ICP-WATERS REPORT 62/2001

Intercalibration 0005: Invertebrate fauna

Norwegian Institute for Water Research

REPORT

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Title	Serial No.	Date
Intercalibration 0005: Invertebrate fauna	4384/2001	April 2001
	Report No. Sub-No. ICP Waters report 62/2001	Pages Price 26
Author(s) Gunnar G. Raddum, Laboratory of Freshwater Ecology and Inland Fisheries, University of Bergen	Topic group	Distribution
	Geographical area Europe	Printed NIVA

Client(s)	Client ref.
The Norwegian Pollution Control Authority	

Abstract

The 5th intercalibration of invertebrates in the ICP Waters programme had contribution from 6 laboratories. Three of the laboratories delivered a pool of biological material from their home region as source material for the test samples. The other three got test samples based on the Norwegian fauna. 5 of the laboratories identified a high portion, usually ≥ 90% of the total number of species in the test samples. Short-coming identifications were consequently relatively low. Of the identified species only few faults were made and the results were regarded as good and within the range of good identification proposed for intercalibration of biological material. One laboratory identifying material from Norway, determined a lower portion of the species than proposed for biological material and did also more misidentifications. However, the result was sufficient for establishing the acidity index, but probably not for multivariate statistical analyses.

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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ISBN 82-577-4023-3

CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

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

Intercalibration 0005: Invertebrate fauna

ICP Waters Programme Subcentre
Laboratory of Freshwater Ecology and Inland Fisheries
University of Bergen, April 2001

Preface

The International Cooperative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes (ICP Water) 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 has 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 University of Bergen. The ICP Water programme has been lead by Berit Kvæven, Norwegian Pollution Control Authority.

The Programme objective is to establish an international network of surface water monitoring sites and promote international harmonization of monitoring practices. One of the tools in this work is an inter-laboratory quality assurance test. The bias between analyses carried out by the individual participants of the Programme has to be clearly identified and controlled.

We here report the results from the 5th intercalibration on invertebrate fauna.

Bergen, April 2001

Gunnar G.Raddum

Contents

1. Introduction

The purpose of the biological intercalibration is to evaluate the quality of the biological material delivered to the Programme centre. The quality can influence on the evaluation of the acidification index, which is based on the species and their tolerance (Raddum *et al.* 1988, Fjellheim and Raddum 1990). The control is therefore important for evaluation of the significance of trends in the acidification index both for a specific site/watershed, as well as for comparisons of trends between different regions and countries. During the last years the material is also used for multivariate statistical analysis (Larsen *et al.* 1996). This type of data treatment is especially sensitive to the quality of the species identification. The intercalibration of biological material will in general put focus on the taxonomic work and through this be a basis for improving the quality and detect weak fields at the different laboratories.

The methods for intercalibration of biological material were outlined in 1991 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. 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 standardized samples for all participants. To solve this problem each laboratory send samples of invertebrates from their own monitoring sites to the Programme centre. Based on this material each laboratory receive individual test samples composed of the fauna from their own monitoring region. One problem with this procedure is that the Programme centre needs material from the different areas in the ICP Water region. This material have to be collected, identified and send by the participating laboratories to the centre for making test samples. For the tests carried out in 2000 only three laboratories sent material from their home region to the Programme centre. For the other participants we made samples based on Norwegian material and “left over” material received from other countries.

Laboratory 5 participated for the first time in the intercalibration of invertebrates. The Laboratory was one of the laboratories that got Norwegian test material. The two other laboratories were number 2 and 3. It is suggested that the Norwegian fauna is quite similar to what Laboratory 3 has in their home region. For Laboratory 2 the Norwegian fauna will contain some species that do not exist in their country. The largest difference between the Norwegian fauna and “the laboratory home fauna” will be for Laboratory 5. They have informed us that they mainly work with water chemical issues, but want to build up expertise on invertebrates. They therefore wanted to take part in the test so they could get experience in this type of work. They have also informed us that about 30 % of the Norwegian fauna will not occur in their home region. They have therefore got the most unfair test samples. This and the situation of being a newcomer should be kept in mind when looking at the results. However, we have treated the results from all the laboratories in the same way. This is important for harmonising the biological database for later comparisons on a larger scale.

2. Methods

2.1 Preparation of test-samples

Three of the participating laboratories have delivered samples from their own region for the intercalibration in 2000. Between 250 and 300 identified invertebrates have been received. In addition we had some surplus material from earlier exercises, which also was used. All together the material made up a diverse pool of organisms on which the test-samples have been prepared. Species living in the home country of the laboratory have mainly been used in the test material, but in some cases species from other regions have been included in need of species.

The other three participating laboratories did not send testmaterial to the Programme centre. For these participants we made testsamples based on Norwegian material and some surplus material from other countries. However, this is not fair for these laboratories since some of the species will not occur in their region.

Identification
When preparing the biological test-samples we try to be as accurate as possible when composing the samples concerning the species put in the sample as well as the number of individuals. To minimise possible faults the following procedure have been used for the three laboratories that have sent us material:

> 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.
>
> 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 right number and species is placed in the samples according to the list.

For the participants that did not send us material for making the test samples, we have used Norwegian – and surplus material from other countries. The participating laboratory has therefore not earlier identified the source material for these samples. Due to this the content of the test samples will only relay on the skill of the Programme centre, which is not an ideal situation. Except for this, the same procedure as mentioned for the other laboratories is followed.

Damages of the material
When handling invertebrates there is a risk of reducing the quality of the material with respect to taxonomic work. Important taxonomically parts as gills, legs, moth parts etc. can be lost/destroyed during handling connected with identification, sample composition and transportation. Contamination of larvae can also happen during these processes as well as during the identification work at the participating laboratories. All mentioned possibilities for faults may influence on the results of the identifications and disturb the results in a negative way.

3. Results and discussion

Six laboratories participated in the sixth intercalibration of invertebrates in 2000. Three of the laboratories number 1, 3 and 6 sent us source material, while the other three got samples based on Norwegian material. Laboratory 5 gives the number of individuals for sample 1, while identified species/taxa for sample 2 are indicated by x. We have therefore split the results from the laboratory into 5a (sample 1) and 5b (sample 2). The test samples delivered - and the results of the identification by the different laboratories are shown in Appendix Tables 1 - 6.

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 contain 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.

We have discriminated between "short coming" identification, probably due to damaged material, and virtual fault (wrong species - or genus name).

From the factors mentioned above some subjective evaluation of the results have to be made when evaluating the quality of the determinations.

For the evaluation it is also of interest to know the fraction of "short coming" identification. "Short coming" identification is given in percent of the number of individuals, and is named *% identified*.

Mayflies
Laboratory 1, 3 and 4 identified the mayflies (Ephemeroptera) without any faults (Figure 1). Also laboratory 6 was very good, but did not go to species level for all the individuals. Laboratory 2 identified all individuals to species level, but did some misidentifications. All together the result is regarded as well within the acceptable level. Laboratory 5 (5a and 5b) made more faults and the results are not regarded as acceptable for statistical analyses. For stating the acidity index the identifications were sufficient, but one problem with the results is low identification percent and that no number of individuals was given for sample 2 (5b)**.** As mentioned it should be taken into account that this laboratory got Norwegian material, like laboratory 2 and 3, which make the identification work more difficult.

