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ICP Waters Report 95/2008
Biological intercalibration: Invertebrates 1208

Sample processing at ICP Waters subcentre in Bergen. Photo: Tore Wiers.

International Cooperative Programme on Assessment and Monitoring Effects of Air Pollution on Rivers and Lakes

Convention on Long-Range Transboundary Air Pollution

LRTAP
Long-range Transboundary Air Pollution

Norwegian Institute for Water Research
– an institute in the Environmental Research Alliance of Norway

REPORT

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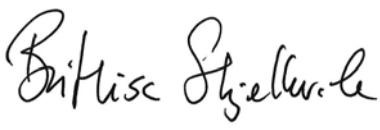
Abstract

The 12th intercalibration of invertebrates in the ICP Waters programme had contribution from five laboratories. The laboratories identified a high portion of the individuals in the test samples, usually > 90% of the total number of species. Shortcoming identifications below this limit were also noted. Misidentifications and low % identified were in general made on material coming from regions outside the home region of the laboratory. Few faults were recorded on genus level. The taxonomic quality was sufficient for stating the acidity index. The mean Quality assurance index was > 80 for all the laboratories, indicating good taxonomic work.

4 keywords, Norwegian	4 keywords, English
1. Interkalibrering	1. Intercalibration
2. Invertebrater	2. Invertebrates
3. Akvatisk fauna	3. Aquatic fauna
4. Overvåking	4. Monitoring



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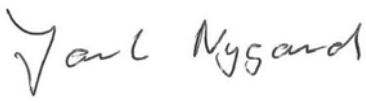

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CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

INTERNATIONAL COOPERATIVE PROGRAMME ON ASSESSMENT AND MONITORING OF ACIDIFICATION OF RIVERS AND LAKES

Intercalibration: Invertebrate fauna 1208

ICP Waters Programme Subcentre
Laboratory of Freshwater Ecology and Inland Fisheries
University of Bergen, November 2008

Preface

The International Cooperative Programme on Assessment and Monitoring Effects of Air Pollutants on Rivers and Lakes (ICP Waters) was established under the Executive Body of the Convention on Long-Range Transboundary Air Pollution at its third session in Helsinki in July 1985. The Executive Body also accepted Norway's offer to provide facilities for the Programme Centre, which has been established at the Norwegian Institute for Water Research, NIVA. A programme subcentre is established at the Laboratory of Freshwater Ecology and Inland Fisheries at the University of Bergen. Berit Kvæven, Norwegian Pollution Control Authority (SFT), has led the ICP Waters programme. SFT provides financial support to the work of the Programme Centre.

The main aim of the ICP Waters Programme is to assess, on a regional basis, the degree and geographical extent of the impact of air pollution, in particular acidification, on surface waters. Thirty countries in Europe and North America have participated in the programme since the start. Since 2002, ten countries have been involved in the biological intercalibration.

ICP Waters is based on existing surface water monitoring programmes in the participating countries, including biological monitoring,and implemented by voluntary contributions. The monitoring sites are generally acid sensitive and representative of low acid neutralising capacity (ANC) and low critical load levels of the distributions for all the waters surveyed in the region. The ICP site network is geographically extensive and includes long-term data series (more than 25 years) for some sites.

The Programme objective is to establish an international network of surface water monitoring sites and promote international harmonisation of monitoring practices. A tool in this work is inter-laboratory quality assurance tests. The bias between analyses carried out by the individual participants of the Programme has to be identified and controlled. The tests will also be a valuable tool in improve the taxonomic skill of the participating laboratories.

We here report the results from the 12th intercalibration on invertebrate fauna.

Bergen, November 2008

Arne Fjellheim and Gunnar G. Raddum

Contents

1. Introduction

The purpose of the biological intercalibration is to evaluate the quality of the taxonomic work on the biological material delivered to the Programme centre. The quality can influence on the evaluation of the samples, which is based on the species and their tolerance (Raddum *et al.* 1988, Fjellheim and Raddum 1990, Raddum 1999). The control is therefore important for evaluation of the significance of trends in biotic indexes both for a specific site/watershed, as well as for comparisons of trends between different regions and countries. The material is also used for multivariate statistical analysis (Larsen *et al.* 1996, Skjelkvåle *et al.* 2000, Halvorsen *et al.* 2002). The results of this type of data treatment are especially sensitive to the quality of the species identification. The biological intercalibration focuses on the taxonomic skills of the participants and is a tool for improving the quality of work at the different laboratories as well as harmonisation of the biological database.

The methods for intercalibration of biological material were outlined in 1991 at the 7th ICP Waters Task Force meeting in Galway, Ireland. The different countries/laboratories have to know, first of all, their home fauna. Since the fauna in different geographical regions vary, it is necessary to prepare specific samples for each participating laboratory, based on their home fauna. It is a problem for the exercise of the intercalibration that it is not possible to use standardised samples for all participants. To solve this problem each laboratory send samples of invertebrates from their own monitoring sites to the Programme centre. The Programme centre may additionally add species known to be present in the region of the specific laboratory. Based on this, each laboratory receives individual test samples composed of species representing their own monitoring region. One problem with this procedure is that the Programme centre needs material from the different areas in the ICP Waters region. This material has to be collected, identified and sent by the participating laboratories to the centre for making test samples. For the tests carried out in 2008, four laboratories got test material mainly composed of fauna from their home region, while one participant received material from other countries.

In this report we have calculated the quality assurance index for the participants, see Raddum (2005). This index evaluates the skill of identifying the species as well as the genus. It also takes into account the effort of identifying all specimens in the sample. The highest index score is 100, while a value of 80 is set as the limit of good taxonomic work.

