CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

INTERNATIONAL CO-OPERATIVE PROGRAMME ON ASSESSMENT AND MONITORING OF ACIDIFICATION OF RIVERS AND LAKES

Intercalibration of Invertebrate Fauna 9301

Prepared by the Programme Centre,
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ABSTRACT:
Eleven laboratories in seven countries participated in the first intercalibration on the invertebrate fauna. Compared with general accuracies of 20% the identification of the fauna was very good. For the whole material the mean fault percent was 4, but misidentifications in different groups could be higher. The quality of the identifications fulfil the demands for estimating the acidification index.

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1. INTRODUCTION

At the 7th task force meeting of the International Co-operative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes in Galway, Ireland, it was decided to start intercalibration of biological material. The difficulties with this type of intercalibration is that the flora and fauna can vary considerably between different regions/countries. Due to this standardized biological samples will not test how competent the participating laboratories are to determine their own fauna, which is the main intention of the biological intercalibration. This fact must be taken into account when the biological testsamples are prepared. To cope with this problem it was decided that each laboratory should send invertebrate samples from their own monitoring sites/region to the Programme Centre. Preparation of the test-samples should then be based on this material and material from the Programme Centre so each laboratory could receive samples relevant for their own region or country. The content of the samples to the various participants have therefore been different, which is in contrast to the practice used in intercalibration of water chemistry.

The quality of the biological material will influence directly on the evaluation of the acidification, based on biological parameters (the Raddum index). The basis for the index is that various species have different tolerance to acidic water (Raddum et al. 1988, Fjellheim and Raddum 1990). For this reason the main goal is to identify organisms to species level, at least for known sensitive invertebrates. Exceptions can be accepted if all species within a higher taxa consist of sensitive species. In these cases identification to the sensitive taxa is sufficient for setting the acidification number.

Aspects about the use of the biological intercalibration can be as follows:

> Give information about the quality of the biological material with respect to evaluation of acidity.

Give general information about the quality of the taxonomic work which will be important for all tests where species richness and structure of the invertebrate community is the parameter.

Give a basis for improving taxonomic work or detect weak fields at the different laboratories.

2. METHODS

2.1. Preparation of the test-samples

The participating laboratories have delivered samples containing 250 to 300 identified invertebrates from their own monitoring sites. The material received from the laboratories made up a large diverse pool of organisms on which the test-samples were prepared. Only species on the fauna list of the country of the laboratory were put in the samples.

Our own identification

With reference to chemical test-samples we can not construct biological samples by putting in weighted standardized compounds. When preparing biological samples we must be sure of the species we place in the sample, know the number of individuals and that taxonomic important characteristics of the species are present. To minimize possible fault from us the following procedure have been used:

The species have first been identified by the participating country. Two of us have verified the identification of the species.

The content of the testsamples for each laboratory is decided and listed in a table. Two persons have controlled that the number of species, according to the table are put in the samples.

Each laboratory have received two samples with different content.

Sources of error

During the handling of the invertebrates there is a risk of reducing the quality of the material with respect to taxonomic work. The most susceptible larvae during the processing of samples are the mayflies which easily lose legs and gills, parts that are necessary for identification to species level. The loss of important parts can also occur during transportation. Contamination of larvae can possibly take place both during our work as well as at the participating laboratories. This will result in a wrong number of individuals in the sample compared with the delivery list.

3. RESULTS AND DISCUSSION

3.1 Criteria for evaluation

It is distinguished between right and wrong identifications of genus and species. The purpose of showing the results for both taxonomic levels is to get information about the faults made at these levels. Identification to wrong genus is a more serious fault than determining a wrong species. However, we have not weighted the errors made in this presentation.

Another reason for splitting up the determinations made on species and genus is that identification to species not always have been possible, due to loss of important taxonomic characteristics. This happened often among mayflies and can be illustrated as follows:

> We placed 5 individuals of the species *Leptophlebia vespertina* in the sample and got the result 2 *L. vespertina* and 3 *Leptophlebia sp.* The result is "wrong" compared with what we put in the sample. The laboratory has, however, probably done the best possible determination as the species easily lose legs and gills, parts that are necessary for identification.

Determinations "only" to the genus level were also seen among some small specimens of stoneflies. In these cases the characters of the species are probably present and the identification should have been brought to the species level. However, no faults have been made in these cases.

From the experience mentioned above we have tried to discriminate between shortcoming identification, probably due to damage of the material or poor taxonomic characters and virtual faults; wrong species - or genus name. By shortcoming identification the quality of the biological material will to some extent be reduced, depending on the frequency of this. In this report, however, shortcoming determination is not recorded as a fault. The identification of higher taxa were correctly carried out by all laboratories.

3.2 The identifications

Nine laboratories from seven countries participated in the first intercalibration of invertebrates in 1992. However, some additional laboratories wanted to take part in the test, but was not able to send material within the scheduled time. Two of these laboratories attended in 1993. The results for both 1992 and 1993 is presented in this report.

The content of the test samples delivered - and that identified by the laboratories are shown in Appendix Tables 1 - 15. Figures 1 illustrate correct and wrong identifications of the total material of species and genus. The same is shown for mayflies, stoneflies and caddisflies in Figure 2 - 4.

All laboratories identified a high portion (>89%) of the total number of the genus/species in the samples. In 1992 the average faults was 4 % with mean and maximum of 0 - and 11 %, respectively. In 1993 the corresponding values were 3.4 -,1 - and 11 %, a result practically identical with the previous year.