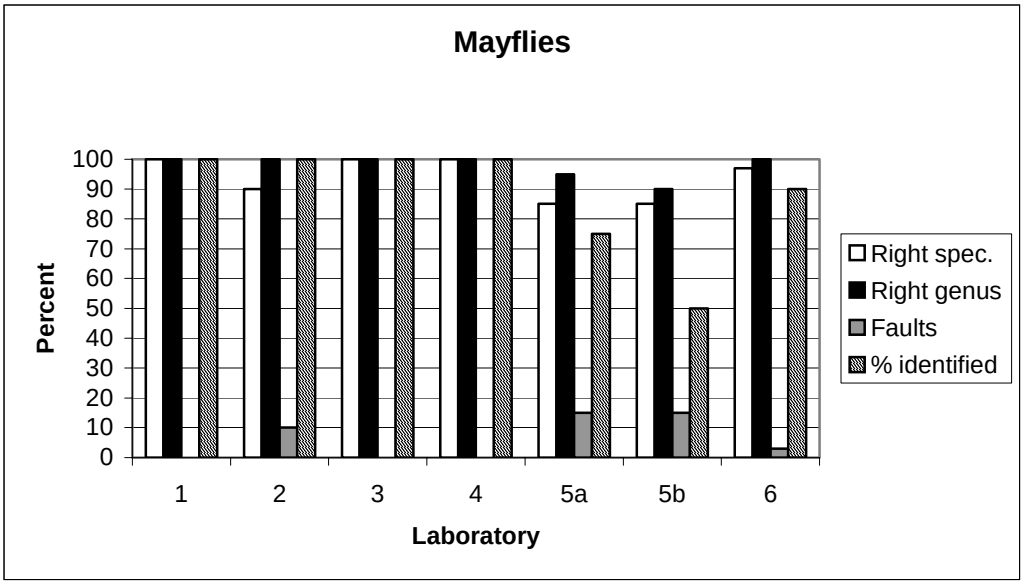

Figure 1. Results of the identification of mayflies.

Stoneflies

Laboratory 1 made no real misidentifications with respect to stoneflies (Plecopera), while laboratory 2, 3, 4 and 6 did some faults, but all laboratories were well within the acceptable level of identification work. The faults made by laboratory 4 were also on genus level, but not of serious character. The results from laboratory 5 were acceptable for stating the acidity index, but for statistical analysis the identifications should be improved. This is due to low percent of identified species as well as faults made on the identified portion.

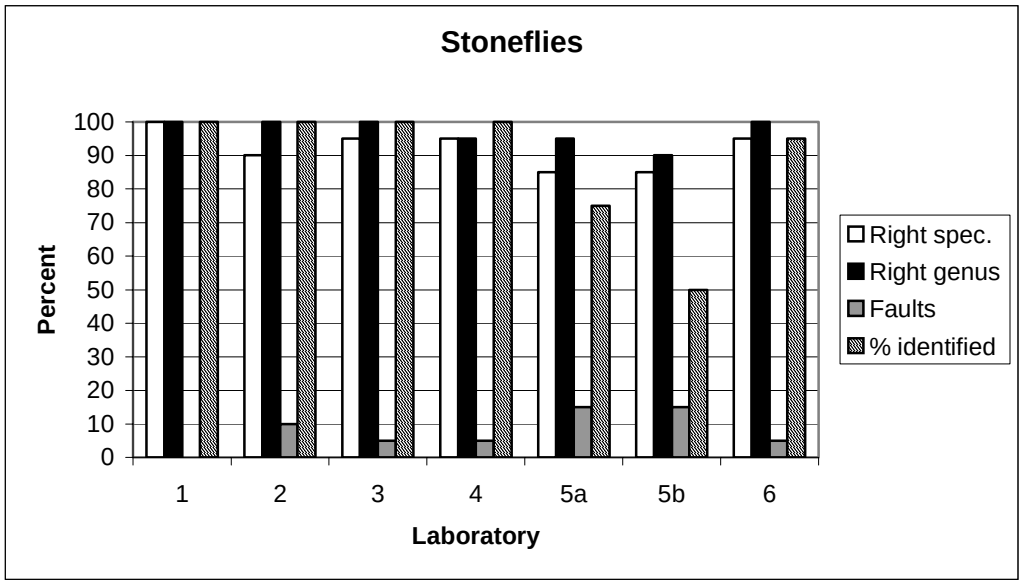

Figure 2. Results of the identification of stoneflies.

Caddisflies
The identification of caddisflies (Trichoptera) was good with no faults for laboratory 1, 3 and 4 (Figure 3). The results for the other laboratories were very similar to the results they obtained for mayflies and stoneflies.

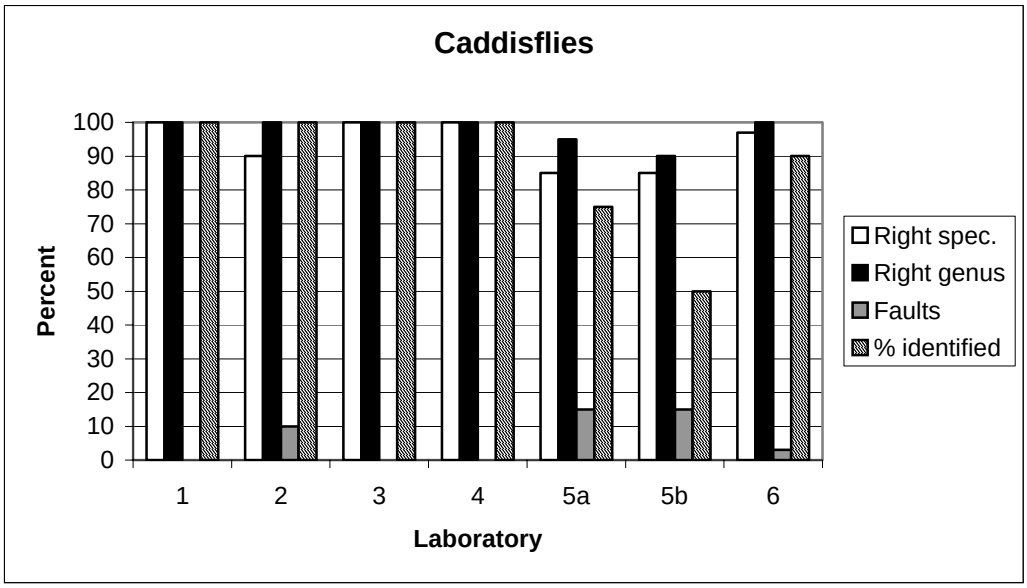

Figure 3. Results of the identification of caddisflies.

The results from all participants were sufficient for stating the acidity index. The results will also meet the requirements needed for statistical analyses except for laboratory 5. The result from this laboratory will be of low value in statistical analyses due to low percent identified and that number of identified species is missing for sample 2 (5b).

Other groups
In this intercalibration we have included Coleopta (water beetles), larger crustaceans, oligochaets, molluscs, chironomids etc. Both larvae and imagos have been included for some of the groups. Besides the molluscs and larger crustaceans, which are sensitive to acid water, we mostly lack information about the tolerance of many of the other invertebrates like oligochaets and coleopterans. Due to this the species in these groups is treated as tolerant to acid water and consequently have low importance for evaluation of the acidity index. However, all species will be important for statistical analysis of the whole community. Figure 4 shows the results of the identification of these groups, which to a large degree reflect the picture seen for the other groups. Laboratory 2 and 5 made 15 % misidentifications. However laboratory 2 identified 100 % of the individuals to species level, while laboratory 5 identified 75- and 50 % of the individuals in sample 1 and 2, respectively, which reduce the value of the work.

