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# ICP Waters Report 133/2017
## Biological intercalibration: Invertebrates 2017

Photo: Potamophylax sp. Arne Fjellheim, Uni Research Environment

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

# REPORT

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The 21th intercalibration of invertebrates in the ICP Waters programme had contribution from four laboratories. The biological intercalibration is important for harmonizing taxonomic work across countries and will be of high value for programmes where community analyses are in focus, such as classification of ecological status according to EU's Water Framework Directive. The biological intercalibration under the ICP Waters programme was the first regular test comprising identification of organisms down to the level of individual species.

The laboratories identified a high proportion of the individuals in the test samples, 89.2 % of the total number of species was correctly identified. Few faults were recorded on genus level. The mean Quality assurance index ranged between 77.4 and 100. Only one laboratory had a value below 80 – the limit for acceptable taxonomic work, while one other laboratory had all identifications correct.

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# Biological Intercalibration: Invertebrates 2017

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# Preface

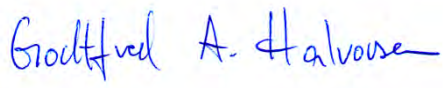
The international cooperative programme on assessment and monitoring of air pollution on rivers and lakes (ICP Waters) was established under the Executive Body of the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP) in July 1985. Since then ICP Waters has been an important contributor to document the effects of implementing the Protocols under the Convention. Numerous assessments, workshops, reports and publications covering the effects of long-range transported air pollution have been published over the years.

The ICP Waters Programme Centre is hosted by the Norwegian Institute for Water Research (NIVA), while the Norwegian Environment Agency manages the programme. A programme subcentre is established at Uni Research, Bergen. The Programme Centre's work is supported financially by the Norwegian Environment Agency and from the UNECE LRTAP Trust Fund.

The main aim of the ICP Waters Programme is to assess, on a regional basis, the degree and geographical extent of the impact of atmospheric pollution, in particular acidification, on surface waters. More than 20 countries in Europe and North America participate in the programme on a regular basis.

The Programme objective is to establish and maintain an international network of surface water monitoring sites and promote international harmonisation of monitoring practices. A tool in this work is the 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 improving the taxonomic skill of the participating laboratories.

We here report the results from the 21$^{th}$ intercalibration on the invertebrate fauna.



*Godtfred Anker Halvorsen*

ICP Waters Programme Subcentre
Bergen, October 2017

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# Summary

The 21th intercalibration of invertebrates in the ICP Waters programme had contribution from four laboratories. The biological intercalibration is important for harmonizing taxonomic work across countries and will be of high value for programmes where community analyses are in focus, such as classification of ecological status according to EU's Water Framework Directive. The biological intercalibration under the ICP Waters programme was the first regular test comprising identification of organisms down to the level of individual species.

The laboratories identified a high proportion of the individuals in the test samples, 93 % of the total number of species were correctly identified. Few faults were recorded on genus level. The mean Quality assurance index ranged between 77.4 and 100. Only one laboratory had a value below 80 – the limit for acceptable taxonomic work, while one other laboratory had all identifications correct.

# 1 Introduction

The purpose of the biological intercalibration is to evaluate the quality of the taxonomic work producing data for submission to the Programme subcentre. 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 in multivariate statistical analysis (Larsen *et al.* 1996, Skjelkvåle *et al.* 2000, Halvorsen *et al.* 2002, Halvorsen *et al.* 2003), and in analyses of biodiversity (Velle *et al*., 2013, Velle *et al*. 2016). 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 7$^{th}$ ICP Waters Task Force meeting in Galway, Ireland. The different countries/laboratories have to know, first of all, their native fauna. Since the fauna in different geographical regions vary, it is necessary to prepare specific samples for each participating laboratory, based on their native 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 identified samples of invertebrates from their own monitoring sites to the Programme centre. The Programme centre will 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.

The taxonomic skill of the different participants is measured by using a quality assurance index, 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 the test-samples

Samples of identified invertebrates were received from all participating laboratories. These samples were used to compose test samples, with the addition of specimens from earlier exercises and from own stocks. The geographical distribution of species was checked by the use of the Fauna Europaea Web Service 2013 (http://www.faunaeur.org ). This is a database of the scientific names and distribution of multicellular European land and fresh-water animals (see example in Figure 1).