2. Methods

Preparation of test-samples

Samples of identified invertebrates were received from four of the participating laboratories. These samples were used to compose test samples, with the addition of some specimens from earlier exercises and from own stocks. For one laboratory we did not receive material. In this case the test sample was based on surplus material from a neighbouring country with the addition of material from Scandinavia and the Baltic region, regarded as relevant for the participant.

Identification

To minimise possible faults the following procedure have been used in preparing the test samples:

- The participating country has first identified the source material for the test samples. Two of us have verified the identification of the species/taxa as far as possible without damaging the individuals.
- The content of the two test samples for each laboratory, with respect to species and numbers, is listed in a table. Two persons control that the correct number and species is placed in the test samples according to the list.

Damages of the material

When handling and shipping invertebrates, there is a risk of reducing the quality of the material. Taxonomically important parts of the body, as gills, legs, cerci, mouthparts etc., can be lost or destroyed in actions connected with identification, sample composition and transportation. Contamination of larvae can also occur during these processes as well as during the identification work at the participating laboratories. All mentioned possibilities for faults could influence on the results of the identifications and disturb the results in a negative way.

Evaluation

For calculation of faults (in percent), we must take into account possible destructions of the material as mentioned above. Further, a wrong identification of a species is one fault even if the sample contains many individuals of the species. For some species, in the same genus, the time of sampling is important for discrimination between them. Faults made on species where time of sampling is important for determination have been neglected. Misidentification of species where important taxonomic characters easily disappear during handling, are also neglected when the participant points this out.

We have discriminated between "short coming" identification, probably due to damaged material, and virtual fault (wrong species - or genus name). Due to this, some subjective evaluations of the results have to be made. The percent of faults is therefore not always the exact calculated percent of faults, but can be a modified value where some “expert judgement” is taken into account.

It is also of interest to know how many individuals that have been identified to species level

of the total number in the sample. This is named *% identified*. A low percent means that many individuals are not brought to the species level and will consequently reduce the value of the taxonomic work.

Available material for making test samples varies. The number of individuals and number of species delivered will therefore differ between the laboratories. Samples with low diversity will be easier to handle than samples with high diversity, see Appendix tables. This should also be kept in mind when the results are evaluated. On the other hand, small samples should be avoided as only a few misidentifications could result in a low score.

We have calculated the quality assurance index, Qi, for important groups of invertebrates as well as the mean index for each participant. The Qi integrates the separate levels of the identifications as follows:

Qi = % correct species/10 * % correct genus/10 * % identified individuals/100

Qi will be a number between 0 and 100. 100 are the highest score that can be obtained. A score ≥80 is regarded as good taxonomical work.

3. Results and discussion

Five laboratories participated in the intercalibration of invertebrates in 2008 (Appendix A). The content of species in the test samples delivered - and the results of the identification by the different laboratories are shown in Appendix Tables 1 - 5.

Mayflies

The identification of mayflies was generally good. Laboratory 1 and 2 identified the mayflies (Ephemeroptera) without faults (Figure 1, Appendix Table 1 and 2). Laboratory 3 identified some specimens only to genus level (Appendix table 3), but explained why species identification was difficult in these cases. The programme sub centre approved the explanations, which indicate good taxonomic understanding. The results from the other laboratories were also acceptable. The genus level was 100% correctly identified by the laboratory 3. The Qi index was > 80 for all laboratories indicating high quality of the work.