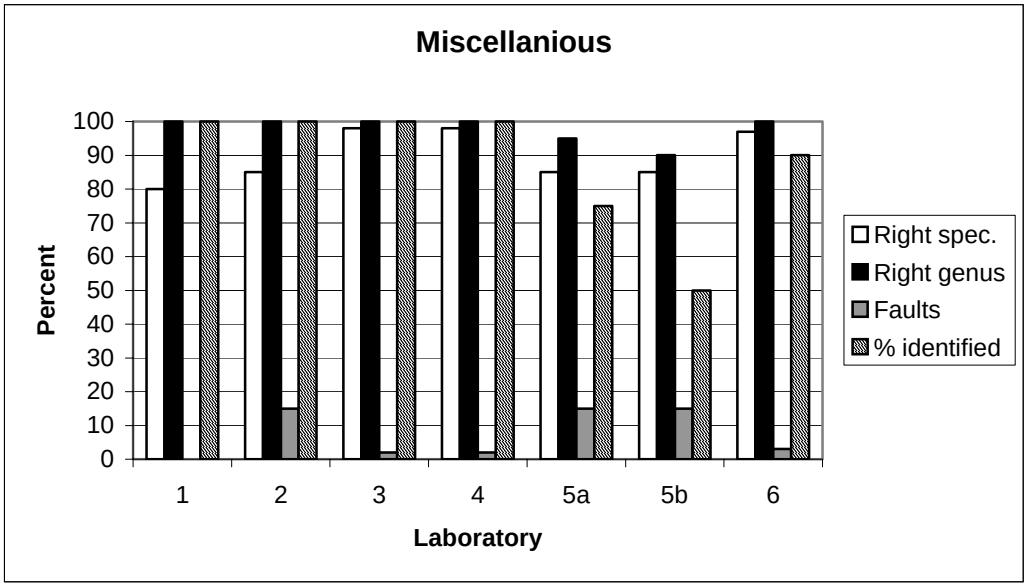

Figure 4. Results of the identification of miscellaneous groups

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, in a few cases records of species that should not be in the samples are identified. We have not registered this as a fault since contamination can have occurred by us as well as by the participant.

4. Evaluation/conclusion

All laboratories, except 5, identified a high portion of the total number of species in the test samples. Shortcoming identification was usually ≤ 10 %, which is regarded as good and within the limit of faults (10 %) proposed for intercalibration of biological material (Raddum 1993). For laboratory 5 between 25% and 50% of the species were not identified to species level and consequently were outside the proposed range for good quality.

Non of the participants did misidentifications that could result in a wrong acidity index. Also participant 5, with the lowest identification percent, had most of the sensitive species right and come out with correct acidification score. By this no discrepancy between the score of delivered and identified samples was recorded (Figure 5).

As mentioned in the introduction laboratory 5 have just started to develop expertise on invertebrate communities. In spite of this they wanted to participate and have their work evaluated so they could get information about which tasks they should develop further. The other laboratories have participated in the ICP Waters for a long time and this experience is probably one reason for the good results of these laboratories. Laboratory 1, 4 and 6 got test samples based on a pool of invertebrates from their home region sent to the Programme centre by the participants. It was therefore expected that these laboratories should do fewer faults than those identifying Norwegian material. The laboratories identifying Norwegian material

showed varying skill in the determination of this material. Of these laboratories number 3 did very few faults. It should be mentioned that the home fauna of this laboratory is rather similar to the Norwegian fauna. Also the results from laboratory 2 were good when taking into account that they identified unknown Norwegian material. Laboratory 5 got the most "unfair" test samples with respect to match their home fauna. The evaluation based on the Norwegian material is therefore not a real test of how well they know their home fauna. It is therefor important that the participating laboratories send us identified material in forehand.

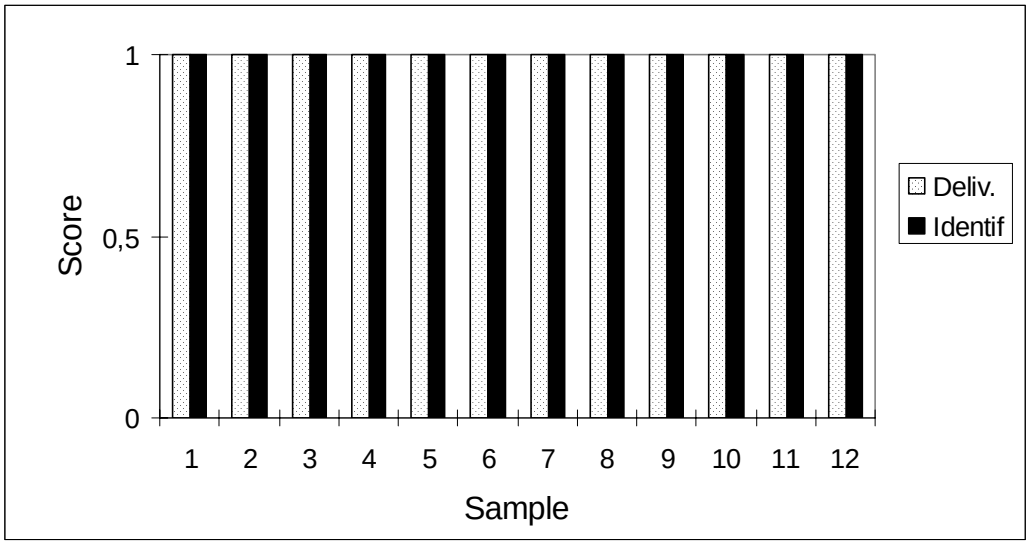

Fig. 6. Acidification score in delivered and identified samples.

5. References

Fjellheim, A. and G. G. Raddum, 1990. Acid precipitation: biological monitoring of streams and lakes. The Science of the Total Environment, 96, 57-66.

Larsen, J., H.J.B. Birks, G.G. Raddum & A. Fjellheim. Quantitative relationships of invertebrates to pH in Norwegian river systems. Hydrobiologia 328: 57-74.

Raddum, G. G., A. Fjellheim and T. Hesthagen, 1988. Monitoring of acidification through the use of aquatic organisms. Veh. Int. Verein. Limnol. 23: 2291-2297.

Raddum, G.G. 1993. Intercalibration of invertebrate fauna. Lab. f. Freshw. Ecology and Inland Fisheries, Zool. Inst., Univ. of Bergen. Rep. No 9301: 31pp.