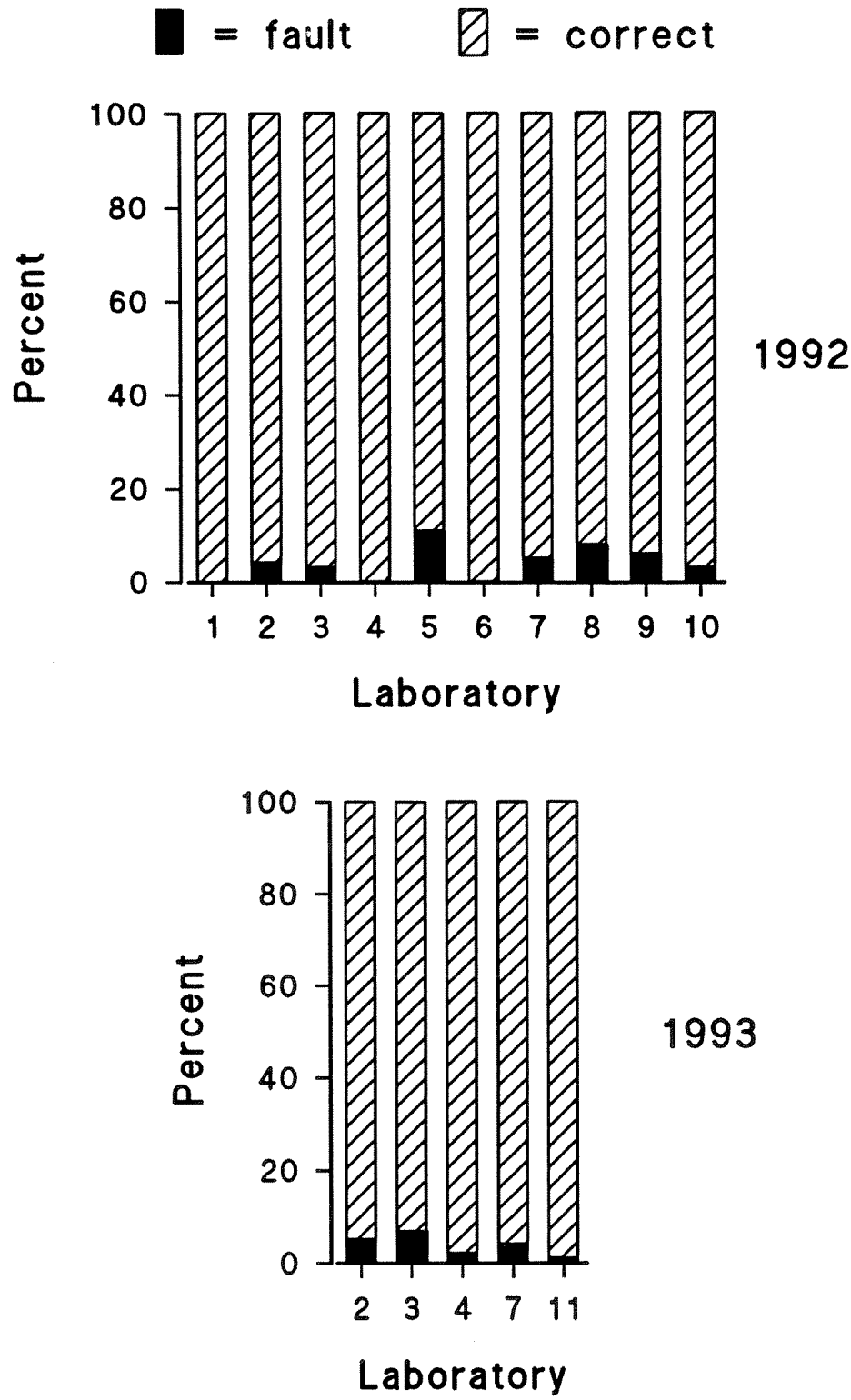

Figure 1. Correct and wrong identifications of the total material at the different laboratories.

The results for the specific groups varied more, Figure 2 - 4. The laboratories identified mayflies very well, but short coming determinations were in some cases relatively high. This can be seen by looking at laboratories with no faults, but reduced number (< 100 %) of correct identified species.

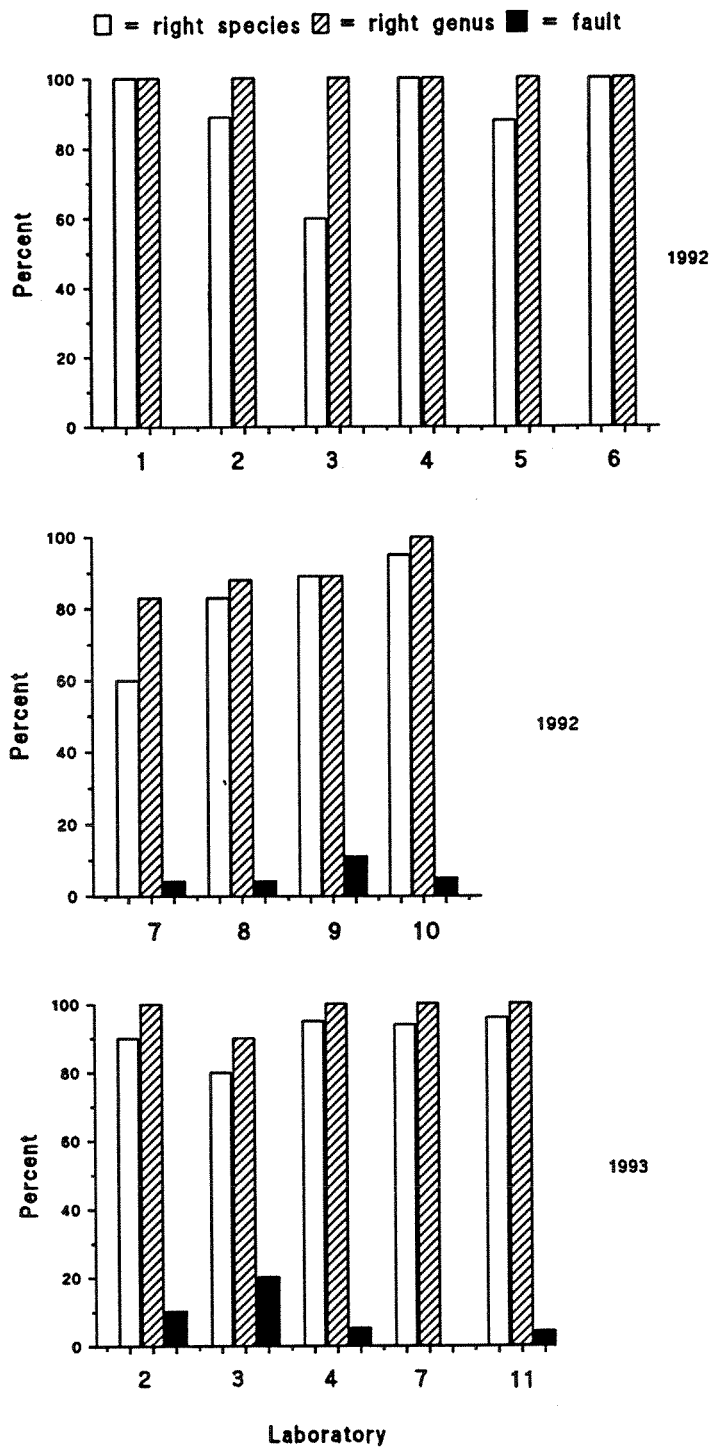

Figure 2. Right and wrong identifications of mayflies at the different laboratories.

The errors made in determination of stoneflies were in contrast to the mayflies, only at species level. At some laboratories the determination were just carried out at genus level in cases where species determination was expected. This was mostly seen among the leuctrids and nemourids. However, there are no known sensitive species among these stoneflies so shortcoming identification will not influence on the acidification index.