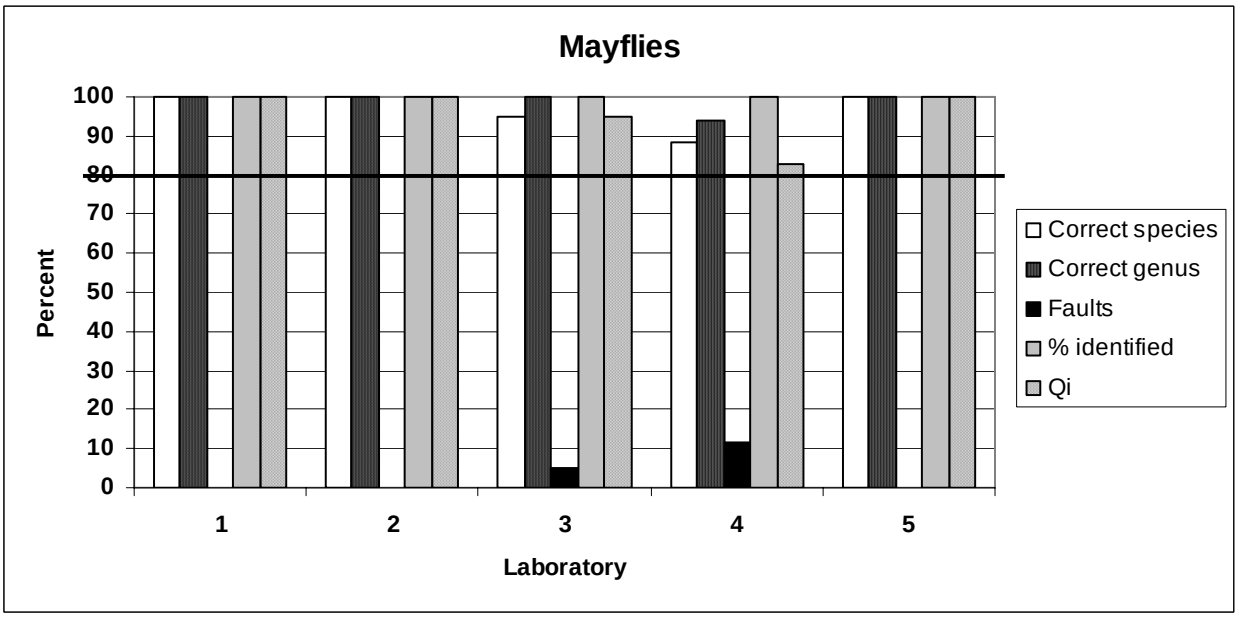

Figure 1. *Results of the identification of mayflies.*

Stoneflies

Laboratories 2 and 5 identified the stoneflies without faults, while the results from participants 3 and 4 were acceptable (Figure 2, Appendix tables 2 - 5). Laboratory 1 made some fault at both species and genus level, bringing the Qi to a level below what is considered to be acceptable (Figure 2, Appendix table 1). A reason for this is that the laboratory was presented some species that were uncommon in the ICP Waters monitoring sites. The Qi was calculated to 65, 100, 90, 82 and 100 for laboratories 1, 2, 3, 4 and 5, respectively. By a mistake, laboratory 4 received a specimen of the stonefly *Diura nanseni*, which is not a part of the home fauna of the laboratory (Figure 3). This was taken into consideration when evaluating the results.