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 1996 and their code numbers are:

1. Centre de Researches Ecologiques, Laboratoire d'Ecotoxicologie, Universite de Mar BP4116, 57040 Metz Cedex 01, France

2. Environmental Protection Agency, Laboratory Pottery Road, Dun Laoghaire, IRELAND

3. Institute of North Industrial Ecology Problems, Kola Science Centre, Russian Academy of Sciences 14 Fersman St., Apatity, Murmansk region, 184200, Russia

4. Sveriges Lantbruksuniversitet, Inst. för miljöanalys, Uppsala, Sweden

5. Div. Ambiente Canton Ticino, Laboratorio Studi Ambientali, Sez. Protezione Aria Acqua Riva Paradiso 15, CH-6900 Lugano Paradiso, SWITZERLAND

6. Staatliche Umweltbetriebsgesellschaft, des Freistaates Sachsen, Zentrallabor, Prasseweg 9 01640 Coswig-Neusörnewitz

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

	Sample 1		Sample 2	
Taxa/species	Identified	Delivered	Identified	Delivered
Ephemeroptera				
Heptagenia sp	1	1	2	2
Heptagenia fuscogrisea	1	0	0	0
Heptagenia sulphurea	0	0	2	0
Epeorus sylvicola	1	1	1	1
Baetis rhodani	2	2	1	1
Baetis muticus	1	1	2	1
Baetis gp alpinus	0	0	1	1
Seratella ignita	0	0	1	1
Ephemerella mucronata	1	1	0	0
Ephemerella ignita	0	0	1	0
Caenis luctuosa	1	1	1	1
Leptophlebia (vespertina)	1	1	0	0
Habroleptoides confusa	0	0	1	1
Habrophlebia fusca	0	0	1	1
Potamanthus luteus	0	0	1	1
Plecoptera				
Isoperla grammatica	1	1	0	0
Siphonoperla torrentium	1	1	0	0
Siphonoperla sp	0	0	1	1
Brachyptera risi	1	1	1	1
Brachyptera seticornis	2	2	0	0
Brachyptera sp	0	0	1	1
Nemoura (cinerea)	2	2	2	2
Nemurella pictetii	2	0	0	0
Amphinemura (sulcicollis)	2	2	0	0
Protonemura meyeri	1	1	0	0
Trichoptera				
Rhyacophila (dorsalis)	1	1	1	1
Hydropsyche siltalai	2	2	0	0
Hydropsyche (angustipennis)	0	0	2	2
Sericostoma (personatum)	1	1	1	1
Philopotamus (ludificatus)	1	1	1	1
Wormaldia (subnigra)	1	1	0	0
Neureclipsis bimaculata	1	1	0	0
Cyrnus (flavidus)	1	1	0	0
Holocentropus dubius	1	1	1	1
Plectrocnemia sp	1	1	1	1
Plectrocnemia conspersa	1	0	1	0
Ecnomus sp	0	0	1	1
Ecnomus tenellus	0	0	1	0
Limnephilidae	0	0	1	1
Potamophylax sp	0	0	1	0
Coleoptera				
Esolus	0	0	1	1
Limnius	1	1	0	0
Olimnius turbercullatus	0	0	1	0
Hydraena (gracilis)	1	1	0	0
Crustaceans				
Gammarus (pulex)	0	0	0	2
Gammarus sp	4	4	0	0
Gammarus lacustris	4	0	2	0

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

	Sample 1		Sample 2	
Taxa/species	Identified	Delivered	Identified	Delivered
Ephemeroptera				
Ephemera lineata	1	1		
Ephemerella notata	1	0		
Ephemerella aurivilli	0	1	0	1
Ephemerella ignita			1	0
Ephemerella mucronata			0	1
Ephemerella notata			1	0
Heptagenia fuscogrisea			1	1
Leptophlebia sp(marginata)			0	1
Heptagenia lateralis	1	0	1	0
Heptagenia (fuscogrisea)?	1		1	0
Heptagenia sulphurea			0	1
Heptagenia sp	0	1		
Baetis rhodani	2	2	1	0
Baetis muticus			1	1
Baetis subalpinus			0	1
Caenis luctosa			1	1
Caenis horaria	1	1	1	1
Caenis rivulorum	0	1		
Leptophlebia vespertina	1	0		
Epeorus sylvicola	1	1		
Plecoptera				
Diura bicaudata	1	0	3	1
Diura nanseni	0	1	0	2
Isoperla obscura	1	1		
Brachyptera risi	2	2	1	1
Taeniopteryx nebulosa	1	1	1	1
Leuctra nigra			1	1
Leuctra inermis	2	0		
Leuctra hippopus	1	2		
Leuctra fusca	0	1		
Amphinemura sulcicollis	1	1	2	2
Protonemoura meyeri	1	1	1	1
Nemoura avicularis			0	1
Nemoura cinerea	1	1	1	0
Nemurella picteti			1	1
Siphonoperla (Chloroperla) torrentium	1	0		
Siphonoperla burmeisteri	0	1		
Trichoptera				
Hydropsyche pellucidula	1	1		
Hydropsyche siltalai			1	1
Diplectrona felix			1	0
Hydropsyche angustipennis	1	1		
Arctopsyche ladogensis	0	1		
Cyrnus trimaculatus	1	1	1	1
Plectrocnemia conspersa			1	1
Polycentropus flavomaculatus				
Holocentropus dubius	1	1		
Neureclipsis bimaculatus			4	2
Rhyacophila septentrionalis	2	1	1	0

Taxa/species	Sample 1 Identified	Delivered	Sample 2 Identified	Delivered
Micrasema longulum			0	1
Micrasema minimum			0	1
Rhyacophila dorsalis	0	1		
Rhyacophila nubila	1	0	0	1
Molanna angustata	0	1		
Philopotamus montanus			1	0
Philopotamus ludificatus			0	1
Wormaldia subnigra			0	1
Sericostoma personatum	1	1	1	0
Notidobia ciliaris	1	1	1	0
Holocentropus dubius			0	1
Oxyethira sp.	1	1		
Apatania (auricula)	4	4		
Instar II	1	1		
Lepidostoma hirtum	1			
Oxyethira sp.			2	2
Drusus annulatus			1	1
Miscellanious				
Gammarus lacustris	1	2	1	0
Gammarus pulex			0	1
Asellus aquaticus (fem.)	1	1	2	2
Elmis aenea	1	1	1	1
Limnius volckmari	1	1	1	1
Platambus sp.			1	1
Helobdella stagnalis			1	1
Eropdella sp.			1	0
Helobdella octoculata			0	1
Sialis sp	1	0	1	0
Sialis fuliginosa	0	1	0	1
Ancylus fluvialtilis	0	1		
Bithynia tentaculata	1	1		

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

	Sample 1		Sample 2	
Taxa/species	Identified	Delivered	Identified	Delivered
Ephemeroptera				
Baetis muticus	0	0	1	1
Baetis rhodani	2	2	0	0
Baetis subalpinus	0	0	1	1
Caenis horaria	1	1	1	1
Caenis luctuosa	1	1	1	1
Epeorus silvicola	1	1	0	0
Ephemera lineata	1	1	0	0
Ephemerella aurivillii	1	1	1	1
Ephemerella mucronata	0	0	1	1
Heptagenia fuscogrisea	1	0	0	1
Heptagenia sulphurea	0	0	2	2
Leptophlebia marginata	0	0	1	1
Leptophlebia vespertina	1	1	0	0
Plecoptera				
Amphinemura borealis	1	1	2	2
Brachyptera risi	2	2	1	1
Diura nanseni	1	1	3	2
D. bicaudata	0	0	0	1
Isoperla grammatica	1	0	0	1
Leuctra hippopus	0	2	0	0
Leuctra digitata	3	0	0	0
L. fusca	0	1	0	0
Leuctra nigra	0	0	1	1
Nemoura avicularis	0	0	1	1
Nemoura cinerea	1	0	0	1
Nemurella pictetii	0	0	1	1
Protonemura meyeri	1	1	1	0
Siphonoperla burmeisteri	1	1	0	0
Taeniopteryx nebulosa	1	1	1	1
Trichoptera				
Arctopsyche ladogensis	0	0	1	1
Cyrnus flavidus	1	1	1	1
Halesus radiatus	0	0	1	1
Hydropsyshe angustipennis	0	0	1	1
Hydropsyshe pellucidula	1	1	0	1
Hydropsyshe siltalai	1	1	0	0
Apatania sp	0	1	0	0
Lasiocephala basalis	1	0	0	0
Lepidostoma hirtum	2	2	0	0
Drusus annulatus	0	0	0	1
Lithax obscurus	0	0	1	0
Micrasema gelidum	1	1	0	0
Molanna angustata	1	1	0	0
Neureclipsis bimaculata	2	1	3	2
Odontocerum albicorne	1	1	0	0
Oligoplectrum maculatum	0	0	1	1
Oxyethira flavicornis	4	4	2	2
Philopotamus montanus	0	0	1	1
Polycentropus flavomaculatus	1	1	0	0
Plectrocnemia conspersa	0	0	1	1