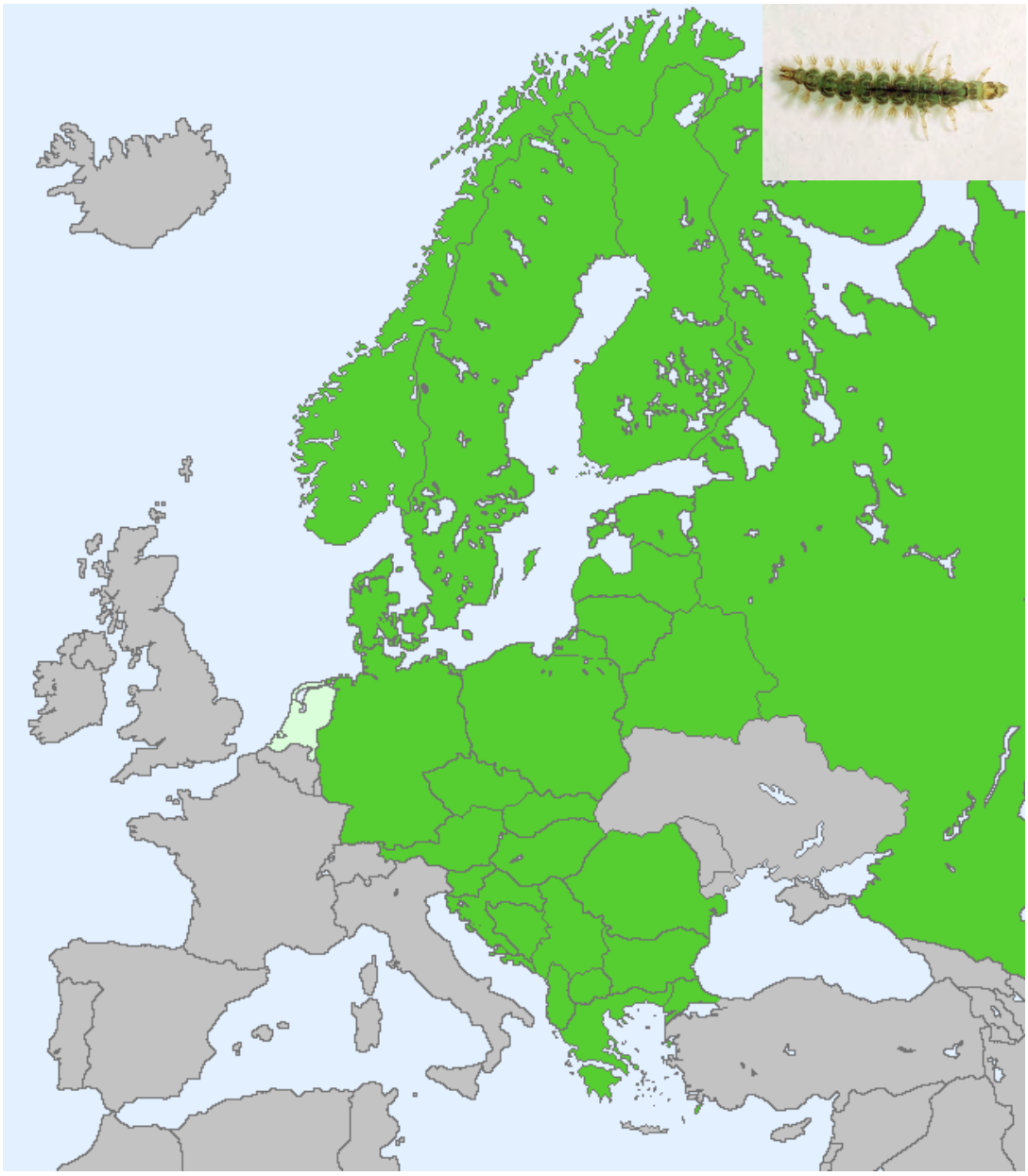

***Figure 1.*** *Geographical distribution of the caddisfly* Rhyacophila nubila *in Europe. This species is widely distributed, but is absent from several West-European countries. Map after Fauna Europaea Web Service, http://www.faunaeur.org, Photo: Arne Fjellheim*

## Identification

To minimize possible faults, the following procedure is 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

The quality of the test material may be reduced during handling and shipping. 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 may 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

The results of the tests are sent to the laboratories for eventual comments before publishing the report. In this way, we can remove taxonomical biases - for example misidentified or destroyed test material. In cases of disagreement, material may be sent back to the programme subcentre for control. This procedure may act educational for both parts.