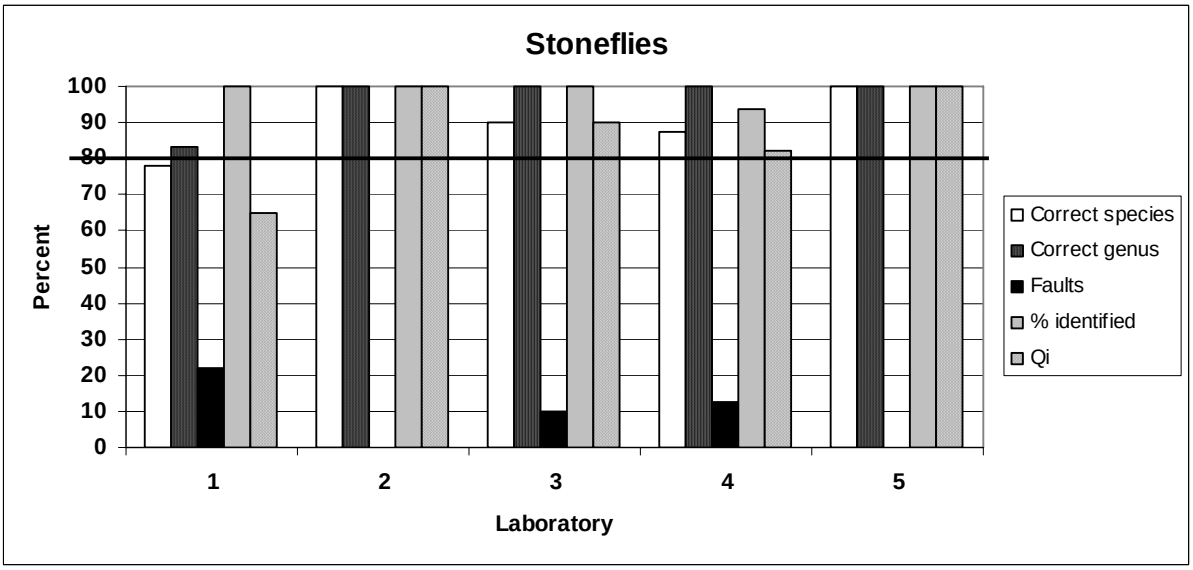

Figure 2. *Results of the identification of stoneflies.*

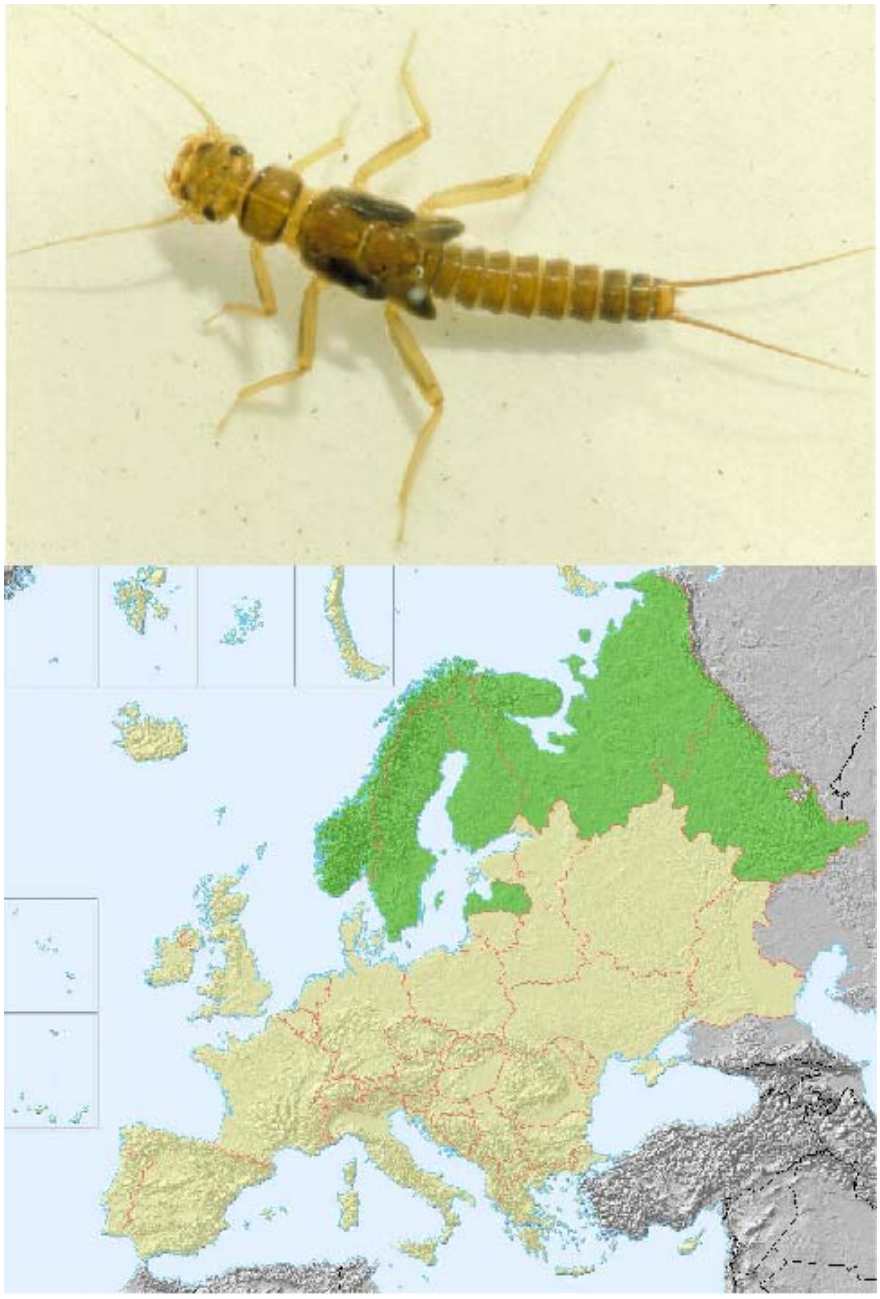

Figure 3. *The stonefly* Diura nanseni. *This species reaches its southernmost European distribution limit in Fennoscandia (Lillehammer, 1988, Fauna Europaea 2004). Additionally the species is found in North America. Photo of Diura: Arne Fjellheim.*

Caddisflies

The identification of caddisflies (Trichoptera) was generally good (Figure 3). Laboratory 1 and 2 identified all specimens correctly. Laboratory 3, 4 and 5 did 3, 6 and 6 % faults, respectively. On genus level three of the laboratories were faultless. The *% identified* was 100% for all participants. The taxonomic work on caddisflies is also regarded as good with Qi values of 100, 100, 93, 94 and 89, for participants 1, 2, 3, 4 and 5, respectively.

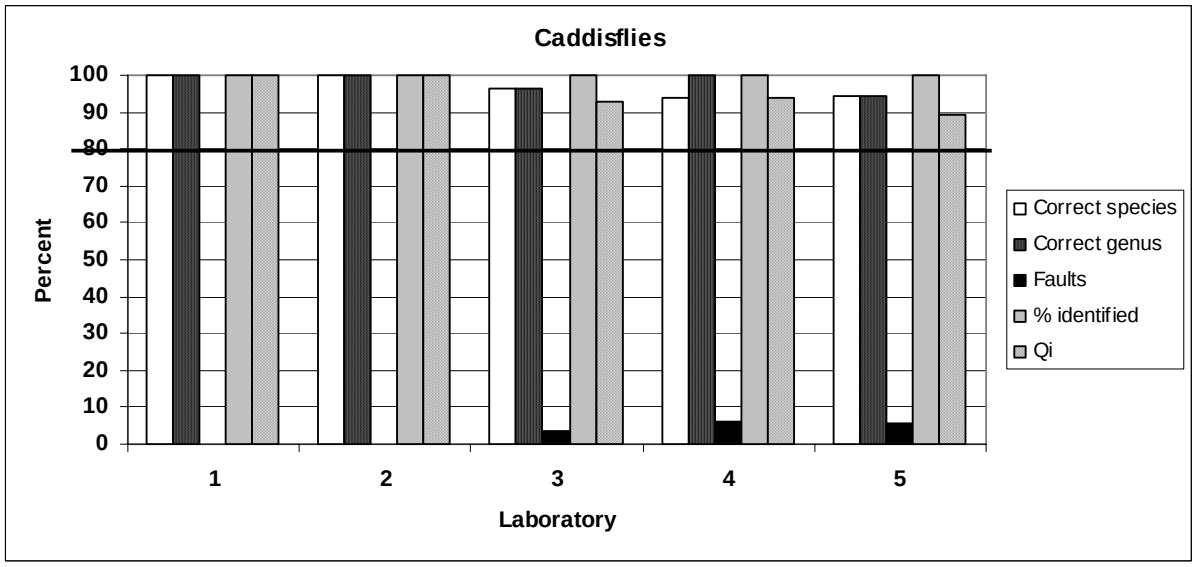

Figure 3. *Results of the identification of caddisflies.*

Other groups

In this intercalibration we have included water beetles (Coleoptera), larger crustaceans (Malacostraca), leeches (Hirudinea), molluscs (Gastropoda), alder-flies (Megaloptera), Diptera etc. Both larvae and imagines have been included for some of the groups. Molluscs and larger crustaceans are sensitive to acid water and important for the evaluation of acidification. The tolerance of the invertebrates among Coleoptera, Megaloptera, Diptera etc. is little known, but generally they are regarded as tolerant to acid water and consequently have low importance for evaluation of the acidity index. However, all species will be important for invertebrate community analysis. Figure 4 shows the results of the identification of these groups. The identifications made by laboratory 1 were perfect with no faults. The quality of the other laboratories was acceptable. With one exception, all larvae were identified to correct genus. The *% identified* was 100% for all participants except one. The Qi score was acceptable: 100, 97, 88, 92and 90, for participants 1, 2, 3, 4 and 5.