	Sample 1		Sample 2	
Taxa/species	Identified	Delivered	Identified	Delivered
Rhyacophila nubila	1	0	1	1
Rhyacophila obliterata	1	0	0	0
Sericostoma personatum	1	1	0	0
Wormaldia subnigra	0	0	1	1
Gastropoda				
Ancylus fluviatilis	1	1	0	1
Lymnaea fusca	1	1	0	0
Hirudinea				
Erpobdella octoculata	0	0	1	1
Helobdella stagnalis	0	0	1	1
Crustacea				
Asellus aquaticus	1	1	2	2
Gammarus lacustris	1	1	1	1
Megaloptera				
Sialis lutaria	1	1	1	1
Coleoptera				
Elmis aenea	0	0	1	1
Limnius volkmari	1ad.	1ad.	1	1
Platambus maculatus	0	0	1	1

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

Taxa/species	Sample 1 Identified	Delivered	Sample 2 Identified	Delivered
Ephemeroptera				
Baetis rhodani	2	2	0	0
Baetis subalpinus	1	1	1	1
Caenis luctuosa	0	0	2	2
Heptagenia dalecarlica	1	1	0	0
Heptagenia fuscogrisea	1	1	1	1
Heptagenia sulphurea	0	0	2	2
Siphlonurus cf aestivalis	1	1	0	0
Plecoptera				
Amphinemura borealis	0	0	1	1
Amphinemura sulcicollis	2	2	1	1
Brachyptera risi	1	1	1	1
Capnia bifrons	2	2	0	0
Diura nanseni	0	0	1	1
Isoperla difformis	1	1	0	0
Isoperla sp(best. Til grammatica)	1	1	0	0
Nemoura avicularis	1	1	1	1
Nemoura cinerea	2	2	0	1
Nemoura cf cinereus	0	0	1	0
Nemurella picteti	1	1	0	0
Protonemura meyeri	0	0	1	1
Siphonoperla burmeisteri	0	0	0	1
Leuctra fusca	0	0	1	0
Trichoptera				
Apatania sp.	1	1	0	0
Athripsodes cinereus	1	1	1	1
Ceratopsyche silfvenii	2	2	0	0
Cyrnus flavidus	2	2	0	0
Cyrnus trimaculatus	1	1	0	0
Ecnomus tenellus	1	1	0	0
Hydropsyche pellucidula	0	0	1	1
Hydropsyche siltalai	2	2	1	1
Lepidostoma hirtum	3	3	1	1
Limnephilidae (instar II)	1	1	3	3
Mystacides longicornis/nigra	0	1	1	1
Mystacides cf nigra	1	0	0	0
Neureclipsis bimaculata	2	2	1	1
Philopotamus montanus	1	1	1	1
Plectrocnemia conspersa	0	0	1	1
Polycentropus flavomaculatus	0	0	1	1
Rhyacophila cf fasciata	2	0	0	0
Rhyacophila nubila/ obliterata	0	2	0	0
Setodes argentipunctellus	0	0	1	1
Wormaldia subnigra	0	0	2	2
Diptera				
Chaoborus obscuripes	0	0	1	1
Chaoborus flavicans	2	2	0	0
Crustacea				
Monoporeia affinis	2	0	1	0
Pontoporeia affinis		1	0	1
Gammarus lacustris		1	0	0
Coleoptera				
Limnius volkmari	0	0	2	2
Orectochilus villosus	1	1	0	0
Oulimnius tuberculatus	2	2	0	0

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

	Sample 1			Sample 2	
Taxa/species	Identified	Delivered		Identified	Delivered
Ephemeroptera			Ephemeroptera		
Ephemerella mucronata	1	0	Ephemerella mucronata	x	1
Ephemerella aurivilli	0	1	Ephemerella aurivilli		1
Ephemera lineata	1	1	Caenis horaria	x	1
Caenis horaria	1	1	Caenis luctuosa	x	1
Caenis luctosa	0	1	Centroptilum luteolum	x	0
Paraleptophlebia sp.	1	0	Leptophlebia marginata		1
Leptophlebia vespertina	0	1	Heptagenia flava	x	0
Epeorus sylvicola	1	1	Heptagenia sulphurea		1
Heptagenia sp.	1	1	Heptagenia fuscogrisea		1
Baetis rhodani	2	2	Rhithrogena sp.	x	0
Plecoptera			Baetis muticus		1
Amphinemura sulcicollis	1	1	Baetis subalpinus		1
Protonemura meyeri	1	1	Alaintes muticus	x	0
Nemoura sp.	1	0	Baetis sp.	x	0
Nemoura marginata	1	0	Plecoptera		
Nemoura cinerea		1	Nemurella pictetii	x	1
Taeniopteryx sp.	1	0	Amphinemura sp.	x	0
Taeniopteryx nebulosa	0	1	Amphinemura sulcicollis		2
Brachyptera sp.	1	0	Protonemura sp.	x	1
Brachyptera risi	1	1	Brachyptera risi	x	1
Perlodes sp.	1	0	Nemurella pictetii		1
Diura nanseni		1	Nemoura obtusata	x	0
Isoperla sp.	1	1	Nemoura avicularis		1
Leuctra sp.	2	0	Taeniopteryx nebulosa		1
Leuctra hippopus	0	2	Taeniopteryx sp.	x	0
Leuctra fusca	0	1	Isoperla sp.		1
Chloroperla sp.	1	0	Perlodes sp.	x	0
Siphonoperla burmeisteri	0	1	Diura nanseni		2
Trichoptera			Diura bicaudata		1
Polycentropus flavomaculatus	1	1	Leuctra nigra	x	1
Polycentropus sp.	1		Trichoptera		
Neureclipsis bimaculata	2	1	Polycentropus flavomaculatus	x	0
Cyrnus trimaculatus	0	1	Plectrocnemia conspersa		1
Holocentropus dubius	0	1	Cyrnus trimaculatus		1
Hydropsyche siltalai	1	0	Neureclipsis bimaculata	x	2
Hydropsyche (fulvipes)	1	0	Holocentropus dubius		1
Hydropsyche angustipennis	0	1	Holocentropus stagnalis	x	0
Hydropsyche pellucidula	0	1	Hydropsyche siltalai	x	1
Rhyacophila sp.	1	0	Hydropsych sp.	x	
Rhyacophila nubila	0	1	Micrasem lonsulum		1
Oxyethira sp.	3	4	Micrasem minimum		1
Molanna angusta		1	Rhyacophila sp.	x	1
Odontocerum albicorne	1	1	Oxyethira sp.	x	2
Micrasema (morosum)	1		Philopotamus ludificatus	x	1
Micrasema gelidium	0	1	Limnephilidae [Fam.]	x	0
Sericostoma sp.	1	0	Wormaldia sp.	x	0
Sericostoma personatum	0	1	Wormaldia subnigra		1
Lepidostoma sp.	2	0	Sericostoma sp.	x	0
Lepidostoma hirtum	0	2	Leptocerus sp.	x	0
Apatania sp.		1	Drusus annulata		1
Miscellanious			Miscellanious		
Esolus sp.	1	0	Limnius volckmari		1
Sialis fuliginosa		1	Limnius sp.	x	
Sialis sp.	1		Elmis aenea		1
Asellus aquaticus		1	Elmis sp.	x	