Species determination of the caddiesflies was in general good. One laboratory had a low number of correct species/genus in 1992, but this was based on few animals. In 1993 only one laboratory had misidentifications, while the others had proper determinations of species/genus. Shortcoming identifications were, however, also recorded in this group.

Other sensitive and tolerant species

A low number of sensitive as well as tolerant species belonging to other taxa than mentioned above, were included in the samples. No mistake were made, either regarding genus or species on these invertebrates, but shortcoming determinations were recorded.

Compared with the fault margin of 20 % of the intercalibration of water chemistry the results is fairly good. Further the estimations of the acidification index, based on the identifications of the laboratories and the material placed in the test-samples were identical in 21 of 22 samples (Fig. 5). The explanation for this is that the index is based on common and well known species which had the lowest fault percent. The misidentifications usually occur among rare species or species that seldom are important for the evaluation of the acidification index. The divergence of the score in one sample was due to the record of one sensitive larvae which was "not placed in the sample". The presence of the species can probably be explained by contamination during the processing of this sample which was intended to contain invertebrates typical for a moderately acidic site. However, the registration of the sensitive species lead in this case to the divergence as mentioned. To cope with faults like this, two individuals should be required of a common sensitive species for stating the acidity.

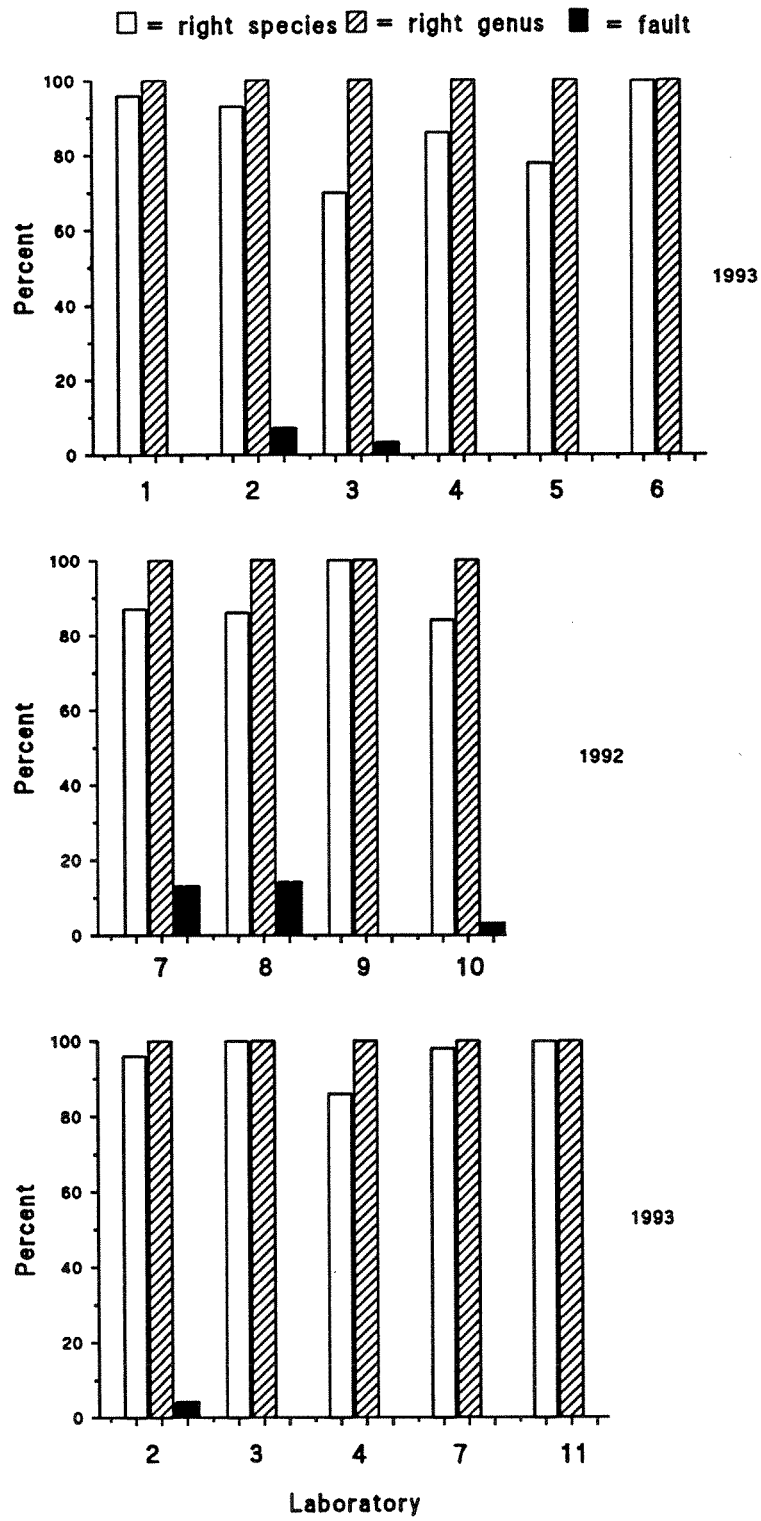

Figure 3. Right and wrong identifications of stoneflies at the different laboratories.