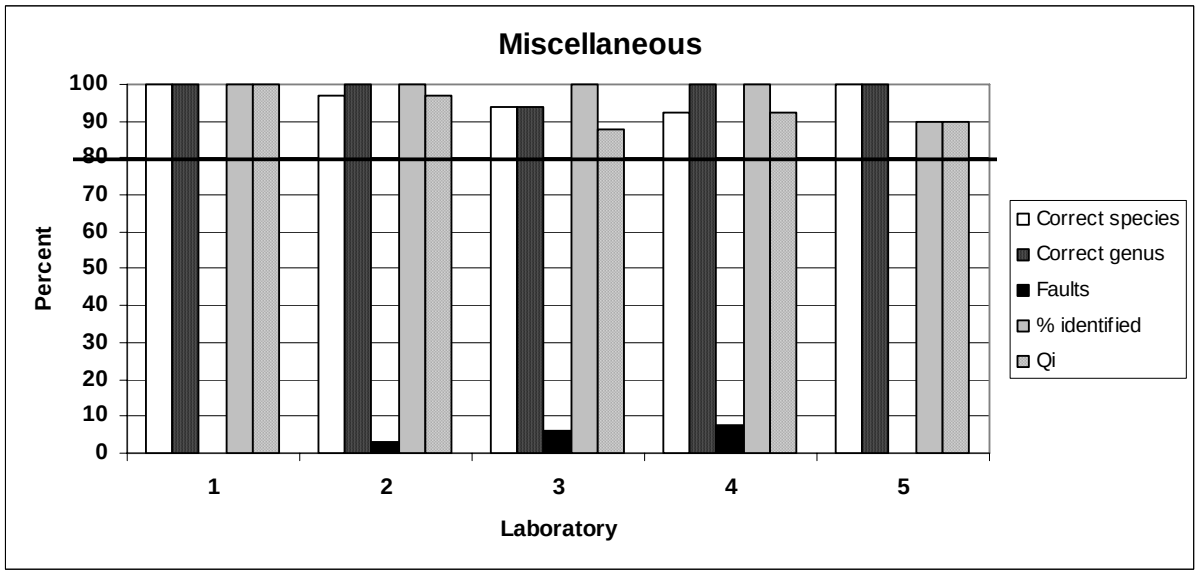

Figure 4. *Results of the identification of miscellaneous groups*

Total number of species in the sample

It was generally low discrepancy between the number of individuals put into the samples and the reported number of larvae. However, some differences have occurred between delivered and identified numbers of individuals. More species are sometimes identified than put into the sample, but this has been neglected in this test.

4. Evaluation/conclusion

The laboratories generally identified a high portion (≥ 95%) of the total number of species in the test samples. Shortcoming identification was low and indicated a good taxonomic skill by all participants. The mean skill of identifying species and genus and Qi score per laboratory is shown in Figure 5. Laboratory 1 to 5 got a mean Qi score of 91, 99, 91, 88 and 95, respectively. All tests were characterized as good taxonomic work.

The biological intercalibration is important for harmonising biological material/databases and will be of high value in programmes where community analyses is in focus or where the ecological status should be stated, like EU's Water Framework Directive.

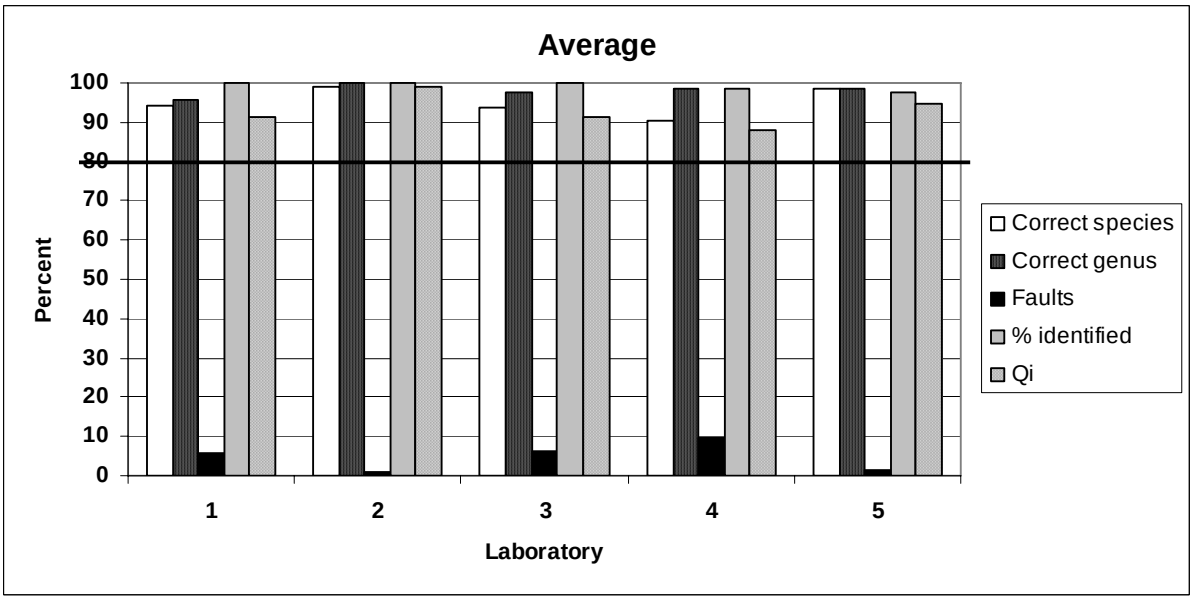

Figure 5. *Mean skill in percent of identifying species and genus and mean Qi for each laboratory.*

None of the participants did misidentifications that could result in a wrong acidity index, see Figure 6.

