	

SUMMARY OF AUDIT

LOSSES 0

GAINS 2

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 11

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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 22/05/97

WATER-
COURSE: Leven

PRIMARY
ANALYST: AM

AQC
ANALYST:

SITE: Renton

CODE: 97/363

SORT/AQC
METHOD: Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

Dendrocoelidae	6
Dendrocoelum lacteum (Muller) 1 only	
Planariidae (incl. Dugesiidae)	6
Planaria torva (Muller)	
Polycelis nigra group	

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Gammaridae (incl. Crangonyctidae)	9
Gammarus pulex (L.) 1 only	
Rhyacophilidae (incl. Glossosomatidae)	9
Agapetus sp. 1 only	
Psychomyiidae (incl. Ecnomidae)	9
Lype sp.	
Tinodes waeneri (L.)	
Sericostomatidae	9
Sericostoma personatum (Spence) 1 only	
Leptoceridae	9
Athripsodes albifrons (L.)	
Ceraclea dissimilis (Stephens)	
Mystacides azurea (L.)	

SUMMARY OF AUDIT

LOSSES 0 GAINS 7 OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 51
ON NO. OF TAXA 7

- | | | |
|--|--|--|
| 1 No representative of family in vial | 5 Specimen dead at time of sampling | 9 Taxon missed in sorting |
| 2 Alternative terrestrial specimen in vial | 6 Taxon in vial but not recorded | 10 Unexplained error |
| 3 Posterior end only in vial | 7 Mis-identification | 11 Taxon added in internal AQC |
| 4 Empty shell or case or cast skin in vial | 8 Typographical error - wrong box ticked | 12 Recorded taxon that was rejected by AQC analyst |

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

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 23/01/97

WATER-
COURSE: Cameron Burn

PRIMARY
ANALYST: KA

AQC
ANALYST:

SITE: Luggie confluence

CODE: 97/71

SORT/AQC
METHOD: Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0 GAINS 0 OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

1 No representative of family in vial

5 Specimen dead at time of sampling

9 Taxon missed in sorting

2 Alternative terrestrial specimen in vial

6 Taxon in vial but not recorded

10 Unexplained error

3 Posterior end only in vial

7 Mis-identification

11 Taxon added in internal AQC

4 Empty shell or case or cast skin in vial

8 Typographical error - wrong box ticked

12 Recorded taxon that was rejected by AQC analyst

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

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 11/09/97

WATER-

COURSE: Ebroch Burn

PRIMARY

ANALYST: KA

AQC

ANALYST:

SITE: u/s Stirling Road

CODE: 97/826

SORT/AQC

METHOD: Preserved/Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Nemouridae

9

Protonemura sp. (juv) 1 only

SUMMARY OF AUDIT

LOSSES 0

GAINS 1

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 7

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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: Dumfries

DATE: 30/01/97

WATER-
COURSE: Little Eachaig

PRIMARY
ANALYST: LM

AQC
ANALYST:

SITE: u/s Dalinlongart Tip

CODE: 97/119

SORT/AQC

METHOD: Preserved/Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

Leptophlebiidae

1

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Chironomidae

9

Tanytarsini 1 only

SUMMARY OF AUDIT

LOSSES 1

GAINS 1

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE -8

ON NO. OF TAXA 0

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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 24/10/97

WATER-
COURSE: Gryfe

PRIMARY
ANALYST: LM

AQC
ANALYST:

SITE: High Mathernock

CODE: 97/1007

SORT/AQC
METHOD: Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Hydrophilidae (incl. Hydraenidae) 9

Hydraena gracilis Germar (a)

Lepidostomatidae 9

Lepidostoma hirtum (Fabricius) 1 only

SUMMARY OF AUDIT

LOSSES 0

GAINS 2

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 15

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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West
WATER-
COURSE: Bothlin Burn
SITE: Muirhead

LABORATORY: East Kilbride
PRIMARY
ANALYST: MC
CODE: 97/72

DATE: 23/01/97
AQC
ANALYST:
SORT/AQC
METHOD: Preserved/Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Nemouridae

9

Nemoura cinerea (Retzius) 1 only

SUMMARY OF AUDIT

LOSSES 0 GAINS 1 OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 7
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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 28/05/97