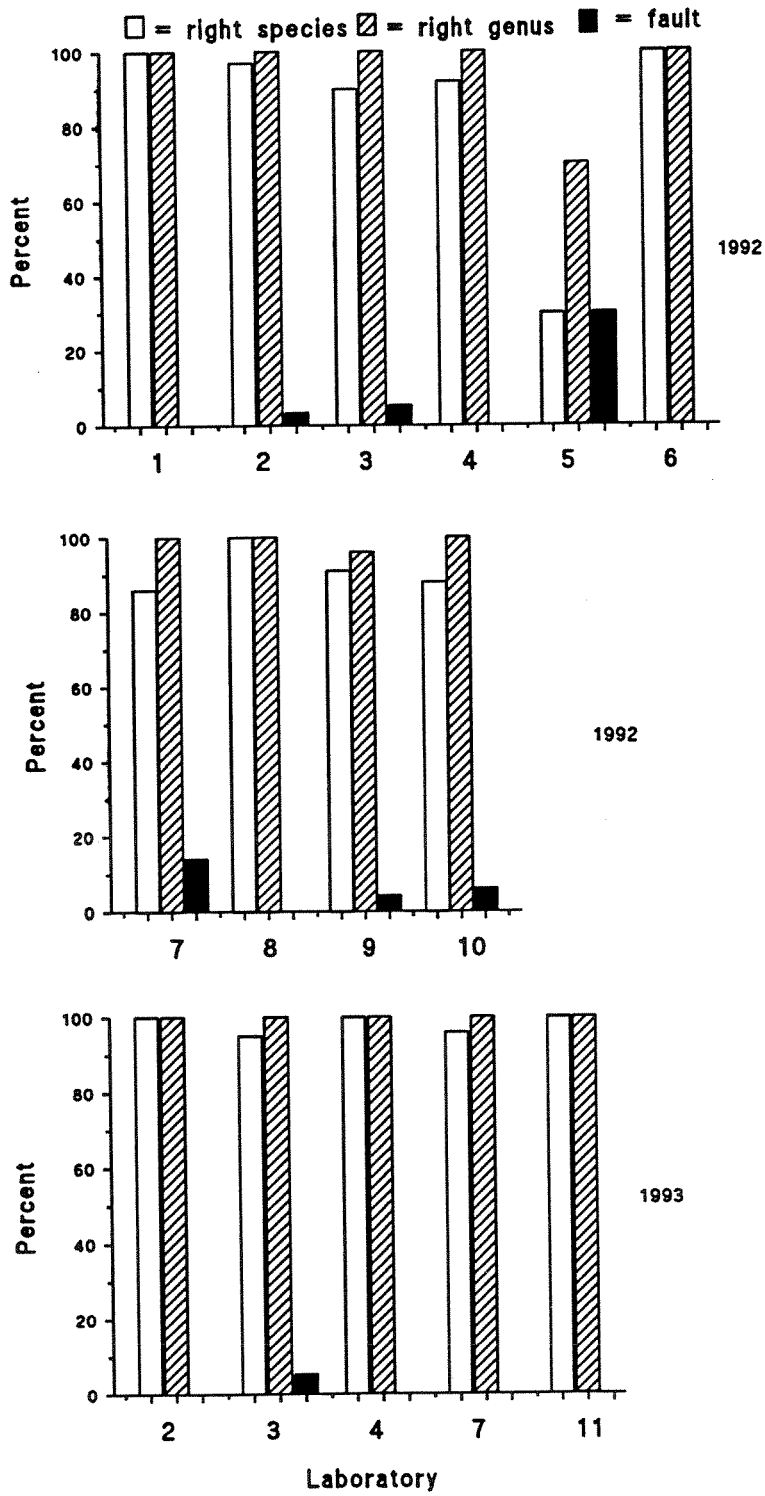

Figure 4. Right and wrong identifications of caddisflies at the different laboratories.

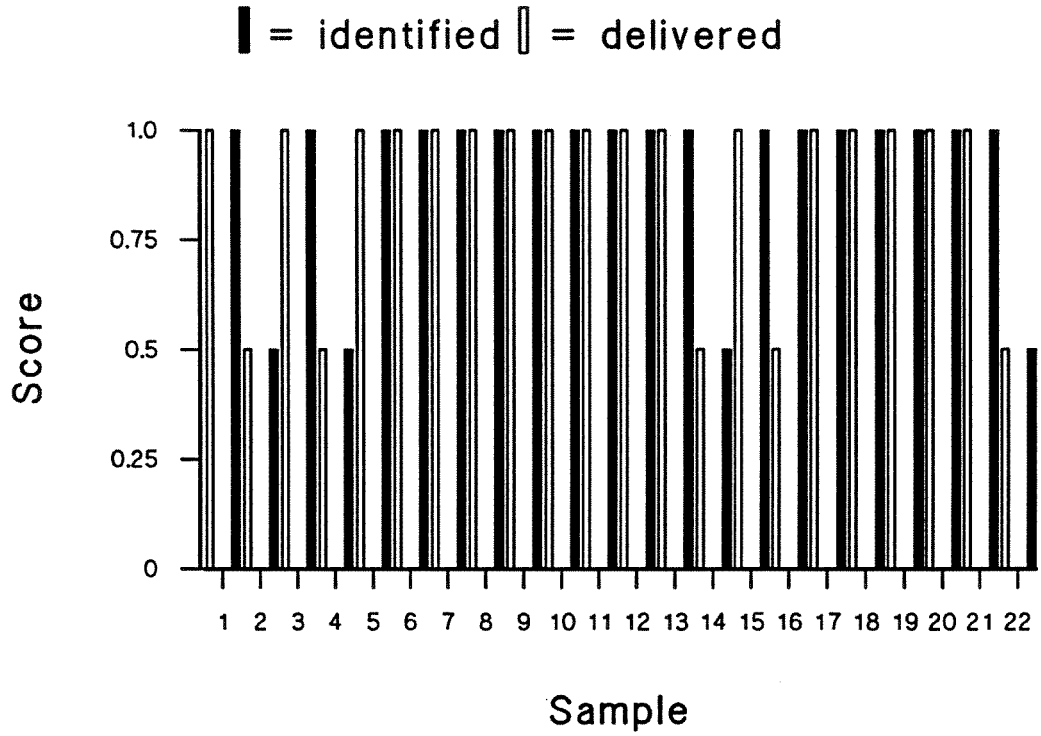

Figure 5. Comparison of the acidification score based on delivered and identified species.

The mean acidification score based on the delivered samples and the determinations was 0.91 and 0.93, respectively, a good agreement. However, the question is if the taxonomic work is acceptable for biological work in general as the database most probably will be used in different models. We know that many biological tests are more sensitive to the quality of the taxonomy than the acidification index. Further development of the index will also increase the demand to the taxonomic work. At the moment we propose that misidentifications should not exceed 5 - 10%. Compared with this range, the results of the intercalibration of biological material were generally good.

4. EVALUATION

The quality of the biological material based on the present intercalibration seems to be generally good and suitable for evaluation of the acidification. The tests included, however, only a part of the species listed for the different countries. Reservations must therefore be taken regarding the quality for any part of the fauna. In future tests it will be

important to cover as much as possible of the whole fauna. Through this a real quality of the biological data can be stated.

The quality of biological material used in models assessing effects on the ecosystem, must in most cases be of high quality. Models dealing with inferred pH are based on species composition, and will solely rely on the quality of the determinations. The need for high quality of biological material is expected to increase and intercalibration exercises will be one important tool for keeping a high taxonomic standard.

5. REFERENCES

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Appendix I (1992)

APPENDIX TABLES

Each participating laboratory is identified by a number. Laboratory number is identical with Table number.

Laboratory 1, 1992.