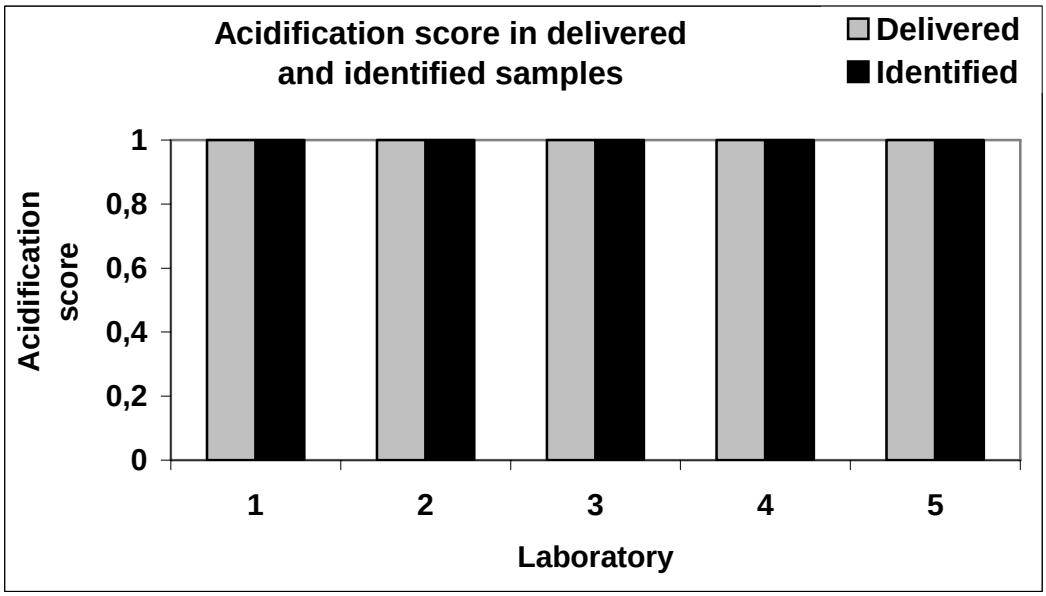

Figure 6. *Acidification score in delivered and identified samples. The calculation of the index was done according to Fjellheim and Raddum (1990) and Raddum (1999).*

The biological intercalibration under the ICP Waters programme is a unique test, as it operates on a species level. A similar test is run by the Natural History Museum, London, aiming to test skills in identifying British freshwater macroinvertebrates to major groups, mostly to family level (Identification Qualifications – IdQ test). The invertebrate groups covered in this test are those used in the BMWP water quality score system (Armitage et al., 1983) and include groups used for monitoring freshwater environments in UK.

5. References

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Appendix A. Identified species/genus

Each participating laboratory is identified by a number, which is identical with table number. Laboratories participating in the intercalibration of invertebrates in 2007 and their code numbers are:

1. Latvian Hydrometeorological Agency, EQOD , Environmental Quality Testing Laboratory, Riga, **Latvia**
2. Swedish University of Agricultural Sciences, Dept. of Environmental Assessment, P.O. Box 7050, S-75007 Uppsala**, Sweden**
3. LFI, Unifob, Thormøhlensgt. 49, N-5006 Bergen, **Norway**
4. Institute for Environmental Studies, Faculty of Science, Charles University, Prague, **Czech Republic**
5. Department of Zoology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, 10000 Zagreb, **Croatia**

Appendix table 1. Identified species/genus in sample 1 and 2 by Laboratory 1

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Ephemeroptera				
Caenis horaria	1	1		
Caenis luctuosa			1	1
Brachycerus harrisellus	1	1	1	1
Ephemerella ignita	1	1		
Ephemera danica			1	1
Ephemera vulgata	1	1		
Ephemera lineata			1	1
Heptagenia fuscogrisea	1	1		
Heptagenia sulphurea			1	1
Cloeon dipterum	1	1	1	1
Centroptilum luteolum	1	1	1	1
Baetis rhodani	1	1	1	1
Plecoptera				
Amphinemura borealis	1	1	1	1
Nemoura cinerea	1	1	1	2
Nemoura flexousa			1	
Nemoura avicularis	1		1	1
Nemoura artica		1		
Nemurella pictetii	1			
Protonemura meyeri	1	1	1	1
Isoperla grammatica	1	1	1	1
Brachyptera risi	1		1	
Taeniopteryx nebulosa	1	1	1	1
Siphonoperla burmeisteri	1		1	
Chloroperla apicalis (xanthoperla?)		1		1
Chloroperla torrentium		2		1
Trichoptera				
Lepidostoma hirtum	2	2	2	2
Notodobia ciliaris	1	1	1	1
Sericostoma personatum	1	1	1	1
Beraeodes minutus	1	1	1	1
Holocentropus dubius	1	1	2	2
Cyrnus flavidus	2	2	1	1
Hydropsyche angustipennis	2	2		
Hydropsyche siltalai			2	2
Hydropsyche pellucidula	1	1	1	1
Hydropsyche conturbernalis	1	1	1	1
Cheumatopsyche lepida	1	1	1	1
Atrhipsodes aterimus	1	1	2	2
Mystacidres azurea	1	1	1	1
Hemiptera				
Aphelocheirus aestivalis	1	1	1	1
Megaloptera				
Sialis lutaria	1	1		

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Sialis fuliginosa			1	1
Malacostraca				
Gammarus lacustris	1	1		
Gammarus pulex			1	1
Gastropoda				
Viviparus contectus	1	1	1	1
Bithynia leachi	1	1	1	1
Bithynia tentaculata	1	1	1	1
Physa fontinalis	1	1		
Ancylus fluviatilis			1	1
Acroloxus lacustris	1	1		
Bathyomphalus contortus	1	1	1	1
Hirudinea				
Erpobdella octoculata	1	1		
Glossiphonia complanata			1	1
Glossiphonia heteroclita	1	1		
Helobdella stagnalis			1	1
Coleoptera				
Elmis aenea	1	1	1	1
Limnius volckmari	1	1	1	1
Olimnius tuberculatus	1	1	1	1
Hydracarina				
Limnochares aquatica	1	1	1	1