Taxa/species	Sample 1 Identified	Sample 1 Delivered		Sample 2 Identified	Sample 2 Delivered
Asellus sp.	1		Platambus maculatus	x	1
Gammarus lacustris		1	Lacophilinae [UFam.]	x	
Gammarus sp.	1		Sialis fuliginosa	x	2
Elmis aenea		1	Asellus aquaticus	x	2
Ancylus fluviatis		1	Gammarus pulex	x	1
Ancylus sp.	1		Helobdella stagnalis	x	1
Viviparus sp.	1	1	Erpobdella octoculata	x	1

Table 6. Identified species/genus in sample 1 and 2 by Laboratory 6

Taxa/species	Sample 1 Identified	Delivered	Sample 2 Identified	Delivered
EPHEMEROPTERA				
Baetis buceratus	0	1	1	1
Baetis rhodani	2	2	2	2
Baetis vernus	1	1	2	2
Baetis spp. ?	1	0	0	0
Caenis luctuosa	1	1	1	1
Caenis macrura	1	1	1	1
Ecdyonurus dispar	1	1	0	0
Ecdyonurus torrentis	0	0	1	1
Electrogena quadrilineata	1	0	0	0
Ephemera danica	0	0	1	1
Ephemera vulgata	1	1	1	1
Ephemerella notata	0	0	1	0
Ephemerella ignita	0	0	0	1
Heptagenia flava	0	2	1	1
Heptagenia longicauda	0	0	1	1
Heptagenia sulphurea	1	1	0	0
Leptophlebiidae ?	2	0	0	0
Leptophlebia marginata	0	1	0	0
Leptophlebia vespertina	0	1	0	0
Oligoneuriella rhenana	1	1	4	4
Potamanthus luteus	0	0	1	1
Rhithrogena semicolorata	0	0	1	1
Rhithrogena spp.	1	0	0	0
PLECOPTERA				
Amphinemura sulcicollis	1	1	2	2
Amphinemura spp.	2	2	0	0
Brachyptera risi	2	2	2	2
Brachyptera risi (incomplete)	1	1	0	0
Brachyptera seticornis	0	1	1	1
Diura bicaudata	1	0	3	1
Diura nanseni	0	0	0	2
Isoperla grammatica	0	1	1	1
Isoperla oxylepis	0	0	1	1
Isoperla spp.	1	1	0	0
Leuctra spp. (hippopus)	0	1	1	2
Leuctra spp.	1		2	0
Leuctra nigra	1	1	1	1
Nemoura avicularis	0	1	1	1
Nemoura sciurus	0	0	1	0
Nemoura spp.	4	0	0	0
Nemoura cinerea	0	3	0	1
Perla burmeisteriana	0	0	1	1
Protonemura nimborum	2	0	0	0
Protonemura nitida	0	0	1	0
Protonemura meyeri	0	2	0	1
Siphonoperla torrentium	1	0	0	0
Siphonoperla spp. (taurica)	0	0	1	0
Siphonoperla burmeisteri	0	1	0	1
Taeniopteryx nebulosa	2	2	0	0
TRICHOPTERA				
Allogamus auricollis	0	1	2	2
Anabolia nervosa	0	0	2	2
Chaetopteryx villosa/fusca	3	3	0	0
Drusus discolor	2	2	1	1

Taxa/species	Sample 1 Identified	Delivered	Sample 2 Identified	Delivered
Hydropsyche bulbifera	1	1	1	1
Hydropsyche contubernalis	2	2	1	1
Hydropsyche siltalai	2	2	2	2
Melampophylax mucoreus	1	1	0	0
Micrasema longulum	2	2	1	1
Molanna angustata	1	1	1	1
Neureclipsis bimaculata	2	2	1	1
Philopotamus montanus	1	1	0	0
Plectrocnemia conspersa	1	1	3	3
Rhyacophila nubila/dorsalis/vulgaris	0	0	2	2
Rhyacophila tristis	1	1	0	0
Rhyacophila sensu stricto (aurata)	1	0	0	0
Ryacophila dorsalis	0	1	0	0
Sericostoma spp.	0	0	2	0
Sericostoma personatum	0	0	0	2
COLEOPTERA				
Elmis aenea	0	2	1	1
Elmis maugetii	2	2	2	2
Elmis rioloides	1	1	0	0
Elmis spp.-Larva	1	1	1	1
Dytiscinae	0	0	3	0
Gyrinus spp.	0	0	2	0
Hydraena riparia	0	0	3	0
Hydraena gracilis	0	0	0	3
Laccophilus hyalinus	1	1	0	0
Limnius perrisi	1	0	0	0
Orectochilus villosus	1	1	1	2
Orectochilus villosus-Larva	1	1	0	1
Oreodytes sanmarkii	3	3	0	3
Platambus maculatus	1	1	1	1
HIRUDINEA				
Helobdella stagnalis	1	1	0	0
MOLLUSCA				
Ancylus fluviatilis	1	1	2	2
Bithynia tentaculata	2	2	1	1
Dreissena polymorpha	0	0	3	3
Gyraulus albus	0	0	1	0
Valvata macrostoma	1	0	0	0
Valvata sibrica	0	1	0	1
CRUSTACEA				
Gammarus fossarum	3	3	3	3
Gammarus pulex	2	2	2	2
DIPTERA				
Ahtherix ibis	0	0	1	1

Appendix B. Reports and publications from the ICP Waters Programme

1. Manual for Chemical and Biological Monitoring. Programme Manual. Prepared by the Programme Centre, Norwegian Institute for Water Research. NIVA, Oslo 1987.
2. Norwegian Institute for Water Research, 1987. Intercalibration 8701. pH, Ks, SO_4, Ca. Programme Centre, NIVA, Oslo.
3. Norwegian Institute for Water Research, 1988. Data Report 1987 and available Data from Previous Years. Programme Centre, NIVA, Oslo.
4. Norwegian Institute for Water Research, 1988. Intercalibration 8802. pH, K_{25}, HCO_3, NO_3, SO, Cl, Ca, Mg, Na, K. Programme Centre, NIVA, Oslo.
5. Proceedings of the Workshop on Assessment and Monitoring of Acidification in Rivers and Lakes, Espoo, Finland, 3rd to 5th October 1988. Prepared by the Finnish Acidification Research Project, HAPRO, Ministry of Environment, October 1988.
6. Norwegian Institute for Water Research, 1989. Intercalibration 8903: Dissolved organic carbon and aluminium fractions. Programme Centre, NIVA, Oslo. NIVA-Report SNO 2238-89. ISBN 82-577-1534-4.
7. Note: Some reflections about the determination of pH and alkalinity. Prepared by the Programme Centre, Norwegian Institute for Water Research. Håvard Hovind, NIVA, Oslo October 1989.
8. Hovind, H. 1990. Intercalibration 9004: pH and alkalinity. Programme Centre, NIVA, Oslo. NIVA-Report SNO 2465-90. ISBN 82-577-1776-2.