Species	Sample 1 Deliv.	Sample 1 Ident.	Sample 2 Deliv.	Sample 2 Ident
CRUSTACEA				
Gammarus pulex (L)	2	2		
HIRUDINEA				
Glossiphonia complanata	1	1		
EPHEMEROPTERA				
Baetis muticus(L)	2	1		
Baetis rhodani (Pictet)	8	8		
Heptagenia sulphurea (Müller)			3	3
H. dalecarlica (Bengtson)	1	1		
Leptophlebia vespertina (L)			4	4
Ephemerella ignita (Poda)	2	2		
Caenis horaria(L)	3	3		
PLECOPTERA				
Diura bicaudata (L)	1	1	1	1
Diura nanseni (Klapalek)	1	1	2	2
Brachyptera risi (Morton)	8	8	12	12
Amphinemura borealis (Morton)			5	5
A. sulcicollis (Stephens)			4	4
Nemoura avicularis (Morton)			2	2
Nemoura cinerea (Retzius)	2	2	1	1
Nemoura flexuosa (Aubert)	2	2	2	2
Nemoura sp.juv.	1	0		
Nemurella picteti (Klapalek)			3	3
Protonemura intricata (Ris)	1	0		
Protonemura meyeri (Pictet)			4	4
Leuctra fusca(L)	4	4		
MEGALOPTERA AND COLEOPTERA				
Sialis fuliginosa (Pictet)			2	2
Stenelmis canaliculata (Gyllen)	3	3		
Oulimnius tubercul.(P.W.Muller)			5	5
Limnius volckmari (Panzer)	3	3	3	3
TRICHOPTERA				
Rhyacophila fasciata (Hagen)	3	3		
R. nubila (Zettersted)	3	3		
Ithytrichia lamellaris (Eaton)	2	2	2	2
Philopot. montanus (Donovan)	1	1	1	1
Plectroc. conspersa (Curtis)			2	2
Polycentr. flavomacul.(Pictet)			5	5
Polycentr. irroratus (Curtis)	1	1	2	2
Hydropsyche angust. (Curtis)	1	1		
H. pellucidula (Curtis)			3	3
Micrasema gelidum (McLachlan)	3	3		
Lepidostoma hirtum (Fabricius	2	2		
Molanna angustata (Curtis)			1	1
LAMELLIBRANCHIATA				
Sphaerium corneum (L)	1	1		

Laboratory 2, 1992.

Species	Sample 3 Deliv.	Sample 3 Ident.	Sample 4 Deliv.	Sample 4 Ident.
EPHEMEROPTERA				
Baetis rhodani	18	15		
Baetis sp.	0	2		
Caenis horaria	2	2		
Caenis luctuosa	1	1		
Ephemerella aurivilli	3	3		
Ephemerella ignita	1	1		
Ephemerella mucronata	1	1		
Heptagenia dalecarlica	2	2		
Heptagenia fuscogrisea			4	4
Leptophlebia marginata			4	3
Leptophlebia sp.			0	1
Metretopus borealis	2	2		
PLECOPTERA				
Amphinemura borealis	6	6	3	3
Brachyptera risi	5	5	8	8
Capnopsis schilleri	0	3		
Diura nanseni	2	2		
Leuctra digitata			0	3
Leuctra fusca	3	4		
Leuctra nigra			3	0
Nemoura cinerea	4	4	2	2
Siphonoperla burmeisteri	5	4		
TRICHOPTERA				
Arctopsyche ladogensis	1	1		
Cyrnus flavidus			2	2
Cheumatopsyche lepida			4	4
Hydropsyche pellucidula			0	1
Hydropsyche siltalai			1	0
Lepidostoma hirtum	2	1		
Neureclipsis bimaculata	1	1	5	2
Plectrocnemia conspersa			10	12
Polycentropus flavomaculatus	8	7	5	4
DIPTERA				
Chaoborus flavicans			3	3
Lauterborniella agrayloides			2	2
Sergentia coracina			1	1
Zalutschia zalutschicola			4	4
COLEOPTERA				
Elmis aenea			2	2

Laboratory 3, 1992.

Species	Sample 5 Deliv.	Sample 5 Ident.	Sample 6 Deliv.	Sample 6 Ident.
EPHEMEROPTERA				
Baetis rhodani	5	3	5	3
Baetis sp.	0	2	0	2
PLECOPTERA				
Amphinemura sulcicollis	2	2	1	1
Brachyptera risi	3	2	1	1
Brachyptera seticornis	1	1	1	1
Capnia sp.	1	1	1	1
Diura bicaudata	2	2		
Leuctra braueri	1	1	1	1
Leuctra fusca	1	0	2	0
Leuctra hippopus	3	0	3	0
Leuctra nigra			0	1
Leuctra sp.	0	4	0	4
Nemoura cinerea	4	0	3	0
Nemoura sp.	0	5	0	4
Nemurella picteti	3	1	1	0
TRICOPTERA				
Apatania fimbriata	1	0	2	0
Apatania sp.	0	1	0	2
Drusus annulatus	2	2		
Hydropsyche saxonica	0	1		
Hydropsyche siltalai	2	2	2	2
Hydropsyche tenuis	1	0		
Rhyacophila glareosa			1	1
Rhyacophila obliterata			3	3
Rhyacophila praemorsa	2	2		
Rhyacophila tristis	1	1		
Silo pallipes			2	2
MOLLUSCA				
Ancylus fluviatilis	1	1	1	1
COLEOPTERA				
Limnius perrisi			2	2

Laboratory 4, 1992.

Species	Sample 7		Sample 8	
	Deliv.	Ident	Deliv.	Ident.
EPHEMEROPTERA				
Ameletus inopinatus	2	2	1	1
Baetis rhodani	5	5	5	5
PLECOPTERA				
Brachyptera risi	4	4	2	2
Brachyptera seticornis			1	1
Capnia bifrons	0	1		
Capnia sp.	1	0	1	1
Diura bicaudata	1	1		
Leuctra nigra	3	3	3	3
Leuctra hippopus	4	0	2	0
Leuctra fusca			2	0
Leutra sp.	0	4	0	4
Nemoura sp.	5	5	4	4
Siphonoperla burmeisteri	2	0		
Siphonoperla sp.	0	2		
TRICHOPTERA				
Ecclisopteryx guttulata	1	1	2	2
Hydropsyche pellucidula	2	1	2	2
Hydropsyche sp.	0	1		
Micrasema longulum			1	1
Micrasema minimum			3	3
Rhyacophila tristis	1	1	1	1
COLEOPTERA				
Limnius sp.	1	1	1	1
CRUSTACEA				
Asellus aquaticus	3	3		

Laboratory 5, 1992.

Species	Sample 9 Deliv.	Sample 9 Ident	Sample 10 Deliv.	Sample 10 Ident
EPHEMEROPTERA				
Baetis alpinus	2	2	1	1
Baetis rhodani	5	0	5	0
Baetis sp.	0	6	0	4
Epeorus sylvicola			2	2
Rhitrogena lobata	1	1		
PLECOPTERA				
Amphinemura sulcicollis	1	0	1	0
Amphinemura sp.	0	1	0	1
Brachyptera risi	4	5	3	3
Capnia cf nigra	1	1		
Capnia sp.			1	1
Diura bicaudata	4	4		
Leuctra fusca	4	0	2	0
Leuctra hippopus	5	0	2	0
Leuctra sp.	0	9	0	4
Nemoura sp.	4	4	4	4
Siphonoperla burmeisteri			1	0
Siphonoperla sp.			0	1
TRICHOPTERA				
Drusus chrysotus			2	0
Trichoptera indet	0	1	0	2
Hydropsyche sp.	0	1	0	1
Hydropsyche siltalai	2	1		
Hydropsyche tenuis			1	0
Micrasema longulum	1	2		
Notidobia ciliaris	0	2		
Sericostoma personatum	2	0		
Rhyacophila glareosa	1	0		
Rhyacophila tristis			1	0
Hyporhyacophila sp.			0	1
CRUSTACEA				
Asellus aquaticus	2	2		
MOLLUSCA				
Ancylus fluviatilis	1	1	1	1

Laboratory 6, 1992.