Appendix table 2. Identified species/genus in sample 1 and 2 by Laboratory 2

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Ephemeroptera				
Heptagenia fuscogrisea	1	1		
Heptagenia dalecarlica			1	1
Caenis horaria	1	1		
Caenis luctuosa			1	1
Ephemerella aurivilli	1	1	1	1
Ephemera vulgata			1	1
Ephemera danica	1	1		
Centroptilum luteolum	1	1	1	1
Baetis rhodani	1	1	1	1
Baetis muticus	1	1		
Nigrobaetis niger			1	1
Ameletus inopinatus			1	1
Metretopus borealis	1	1		
Plecoptera				
Taeniopteryx nebulosa	1	1	1	1
Brachyptera risi	1	1	1	1
Siphonoperla burmeisteri	1	1	1	1
Isoperla grammatica			1	1
Amphinemura borealis	1	1	1	1
Nemurella pictetii	1	1	1	1
Nemoura avicularis	1	1	1	1
Nemoura cinerea	1	1		
Protonemura meyeri	1	1	1	1
Capnopsis shilleri	1	1	1	1
Leuctra hippopus	1	1	1	1
Leuctra nigra	1	1	1	1
Leuctra fusca	1	1	1	1
Trichoptera				
Rhyacophila fasciata	1	1		
Rhyacophila nubila			1	1
Neureclipsis bimaculata	1	1	1	1
Polycentropus irroratus	1	1	1	1
Plectrocnemia conspersa	1	1		
Polycentropus flavomaculatus			1	1
Cyrnus flavidus	1	1	1	1
Ecnomus tenellus	1	1	1	1
Hydropsyche pellucidula	1	1		
Hydropsyche siltalai			1	1
Brachycentrus subnubilus	1	1		
Sericostoma personatum			1	1
Lepidostoma hirtum	1	1	1	1
Philopotamus montanus	1	1	1	1
Micrasema setiferum			1	1
Silo pallipes	1	1		

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Goera pilosa			1	1
Diptera				
Ptycoptera lateralis	1	1	1	1
Oligochaeta				
Stylaria lacustris	1	1	1	1
Megaloptera				
Sialis lutaria	1	1	1	1
Malacostraca				
Asellus aquaticus	1	1	1	1
Gammarus pulex	1	1		1
Gammarus lacustris			1	
Saduria entomon	1	1		
Gastropoda				
Teodoxus fluviatilis	1	1	1	1
Anisus vortex (Planorbis)	1	1	1	1
Physa fontinalis	1	1		
Ancylus fluviatilis			1	1
Acroloxus lacustris	1	1		
Bithynia tentaculata	1	1	1	1
Gyraulus crista	1	1	1	1
Pisidium sp.	1	1		
Spaerium corneum			1	1
Hirudinea				
Erpobdella octoculata	1	1	1	1
Helobdella stagnalis	1	1	1	1
Coleoptera				
Elmis aenea	1	1	1	1
Olimnius tuberculatus	1	1		
Limnius volckmari	1	1	2	2

Appendix table 3. Identified species/genus in sample 1 and 2 by Laboratory 3

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Ephemeroptera				
Ephemerella aurivilli	1	1		
Ephemerella mucronata	1	1	1	1
Heptagenia sulphurea	1		1	1
Heptagenia dalecarlica		1		
Heptagenia fuscogrisea	1	1	1	1
Centroptilum luteolum	1	1		
Siphlonurus lacustris	1	1	1	1
Baetis rhodani	1	1	1	1
Baetis niger	1	1	1	1
Baetis digitatus	1	1	1	1
Baetis muticus	1	1	1	1
Baetis fuscatus/scambus			1	1
Plecoptera				
Leuctra nigra	1	1		
Capnia sp.cf.bifrons			1	1
Amphinemura standfussi	1			
Amphinemura sulcicollis		1		
Amphinemura borealis			1	1
Siphonoperla burmeisteri	1	1		
Taeniopteryx nebulosa			1	1
Nemoura cinerea	1	1		
Nemoura flexuosa	1	1		
Nemoura avicularis			1	1
Diura nanseni			1	1
Trichoptera				
Ecnomus tenellus	1	1	1	1
Polycentropus flavomaculatus	1	1	1	1
Plectrocnemia conspersa	1	1	1	1
Neureclipsis bimaculata	1	1	1	1
Holocentropus dubius	1	1		
Polycentropus irroratus	1	1	1	1
Cyrnus trimaculatus	1	1		
Cyrnus flavidus			1	1
Sericostoma personatum	1	1		
Lepidostoma hirtum			1	1
Chimarra marginata	1	1		
Philopotamus montanus			1	1
Rhyacophila fasciata	1	1		
Rhyacophila nubila			1	1
Tinodes waeneri	1	1		
Psychomyia pusilla			1	
Lype phaeopa				1
Silo pallipes	1	1		
Goera pilosa			1	1

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Hydropsyche siltalai	1	1	1	1
Hydropsyche pellucidula	1	1		
Hydropsyche angustipennis			1	1
Hirudinea				
Glossiphonia complanata	1	1		
Helobdella stagnalis			1	1
Gastropoda				
Physa fontinalis			1	1
Gyraulus sp.cf acronicus	1		1	1
Hippeutis complanatus		1		
Diptera:				
Antocha virtipennis	1	1		
Chaoborus flavicans			1	1
Coleoptera:				
Elmis aenea	2	2	1	1
Limnius volckmari	1	1	1	1
Malacostraca:				
Pontoporeia affinis	1	1	1	1
Gammarus lacustris	1	1		
Pallacea quadrispinosa			1	1