WATER-
COURSE: Avon Water

PRIMARY
ANALYST: MC

AQC
ANALYST:

SITE: Haughead

CODE: 97/367

SORT/AQC
METHOD: Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Planorbidae	9
Bathyomphalus contortus (L.) 1 only	
Elmidae	9
Limnius volckmari (Panzer) (l)	

SUMMARY OF AUDIT

LOSSES 0

GAINS 2

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 8

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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 21/03/97

WATER-
COURSE: Fyne

PRIMARY
ANALYST: MT

AQC
ANALYST:

SITE: A83 Old Bridge

CODE: 97/191

SORT/AQC
METHOD: Preserved/Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0

GAINS 0

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

- 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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 03/06/97

WATER-
COURSE: Gower Water

PRIMARY
ANALYST: MT

AQC
ANALYST:

SITE: Bransfield Bridge

CODE: 97/424

SORT/AQC
METHOD: Preserved

RESULTS OF AUDIT

Family name

Presumed
cause of error
(see footnotes)

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0

GAINS 0

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

- 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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 29/01/97

WATER-
COURSE: Clyde

PRIMARY
ANALYST: RW

AQC
ANALYST:

SITE: Motherwell Bridge

CODE: 97/105

SORT/AQC
METHOD: Preserved/Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0

GAINS 0

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

- 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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 19/09/97

WATER-
COURSE: Irvine

PRIMARY
ANALYST: RW

AQC
ANALYST:

SITE: Gatehead

CODE: 97/850

SORT/AQC
METHOD: Preserved

RESULTS OF AUDIT

Family name

Presumed
cause of error
(see footnotes)

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Hydrophilidae (incl. Hydraenidae)

Hydrophilidae indet (l) 1 only

9

SUMMARY OF AUDIT

LOSSES 0

GAINS 1

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 5

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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 25/09/96

WATER-
COURSE: Nell/Feochan

PRIMARY
ANALYST: SC

AQC
ANALYST:

SITE: d/s Fish Farm

CODE: 96/596

SORT/AQC

METHOD: Preserved/Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Rhyacophilidae (incl. Glossosomatidae) 9

Rhyacophila sp. (juv)

Polycentropodidae 9

Polycentropodidae indet (juv)

SUMMARY OF AUDIT

LOSSES 0

GAINS 2

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 14

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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 30/01/97

WATER-
COURSE: Glentarsan Burn

PRIMARY
ANALYST: SC

AQC
ANALYST:

SITE: d/s Fish Farm

CODE: 97/118

SORT/AQC
METHOD: Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
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VIAL

BMWP taxa not found in vial

Hydropsychidae *

1

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

Ancylidae (incl. Acroloxidae)

9

Ancyclus fluviatilis Muller 1 only

Hydropsychidae *

1

Hydropsyche sp. (juv)

SUMMARY OF AUDIT

LOSSES 0

GAINS 1

OMISSIONS: 1

NET EFFECTS:

ON BMWP SCORE 6

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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 15/05/97

WATER-
COURSE: Kittoch Water

PRIMARY
ANALYST: SD

AQC
ANALYST:

SITE: B759 Bridge

CODE: 97/314

SORT/AQC

METHOD: Preserved/Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0

GAINS 0

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

- 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 IFE in sample (no net loss or gain)

EXTERNAL AUDIT OF BIOLOGICAL SAMPLES

REGION: SEPA West

LABORATORY: East Kilbride

DATE: 28/05/97

WATER-
COURSE: Ayr

PRIMARY
ANALYST: SD

AQC
ANALYST:

SITE: Mainholm Ford

CODE: 97/377

SORT/AQC
METHOD: Preserved

RESULTS OF AUDIT

Family name	Presumed cause of error (see footnotes)
-------------	---

VIAL

BMWP taxa not found in vial

None

Additional BMWP taxa found in vial

None

SAMPLE

BMWP taxa not found in sample (For samples where vial is broken or absent)

N/a

Additional BMWP taxa found in sample

None

SUMMARY OF AUDIT

LOSSES 0

GAINS 0

OMISSIONS: 0

NET EFFECTS:

ON BMWP SCORE 0

ON NO. OF TAXA 0

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 IFE in sample (no net loss or gain)

**Centre for
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