Species	Sample 11 Deliv.	Ident	Sample 12 Deliv.	Ident
EPHEMEROPTERA				
Caenis diminuta	9	9		
Ephemera simulans	8	8		
Stenonema femoratum	7	7		
Stenacron interp.canadense			3	3
PLECOPTERA				
Acroneuria lycorias	1	1		
TRICHOPTERA				
Mystacides sepulchralis	3	3	3	3
Oecetis sp.	2	2	3	3
Polycentropus sp.			3	3
CHIRONOMIDAE				
Conchapelopia cutrani			5	5
Chaoborus flavicans	3	4	3	3
Chaoborus punctipennis			5	5
Chironomus longipes	3	3	7	8
Dicrotendipes modestus	0	1	0	1
Dicrotendipes tritomus			0	1
Heterotrissocladius maeaeri	4	4	6	6
Pagastiella ostansa			5	5
Sergentia coracina	8	6	10	9
Tribelos jucundum	5	4	5	4
CRUSTACEA				
Crangonix lauteriana	3	3	5	6
Diporeia hoyi			8	7
Hyalella azteca			6	6
Leptodora kindtii	2	2		
Mysis relicta			10	10
Orconectes virilis	1	1		
GASTROPODA				
Planorbella corpulenta	2	2		
Physella girina	1	1		
BIVALVIA				
Pisidium sp.	2	2	10	10
COLEOPTERA				
Ectopria nervosa			1	1
Hydroporus undulatus	3	3	4	4
HIRUDINEA				
Erpobdella punctata	1	1		
OTHERS				
Gombus exilis			7	7
Notonecta undulata			1	1

Laboratory 7, 1992.

Species	Sample 13 Deliv.	Ident	Sample 14 Deliv.	Ident
EPHEMEROPTERA				
Baetis rhodani	9	10		
Caenis luctuosa	2	2	1	0
Ephemeroptera indet	0	1	0	4
Leptophlebia vespertina			5	0
Heptagenia fuscogrisea	2	0		
Heptagenia sp.	0	1		
Heptagenia sulphurea	1	1	1	1
Paraleptophlebia werneri			0	1
Rhithrogena semicolorata	2	2		
PLECOPTERA				
Amphinemura sulcicollis	2	2	2	2
Brachyptera risi			2	2
Chloroperla tripunctata	0	2	0	3
Chloroperla bipunctata	3	0	3	0
Isoperla grammatica	2	2	3	3
Leuctra hippopus	2	2	3	3
Protonemura meyeri	5	5		
Siphonoperla torrentium	2	2	2	2
TRICHOPTERA				
Hydropsyche siltalai	3	3	2	2
Lepidostoma hirtum			1	1
Plectrocnemia conspersa	1	1		
Polycentropus flavomaculatus	0	3	4	1
Polycentropus kingi	3	1	0	3
Rhyacophila dorsalis			2	2
Sericostoma personatum	2	2		
COLEOPTERA				
Limnius volckmari	5	5	5	5
CRUSTACEA				
Gammarus duebeni	1	1		
MOLLUSCA				
Lymnaea peregra	1	1		

Laboratory 8, 1992.

Species	Sample 15 Deliv.	Ident	Sample 16 Deliv.	Ident
EFHEMEROPTERA				
Baetis rhodani	8	8	0	1
Heptagenia fuscogrisea	1	1		
Heptagenia sulphurea			5	5
Leptophlebia vespertina	4	4	6	2
Paraleptophlebia werneri			0	3
PLECOPTERA				
Amphinemuna borealis	5	0	5	0
Amphinemura standfussi	0	5	0	6
Amphinemura sulcicollis	5	4	5	4
Brachyptera risi			5	5
Leuctra fusca	3	3	4	4
Leuctra hippopus	6	6	7	7
Leuctra nigra	4	4	4	4
Nemoura flexuosa			5	5
Nemurella picteti	3	3	1	1
TRICHOPTERA				
Agapetus fuscipes	3	3		
Bachycentrus maculatum	2	2	2	2
Halesus radiatus	2	2	1	1
Hydropsyche angustipennis			0	1
Hydropsyche siltalai	2	2	3	3
Lepidostoma hirtum	1	1		
Philopotamus montanus	2	2		
Plectrocnemia conspersa			2	2
Potamophylax cingulatus			1	1
Rhyacophila nubila	1	1	4	4
Sericostoma personatum	1	1		
CRUSTACEA				
Gammarus pulex	1	1		
MOLLUSCA				
Anchylus fluviatilis	3	3		
HIRUDINEA				
Dugesia gonocephala	3	3		
MEGALOPTERA				
Sialis lutaria			2	2

Laboratory 9, 1992.

Species	Sample 17 Deliv.	Sample 17 Ident.	Sample 18 Deliv.	Sample 18 Ident.
EPHEMEROPTERA				
Baetis rhodani	9	8		
Caenis horaria			0	2
Caenis sp.	3	3	2	0
Ecdyonurus dispar	1	1	2	2
Ephemerella ignita	4	4	2	2
Habrophlebia fusca	2	0		
Leptophlebidae sp.	0	2		
Rhitrogena semicolorata	2	2		
PLECOPTERA				
Diura sp.	0	1		
Nemurella picteti	1	1	1	1
TRICHOPTERA				
Apatania sp.	3	4	5	7
Glossosomatidae sp.	3	3	2	2
Hydropsyche sp.			2	0
Hydropsyche siltalai			0	2
Lepidostoma hirtum	1	0	1	0
Polycentropus flavomaculatus	2	2	2	2
Rhyacophila septentrionis	1	1	1	1
Sericostomatidae sp.	2	3		
DIPTERA				
Atherix sp.	1	1	0	1
Dicranota sp.			1	0
CHIRONOMIDAE				
Orthocladinae sp.	4	5	0	1
Tanypodinae			3	3
COLEOPTERA				
Dysticidae sp.			2	1
Hydraena sp.			3	3
Potamonectes sp.	0	1		
MEGALOPTERA				
Sialis lutaria			0	2
Sialis sp.			2	0
OLIGOCHAETA				
Lumbriculidae sp.	0	3		
Tubificidae sp.	3	0		
BIVALVIA				
Pisidium sp.			2	2

Laboratory 10, 1992.