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. We encourage the participants to give comments on matters that may impede the identification. For example, misidentification of species in cases where important taxonomic characters have been destroyed may be neglected, if this is pointed out by the participants.

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 of the total number in the sample. This is named *percent identified*. A low percent means that many individuals were not identified and will consequently reduce the value of the taxonomic work.

Available material for making test samples varies. Normally each laboratory gets between 60 and 130 individual species in the two samples. 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. Small samples should be avoided, as only a few misidentifications could result in a low score.

According to Fauna Europaea, the total number of Europaean mayfly, stonefly and caddisfly species (per 2015) is 1814. However, the biodiversity differs between countries. Normally the freshwater fauna gets poorer moving from South Europe towards the Northern countries. This is also a fact to

bear in mind when judging taxonomical capacity. As an example of this, the freshwater fauna of Switerland is much richer than in Norway and Sweden – despite the fact that the area of Switerland is approximately 1/10 of the two Nordic countries (Figure 2).

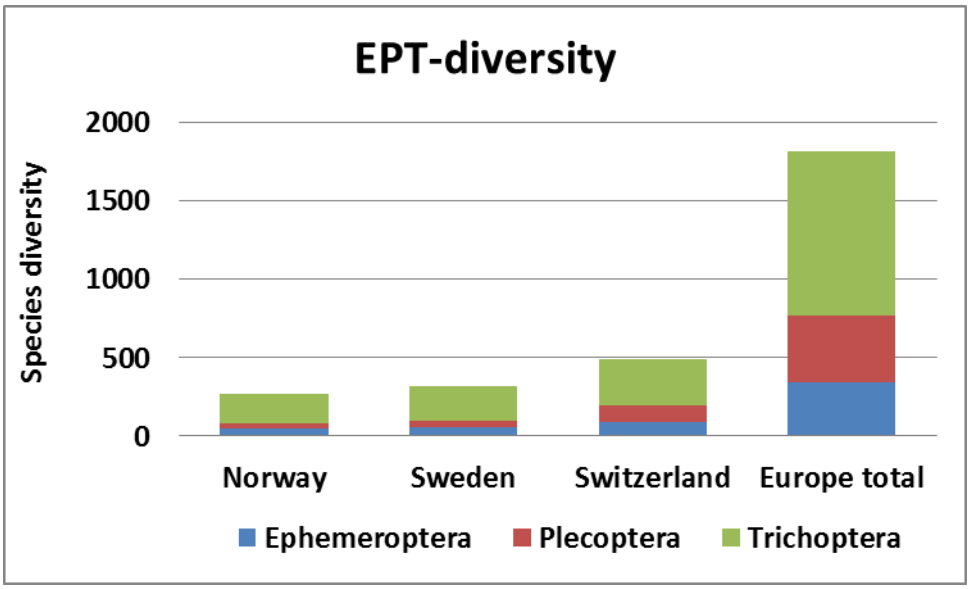


***Figure 2.*** *Species (EPT) diversity of mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera) in Norway, Sweden and Switzerland (after Fauna Europaea Web Service, http://www.faunaeur.org.*

### Quality assurance index

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 acceptable taxonomical work.

### Test of the subcentre

The ICP waters subcentre in Bergen, Norway is tested with the help from Sweden every second year (not in 2017). The Swedish University of Agricultural Sciences in Uppsala prepares and evaluates the test of the subcentre. Methodology and implementation is otherwise identical to the other tests.

# 3 Results and discussion

Four laboratories participated in the intercalibration of invertebrates in 2017 (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 B, Tables 1 – 4.

## Mayflies

The identification of the mayflies (Figure 3) ranged from below acceptable to excellent. The low Qi for Laboratory 1 is a result of too many specimens identified to genus, but not to species.