- Skjelkvåle, B.L. and Wright, R.F. 1990. Overview of areas sensitive to acidification: Europe. Programme Centre, NIVA, Oslo. Acid Rain Research Report 20/1990. NIVA-Report 2405-90. ISBN 82-577-1706-1.

9. Johannessen, M. 1990. Intercalibration in the framework of an international monitoring programme. Proceedings of the third annual Ecological Quality Assurance Workshop, Canada Centre for Inland Waters, Burlington Ontario. Programme Centre, NIVA, Oslo.
10. Norwegian Institute for Water Research, 1990. Data Report 1988. Programme Centre, NIVA, Oslo.
11. Norwegian Institute for Water Research, 1990. Data Report 1989. Programme Centre, NIVA, Oslo.
12. Proceedings for the 5th Meeting of the Programme Task Force Freiburg, Germany, October 17 -19, 1989. Prepared by the Umweltbundesamt, Berlin July 1990.
13. Hovind, H. 1991. Intercalibration 9105: pH, K_{25}, HCO_3, $NO_3 + NO_2$, Cl, SO_4, Ca, Mg, Na, K and TOC. Programme Centre, NIVA, Oslo. NIVA-Report 2591-91. ISBN 82-577-1931-5.
14. Norwegian Institute for Water Research, 1991. The Three Year Report. Summary and results 1987 – 1989: Results from the International Co-operative Programme on Assessment and Monitoring of Acidification in Rivers and Lakes. Programme Centre, NIVA, Oslo.
15. Norwegian Institute for Water Research, 1991. Summary of The Three Year Report 1987 – 1989. Programme Centre, NIVA, Oslo.
16. Scientific papers presented at the Sixth Task Force meeting in Sweden 23 - 24 October 1990. Swedish Environmental Protection Agency, Sweden, September 1991.
17. Seventh Task Force meeting of international Co-operative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes. Galway, Ireland. September 30 - October 3 1991. Proceedings.
18. Johannessen, M., Skjelkvåle, B.L. and Jeffries, D. 1992. International cooperative Programme on Assessment and Monitoring of Rivers and Lakes. In: Conference Abstracts, Intern. Conference on Acidic Deposition, Glasgow 16-21, sept. 1992, p. 449. Kluwer Academic Press.
19. Hovind, H. 1992. Intercalibration 9206: pH, K_{25}, HCO_3, $NO_3 + NO_2$, Cl, SO_4, Ca, Mg, Na, K, Al and DOC. Programme Centre, NIVA, Oslo. NIVA-Report 2784-92. ISBN 82-577-2164-6.
20. Norwegian Institute for Water Research, 1992. Data Report 1990. Programme Centre, NIVA, Oslo.

21. 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.

22. Hovind, H. 1993. Intercalibration 9307: pH, k_{25}, HCO_3, $NO_3 + NO_2$, Cl, SO_4, Ca, Mg, Na, K, total aluminium, reactive and non-labile aluminium, TOC and COD-Mn. Programme Centre, NIVA, Oslo. NIVA-Report 2948-93. ISBN 82-577-2370-3.

23. Raddum, G.G. 1993. Intercalibration of Invertebrate Fauna 9301. Programme Centre, NIVA, Oslo. NIVA-Report SNO 2952-93. ISBN 82-577-2376-2.

24. Proceedings of the 9th Task Force Meeting in Oisterwijk, the Netherlands, November 1-3, 1993. Programme Centre, NIVA, Oslo.

25. Skjelkvåle, B.L., Newell, A.D, and Johannessen, M. 1993. International Cooperative Programme on Assessment and Monitoring of Rivers and lakes: Status and Results. In: BIOGEOMON - Symposium on Ecosystem Behaviour: Evaluation of Integrated Monitoring in small catchments. Prague, September 18-20, 1993. Czech Geological Survey, Prague 1993. s. 274-275.

26. Hovind, H. 1994. Intercomparison 9408. pH, k_{25}, HCO_3, $NO_3 + NO_2$, Cl, SO_4, Ca, Mg, Na, K, total aluminium, TOC and COD-Mn. Programme Centre, NIVA, Oslo. NIVA-Report SNO 3142-94. ISBN 82-577-2616-8.

27. Skjelkvåle, B.L., Newell, A.D., Raddum, G.G., Johannessen, M., Hovind, H., Tjomsland, T. and Wathne, B.M. 1994. The six year report: Acidification of surface water in Europe and North America. Dose/response relationships and long-term trends. Programme Centre, NIVA, Oslo. NIVA-Report SNO 3041-94. ISBN 82-577-2499-8.

28. Norwegian Institute for Water Research, 1994. Data Report 1991. Programme Centre, NIVA, Oslo. ISBN 82-577-2562-5.

29. Stoddard, J.L. and Traaen, T.S. 1994. The stages of Nitrogen Saturation: Classification of catchments included in "ICP on Waters". In: M. Hornung, M.A. Stutton and R.B. Wilson (eds.) Mapping and Modelling of Critical Loads for Nitrogen: a Workshop Report. Proceedings of a workshop held in Grange-over-Sands (UK), 24-26 October 1994. pp.69-76.

30. Hovind, H. 1995. Intercomparison 9509. pH, k_{25}, HCO_3, $NO_3 + NO_2$, Cl, SO_4, Ca, Mg, Na, K, total aluminium, aluminium- reactive and nonlabile, TOC and COD-Mn. Programme Centre, NIVA, Oslo. NIVA-Report SNO 3331-95. ISBN 82-577-2849-7.

31. Traaen, T.S. and Stoddard, J.L. 1995. An Assessment of Nitrogen Leaching from Watersheds included in ICP on Waters. Programme Centre, NIVA, Oslo. NIVA-Report SNO 3201-95. ISBN 82-577-2699-0.

32. Norwegian Institute for Water Research, 1995. Data Report 1992-93. Draft 1994. Part 1, Introduction and Chemistry. Programme Centre, NIVA, Oslo. ISBN 82-577-2852-7.

33. Norwegian Institute for Water Research, 1995. Data Report 1992-1993. Draft 1994. Part 2, Biology and Site-data. Programme Centre, NIVA, Oslo. ISBN 82-577-2852-7.

34. Raddum, G.G. 1995. Aquatic Fauna. Dose/response and long term trends. Programme Centre, NIVA, Oslo. ISBN 82-577-2859-4

35. Raddum, G.G. 1995. Intercalibration of Invertebrate Fauna 9502. Programme Centre, NIVA, Oslo. ISBN 82-577-2834-9.

36. Raddum, G.G., and Skjelkvåle, B.L. 1995. Critical limits of acidification to invertebrates in different regions of Europe. *Water Air Soil Poll.* 85: 475-480.