Species	Sample 1 Deliv.	Sample 1 Ident	Sample 2 Deliv.	Sample 2 Ident
EPHEMEROPTERA				
Baetis alpinus	0	0	2	2
Baetis rhodani	8	8	0	0
Caenis horaria	2	0	0	0
Caenis luctuosa	0	1	0	0
Caenis sp juv	0	1	0	0
Leptophlebia vespertina	0	0	8	8
PLECOPTERA				
Amphinemura sulcicollis	5	5	4	4
Brachyptera risi	0	0	7	7
Capnia sp	3	0	3	0
Capnia atra	0	3	0	3
Isoperla grammatica	2	0	0	0
Isoperla sp	0	2	0	0
Leuctra nigra	2	1	0	0
Leuctra braueri	0	1	0	0
Leuctra fusca	3	0	3	0
Leuctra sp	0	3	0	3
Nemoura sp	1	1	0	0
Protonemura sp	0	0	1	1
TRICHOPTERA				
Apatania fimbriata	0	0	2	2
Glossosoma conformis	1	1	1	1
Plectrocnemia conspersa	2	2	0	0
Polycentropus flavomaculatus	1	1	5	5
Rhyacophila nubila	2	0	0	0
Rhyacophila dorsalis	0	1	0	0
Rhyacophila sp	0	1	0	0
CRUSTACEA				
Asellus aquaticus	0	0	2	2
Gammarus fossarum	1	1	0	0
Niphargus sp	5	5	3	3
PLATHELMINTHES				
Crenobia alpina	0	0	5	0
Turbellaria	0	0	0	5
CHIRONOMIDAE				
Eukiefferiella claripennis	0	0	3	3
Limnophyes sp	2	2	0	0
Macropelopia nebulosa	2	0	2	0
Macropelopia sp	0	2	0	2
Micropsectra sp	2	2	0	0
Orthocladius frigidus	4	4	2	2

Appendix II (1993)

PARTICIPATING LABORATORIES IN 1993.

Laboratory 2, 1993.

Species	Sample 1 Deliv.	Sample 1 Ident.	Sample 2 Deliv.	Sample 2 Ident
CRUSTACEA				
Gammarus Lacustris	1	1	2	2
EPHEMEROPTERA				
Cloeon dipterum	1	0	0	0
Baetis rhodani (Pictet)	4	4	5	5
Ameletus inopinatus	4	4	2	2
H. dalecarlica (Bengtson)	1	1	0	0
Caenis luctuosa	5	5	1	4
Ephemerella aurivilli	5	4	5	4
Caenis horaria(L)	3	3	3	0
Ephemerella mucronata	0	1	0	1
Heptagenia fuscogrisea	4	1	0	0
Heptagenia sp	0	3	0	0
Heptagenia sulphurea	0	0	1	1
Metretopus borealis	2	2	1	1
PLECOPTERA				
Amphenimura standfussi	1	1	1	1
Diura nanseni (Klapalek)	3	3	3	3
Brachyptera risi (Morton)	4	4	3	3
Amphinemura borealis (Morton)	3	3	2	2
A. sulcicollis (Stephens)	3	3	2	1
Capnia atra	0	0	2	2
Isoperla grammatica	2	2	2	2
Leuctra digitata	3	0	1	0
Leuctra fusca (L)	0	3	0	1
Nemurella picteti (Klapalek)	1	1	3	3
Taeniopteryx nebulosa	3	3	5	5
Leuctra nigra	2	2	4	3
COLEOPTERA				
Elmis aenea	7	7	2	2
TRICHOPTERA				
P.flavomaculatus	5	5	4	4
Neureclipsis bimaculata	2	2	3	3
Cheumatopsyche lepida	2	2	3	3
Lepidostoma hirtum (Fabricius	3	3	1	1
DIPTERA				
Orthocladius saxosus	4	0	2	0
Unident. Orthocladiinae	0	5	0	2
Pagastiella ostausa	3	3	0	0
Nilotanipus Dubius	1	0	2	0
Unident. Tanypodinae	0	1	0	2
Dicrotendipus Nodestus	0	0	4	0
Dicrotendipes sp	0	0	0	4
Pseudochironimus prasinatus	2	2	2	2
Zalutschia zalutschicola	1	1	3	3
Stiloclaudius Montanus	1	0	0	0

Laboratory 3, 1993.

	Sample 1		Sample 2	
Species	Deliv.	Ident	Deliv.	Ident.
EPHEMEROPTERA				
Ameletus inopinatus	1	0	0	0
Baetis alpinus	3	3	0	0
Baetis sp	0	1	0	0
Epeorus sylvicola	0	0	1	1
Ephemerella mucronata	4	1	0	0
Ephemerella notata	0	3	0	0
PLECOPTERA				
Brachyptera seticornis	3	3	0	0
Diura bicaudata	0	0	2	2
TRICHOPTERA				
Apatania of. fimbiata	0	0	2	0
Apatania sp	0	0	0	2
C.maclachlani	2	2	0	0
Drusus annulatus	1	1	1	1
Drusus discolor	1	1	1	1
Glossosoma conformis	2	2	2	2
Hydropsyche instabilis	0	0	1	0
Hydropsyche saxonica	0	0	0	1
Lithax niger	1	1	0	0
Micrasema longulum	2	2	1	1
Micrasema minimum	0	0	2	1
Odontocerum albicorne	2	2	0	0
Philopotamus ludificatus	1	1	2	2
Plectrocnemia conspersa	0	0	1	1
Rhyacophila evoluta	1	1	0	0
Rhyacophila fusciata	0	0	1	0
Rhyacophila nubila	0	0	0	1
Rhyacophila glareosa	2	2	0	0
Rhyacophila tristis	0	0	2	2
Silo pallpies	2	2	0	0
Tinodes rostocki	0	0	2	2
COLEOPTERA				
Limnius perrisi	3	3	0	0
Esolus angustatus	0	0	1	1
Agabus guttatus	0	0	2	2

Laboratory 4, 1993.