Appendix table 4. Identified species/genus in sample 1 and 2 by Laboratory 4

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Ephemeroptera				
Baetis rhodani	1	1		
Baetis niger			1	1*
Baetis muticus	2	1*	1	1*
Centroptilum luteolum	1	1		
Cloeon dipterum			1	1
Caenis luctuosa	1			1
Caenis horaria		1	1	1
Caenis macura	1	1	1	
Ephemera vulgata	1	1		
Ephemera danica			1	1
Heptagenia sulphurea			1	1
Ephemerella aurivilli	1			
Ephemerella mucronata		1		
Ephemerella ignita			1	1
Plecoptera				
Taeniopteryx nebulosa	1		1	1
Taeniopteryx sp.		1		
Isoperla grammatica	1		1	
Isoperla oxylepis		1		1
Diura nanseni	1			
Diura bicaudata		1		
Dinocras cephalotes	1	1		
Protonemura meyeri			1	1
Nemurella pictetii			2	1
Nemoura avicularis			1	1
Nemoura cinerea	1	1		
Nemoura flexuosa	1			
Nemoura sp. juv.		1		
Amphinemura borealis			1	1
Amphinemura sulcicollis	1	1		
Leuctra hippopus	1			
Leuctra mortoni		1		
Leuctra nigra			1	1
Trichoptera				
Molanna angustata	1	1		
Cyrnus flavidus	1	1	1	1
Cyrnus trimaculatus			1	1
Holocentropus dubius			1	1
Polycentropus flavomaculatus	1	1		
Polycentropus irroratus			1	1
Plectrocnemia conspersa			1	1
Neureclipsis bimaculata	1	1		
Bracycentrus subnubilus	1	1		
Leptocerus tineiformis	1		1	
Leptocerus interruptus		1		1

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Mystacides azurea			1	1
Athripsodes cinereus	1	1		
Hydropsyche pellucidula			1	1
Goera pilosa	1	1		
Lepidostoma hirtum			1	1
Diptera				
Atherix sp.	1	1		
Megaloptera				
Sialis sordida	1			
Sialis lutaria		1	1	1
Malacostraca				
Asellus aquaticus	1	1	1	1
Gammarus pulex	1	1		
Gammarus lacustris			1	1
Gastropoda				
Theodoxus fluviatilis	1	1		
Bithynia tentaculata			1	1
Hirudinea				
Erpobdella octoculata			1	1
Coleoptera				
Elmis aenea larvae			1	
Elmis sp. juv.				1
Elmis aenea imago	1			
Elmis maugetii		1		
Limnius volckmari	1			
Limnius sp.		1		

Appendix table 5. Identified species/genus in sample 1 and 2 by Laboratory 5

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Ephemeroptera				
Centroptilum luteolum	1	1	1	1
Habroleptoides confusa	1	1		
Habrophlebia lauta			1	1
Baetis alpinus	1	1		
Baetis rhodani			1	1
Baetis rhodani	1	1		
Rhithrogena semicolorata	1	1	1	1
Epeorus assimilis	1	1	1	1
Ephemera danica	1	1		
Ephemera vulgata			1	1
Torleya major	1	1	1	1
Seratella (Ephemerella) ignita			1	1
Potamanthus luteus			1	1
Plecoptera				
Besdolus imhoffi	1	1	1	1
Dinocras megacephala	1	1		
Perla pallida			1	1
Brachyptera tristis	1	1		
Brachyptera seticornis			1	1
Amphinemura triangularis	1	1	1	1
Leuctra braueri	1	1	1	1
Trichoptera				
Ecnomus tenellus	1	1	1	1
Silo nigricornis	1	1	1	1
Hydropsyche contubernalis	1	1	1	
Lepidostoma hirtum	1	1		1
Psychomyia pusilla			1	1
Cyrnus trimaculatus	1	1	1	1
Notodobia ciliaris	1	1	1	1
Anabolia furcata	1	1		
Potamophylax cingulatus	1	1	1	1
Odontocerum albicorne			1	1
Diptera				
Chironomus gr.plumosus	2	2	1	1
Prodiamesa olivacea	1	1	1	1
Oligochaeta				
Branchiura sowerbyi	1		1	1
Stylaria lacustris	1			
Malacostraca				
Synurella ambulans	1	1	1	1
Echinogammarus acarinatus	1	1	1	1
Gammarus balcanicus	1	1		
Gammarus fossarum			1	1
Gammarus roeselii	1	1	1	1

	Sample 1		Sample 2	
Taxa:	**Delivered**	**Identified**	**Delivered**	**Identified**
Gastropoda				
Theodoxus fluviatilis	1	1	1	1
Theodoxus danubialis stragulatus			1	1
Fagotia esperi	1	1		
Fagotia daudebartii acicularis			1	1
Amphimelania holandrii	1	1	1	1
Lithoglyphus naticoides	1	1	1	1
Bithynia tentaculata	1	1		
Emmericia patula	1	1	1	1
Ancylus fluviatilis	2	2	2	2
Hirudinea				
Helobdella stagnalis	1	1	1	1
Coleoptera				
Esolus angustatus	1		1	1
Elmis aenea	1	1	1	1
Hydraena riparia	1		1	1

Appendix B. Reports and publications from ICP Waters

All reports from the ICP Waters programme from 1987 up to present are listed below. All reports are available from the Programme Centre. Publications from 2002 up to present can be found at http://www.icp-waters.no/

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Norwegian Institute for Water Research, 1992. Data Report 1990. Programme Centre, NIVA, Oslo.

Norwegian Institute for Water Research, 1992. Evaluation of the International Co-operative Programme on Assessment and Monitoring of Acidification in Rivers and Lakes. Programme Centre, NIVA, Oslo.

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