37. Hovind, H. 1996. Intercomparison 9610. pH, K_{25}, HCO_3, $NO_3 + NO_2$, Cl, SO_4, Ca, Mg, Na, K, total aluminium, aluminium - reactive and nonlabile, TOC and COD-Mn. Programme Centre, NIVA, Oslo. NIVA-Report SNO 3550-96. ISBN 82-577-3099-8.

38. Newell, A.D, and Skjelkvåle, B.L. 1996. Acidification trends in surface waters in the International Program on Acidification of Rivers and Lakes. *Water Air Soil Poll.* 93:27-57.

♦ Proceedings of the 10th Task Force Meeting in Budapest 1994. Prepared by the Programme Centre, NIVA, Oslo March 1996.

39. Norwegian Institute for Water Research, 1996. Programme Manual. Programme Centre, NIVA, Oslo. NIVA-Report SNO 3547-96. ISBN 82-577-3094-7.

40. Raddum, G.G. 1996. Intercalibration of invertebrate fauna 9603. Programme Centre, NIVA, Oslo. ISBN 82-577-3095-5.

41. Lükewille, A., Jeffries, D., Johannessen, M., Raddum, G.G., Stoddard, J.L and Traaen, T.S. 1997. The Nine Year Report. Acidification of Surface Water in Europe and North America. Long-term Developments (1980s and 1990s). Programme Centre, NIVA, Oslo. NIVA-Report SNO 3637-97. ISBN 82-577-3195-1.

42. Hovind, H. 1997. Intercomparison 9711. pH, K_{25}, HCO_3, NO_3 + NO_2, Cl, SO_4, Ca, Mg, Na, K, total aluminium, aluminium - reactive and nonlabile, TOC and COD-Mn. Programme Centre, NIVA, Oslo. NIVA-Report SNO 3716-97. ISBN 82-577-3284-2.

43. Johannessen, M., and Skjelkvåle, B.L. 1997. International Co-operative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes - ICP Waters; Programme objectives, organization and main results. In: Proceedings to "International Conference on management of Transboundary Waters in Europe" 22-25 September 1997 in Poland. Programme Centre, NIVA, Oslo. ICP Waters Report 43/1997. ISBN 82-577-3297-4.

44. Henriksen, A. and Posch, M. 1998. Critical loads and their exceedances for ICP Waters sites. Programme Centre, NIVA, Oslo. NIVA-Report SNO 3821-98, ICP Waters Report 44/1998. ISBN 82-577-3399-7

45. Smith, D. and Davis, I. 1997. International Co-operative programme on Assessment and Monitoring of Acidification of Rivers and lakes: 8th Task Force Meeting, 1992. Can. Tech. Rep. Fish. Aquat. Sci. 2155: iv 68 p.

46. Summary of The Nine Year Report from the ICP Waters Programme. NIVA-Report SNO 3879-98, ICP Waters report 46/1998. ISBN 82-577-3463-2.

47. Raddum, G.G. 1998. Intercalibration 9804: Invertebrate fauna. NIVA-Report SNO 3912-98, ICP Waters Report 47/1998. ISBN 82-577-3500-0.

48. Larsen, S.E., Friberg, N. and Rebsdorf, Aa.. (eds.) 1999. Proceedings from the 12th Task Force Meeting in Silkeborg, Denmark, October 23-25, 1996. National Environmental Research Institute, Denmark 52 pp NERI Technical Report, No. 271

49. Hovind, H. 1998. Intercomparison 9812. pH, K_{25}, HCO_3, NO_3 + NO_2, Cl, SO_4, Ca, Mg, Na, K, total aluminium, aluminium - reactive and nonlabile, TOC and COD-Mn. NIVA-Report SNO 3939-98, ICP Waters Report 49/1998. ISBN 82-577-3530-2.

50. Rosseland, B.O., Raddum, G.G. and Bowman, J. 1999. Workshop on biological assessment and monitoring; evaluation and models. NIVA-Report SNO 4091-99, ICP Waters Report 50/1999. ISBN 82-577-3698-8.

51. Hovind, H. 1999. Intercomparison 9913. pH, K_{25}, HCO_3, NO_3 + NO_2, Cl, SO_4, Ca, Mg, Na, K, total aluminium, aluminium - reactive and nonlabile, TOC and COD-Mn. NIVA-Report SNO 4093-99, ICP Waters Report 51/1999. ISBN 82-577-3700-3.

52. Skjelkvåle, B. L., Andersen, T., Halvorsen, G. A., Raddum, G.G., Heegaard, E., Stoddard, J. L., and Wright, R. F. 2000. The 12-year report; Acidification of Surface Water in Europe and North America; Trends, biological recovery and heavy metals. NIVA-Report SNO 4208/2000, ICP Waters report 52/2000. ISBN 82-577-3827-1, 115 pp

53. Stoddard, J. L., Jeffries, D. S., Lükewille, A., Clair, T. A., Dillon, P. J., Driscoll, C. T., Forsius, M., Johannessen, M., Kahl, J. S., Kellogg, J. H., Kemp, A., Mannio, J., Monteith, D., Murdoch, P. S., Patrick, S., Rebsdorf, A., Skjelkvåle, B. L., Stainton, M. P., Traaen, T. S., van Dam, H., Webster, K. E., Wieting, J., and Wilander, A. 1999. Regional trends in aquatic recovery from acidification in North America and Europe 1980-95. Nature 401:575- 578.

54. Skjelkvåle, B.L. Olendrzynski, K., Stoddard, J. Traaen, T. and Wright, R.F. 2000 Draft report : Assessment of trends and leaching in Nitrogen at ICP Waters Sites (Europe And North America)

55. Hovind, H. 2000. Intercomparison 0014. pH, K_{25}, HCO_3, NO_3 + NO_2, Cl, SO_4, Ca, Mg, Na, K, total aluminium, aluminium - reactive and nonlabile, TOC, COD-Mn. Fe, Mn, Cd, Pb, Cu, Ni and Zn. NIVA-Report SNO 4281-2000, ICP Waters Report 55/2000. ISBN 82-577-3910-3.

56. Hovind, H. 2000. Trends in intercomparisons 8701-9812: pH, K_{25}, NO_3 + NO_2, Cl, SO_4, Ca, Mg, Na, K and aluminium - reactive and nonlabile, TOC, COD-Mn. NIVA-Report SNO 4281-2000, ICP Waters Report 56/2000. ISBN 82-577-3910-3.

57. Wright, R.F. 2000. Note on: Effect of year-to-year variations in climate on trends in acidification. NIVA-report SNO 4328-2001, ICP Waters report 57/2001. ISBN 82-577-3962-6.

58. Kvaeven, B. Ulstein, M.J., Skjelkvåle, B.L., Raddum, G.G. and Hovind. H. 2000. ICP Waters – An international programme for surface water monitoring. In Press Water Air Soil Poll.

59. Skjelkvåle, B.L. Stoddard J.L. and Andersen, T. 2000. Trends in surface waters acidification in Europe and North America (1989-1998). In Press Water Air Soil Poll.

60. Stoddard, J. Traaen, T and Skjelkvåle, B.L. 2000. Assessment of Nitrogen leaching at ICP Waters sites (Europe and North America). In Press Water Air Soil Poll.

61. Raddum, G.G. and Skjekvåle B.L. 2000. Critical Load of Acidifying Compounds to Invertebrates in Different Ecoregions of Europe. In Press Water Air Soil Poll.

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