Species	Sample 1 Deliv.	Sample 1 Ident.	Sample 2 Deliv.	Sample 2 Ident.
EPHEMEROPTERA				
Baetis rhodani	4	4	0	0
Baetis alpinus	0	0	2	2
Ecdyonurus sp	0	0	2	0
Ecdyonurus venosus	0	0	0	2
Epeorus sylvicola	3	3	0	0
Ephemerella ignita	0	0	2	0
Ephemerella mucronata	0	0	0	2
Habroleptoides confusa	3	3	0	0
Rhitrogena sp	0	0	2	0
Rhitrogena semicolorata	0	0	0	2
Ameletus inopinatus	0	0	1	1
PLECOPTERA				
Amphinemura sulcicollis	3	3	3	3
Isoperla Oxylepis	0	0	3	0
Isoperla sp	0	0	0	3
Brachyptera seticornis	6	6	0	0
Leuctra sp	0	0	2	2
Leuctra nigra	4	4	0	0
Perlodes microcephalus	2	2	0	0
Nemurella picteti	0	0	3	3
Protonemura sp	1	1	1	1
TRICHOPTERA				
Anomalopterygella chauviniana	0	0	3	3
Drusus annulatus	0	0	2	2
Chaetopteryx villosa	1	1	1	1
Hydropsyche siltalai	0	0	3	3
Drusus discolor	3	3	0	0
Ecclisopteryx dalecarlica	2	2	1	1
Hydropsyche contubernalis	3	3	1	1
Hydropsyche pellucidula	3	3	0	0
Odontocerum albicorne	2	2	0	0
Plectrocnemia conspersa	4	4	0	0
Rhyacophila fasciata	1	1	1	0
Rhyacophila sp	0	0	0	1
Rhyacophila nubila	2	2	0	0
Sericostoma personatum	3	0	0	0
Sericostoma sp	0	3	0	0

Laboratory 7, 1993

Species	Sample 3 Deliv.	Sample 3 Ident.	Sample 4 Deliv.	Sample 4 Ident.
EPHEMEROPTERA				
Baetis rhodani	4	4	2	2
Rhitrhogenia semicolorata	3	3	3	3
Caenis luctuosa	5	5	4	4
Heptagenia sulphurea	2	2	2	2
Leptophlebia vespertina	3	0	4	1
Leptophlebiidae (indet)	0	3	0	0
Ephemeroptera (indet)	0	0	0	3
PLECOPTERA				
Amphinemura sulcicollis	5	4	2	2
Brachyptera risi	3	3	1	1
Protonemura meyeri	3	3	3	3
Isoperla grammatica	4	3	2	2
Leuctra hippopus	1	1	6	6
Chloroperla tripunctata	3	3	4	4
Chloroperla torrentium	3	3	3	3
Isoperla sp (indet)	0	1	0	0
TRICHOPTERA				
Polycentropus kingi	2	3	1	2
Sericostoma personatum	4	4	4	4
Hydropsyche instabilis	0	0	0	1
Hydropsyche angustipennis	0	0	1	0
Hydropsyche siltalai	1	1	1	1
Lepidostoma hirtum	0	0	1	0
Rhyacophila dorsalis	4	4	5	5
Plectrocnemia conspersa	1	1	1	1
Polycentropus flavomaculatus	1	0	1	0
Mystacides azurea	2	3	2	2
Holocentropus stagnalis	0	0	1	0
Holocentropus sp	0	0	0	1
Mystacides sp	1	0	0	0
DIPTERA				
Simulium spp	7	7	5	5
Tipula spp	0	0	2	0
Tipuliidae	0	0	0	2
Dicranota	2	2	1	1
COLEOPTERA				
Oulimnius spp	0	0	1	1
Limnius volckmari (adult)	3	2	2	2
Limnius volckmari (larva)	3	3	2	2
BIVALVIA				
Sphaeriidae	5	5	4	4
GASTROPODA AND CRUSTACEA				
Lymnaea peregra	4	4	3	3
Gammarus duebeni	2	2	3	3

Laboratory 11, 1993

Species	Sample 1 Deliv.	Sample 1 Ident	Sample 2 Deliv.	Sample 2 Ident
EPHEMEROPTERA				
Siphlonorus lacustris	2	1	1	1
Rhitrogenia semicolorata	0	0	4	4
Heptagenia lateralis	0	0	3	3
Leptophlebia vespertina	0	0	4	3
Baetis rhodani	5	0	0	0
Baetis sp	0	5	0	0
Leptophlebia marginata	0	0	1	2
Heptagenia sulfurea	0	0	2	2
Caenis horaria	0	0	2	1
Caenis luctuosa	0	0	0	1
PLECOPTERA				
Brachyptera risi	5	5	1	1
Protonemura meyeri	2	2	2	2
Amphenimura sulcicollis	3	3	1	3
Amphenimura borealis *)	0	0	2	0
Nemoura cinerea	4	4	1	1
Nemoura avicularis	0	0	3	3
Leuctra inermis	0	0	2	2
Leuctra hippopus	3	3	0	0
Leuctra nigra	0	0	2	2
Capnia vidua	2	2	0	0
Diura bicaudata	0	0	2	4
Diura nanseni *)	0	0	2	0
Isoperla grammatica	0	0	3	3
Siphonoperla torrentium	3	8	0	0
Siphonoperla burmeisteri *)	5	0	0	0
Chloroperla tripunctata	2	2	0	0
TRICHOPTERA				
Rhyacophila dorsalis	2	5	0	1
Rhyacophila nubila *)	3	0	1	0
Philopotamus montanus	1	1	0	0
Plectrocnemia conspersa	0	0	3	3
P.flavomaculatus	0	0	2	2
Cyrnus trimaculatus	2	2	0	0
Hydropsyche siltalai	0	0	1	1
Agrypnia varia	2	2	0	0
Anabolia nervosa	1	1	0	0
Sericostoma personatum	2	2	0	0
Neuriclipsis bimaculata	2	2	0	0
Tinodes waeneri	2	2	1	1
COLEOPTERA				
Oreodytes davisii	0	0	2	2
Oreodytes sanmarkii	0	0	0	1
Elmis aenea	2	2	0	0
MEGALOPTERA				
Sialis lutaria	1	1	0	0
HIRUDINEA AND AMPHIPODA				

Hellobdella stagnalis	2	2	0	0
Gammarus lacustris	1	1	0	0

*) Indicate that the species do not belong to the fauna of the country. The misidentifications of these species are therefore not recorded as a fault.

APPENDIX A

Laboratories participating in the intercalibration of invertebrates 9301 and their code numbers:

1	Section of Ecology, Karelian Institute, University of Joensuu, *Finland*
2	Freshwater Section, National Environmental Protection Agency, SNV, *Sweden*
3 - 4 - 5	Bayer. Landesamt für Wasserwirtschaft, *Germany*
6	Freshwater Institute, University Crescent, Winnipeg, *Canada*
7	Environmental Research Unit, Dublin, *Ireland*
8	National Agency of Environmental Protection, Silkeborg, *Denmark*
9	Ministerie van Volksgezondheid en Leefmilieu, Brussels, *Belgium*
10	ARGE Limnologie, Innsbruck, *Austria*
11	Queen Mary & Westfield College (University of London), London, *United Kingdom*

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