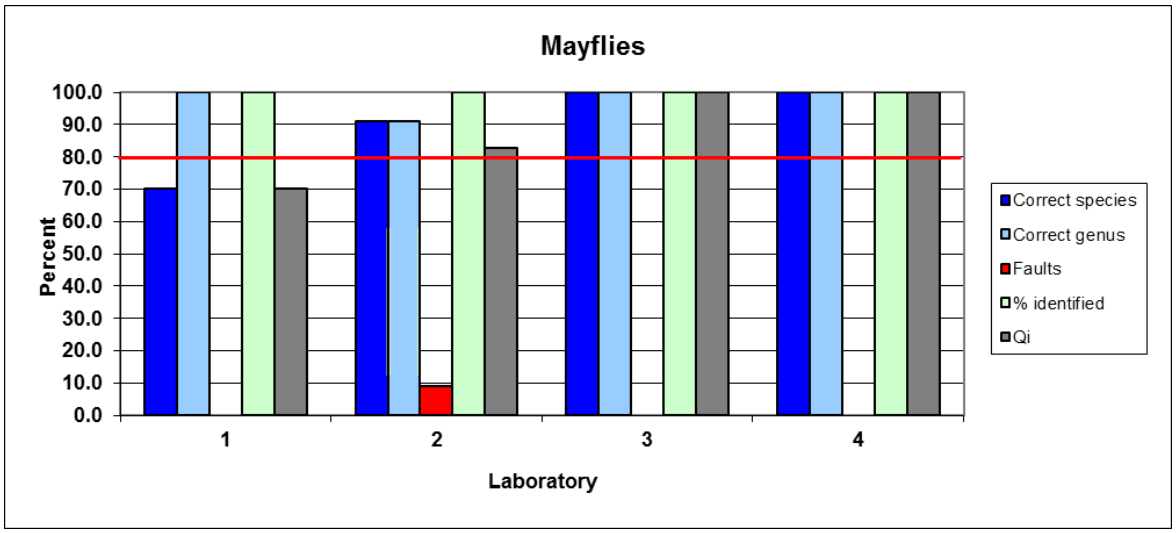


***Figure 3.*** *Results of the identification of the mayflies. The red line indicates the level of acceptance.*

## Stoneflies

The identification of the stoneflies is shown in Figure 4.

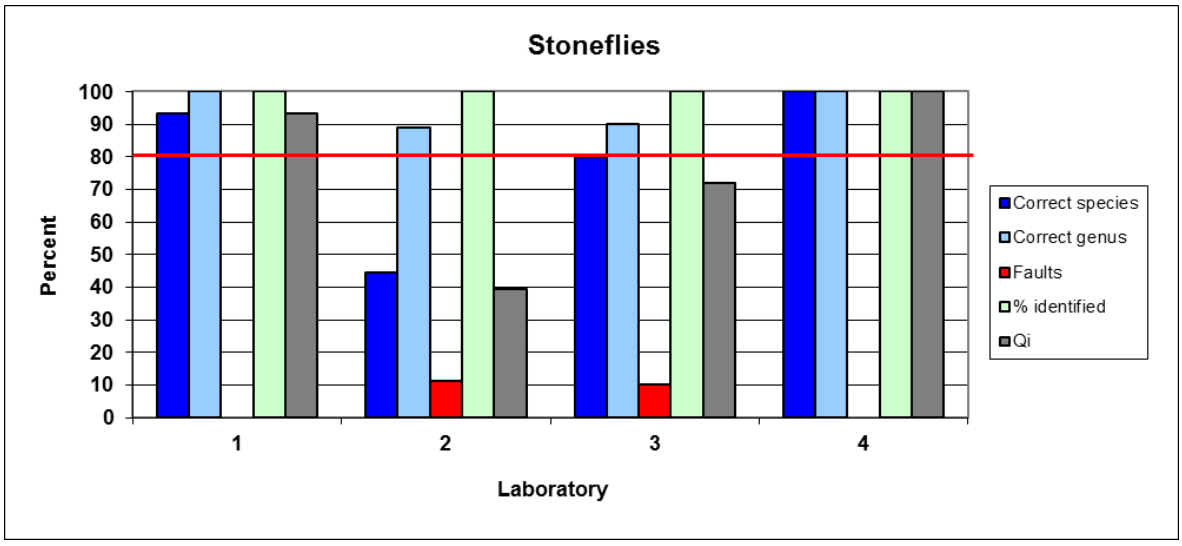


***Figure 4.*** *Results of the identification of stoneflies. The red line indicates the level of acceptance.*

The results were below the level of acceptance for two of the laboratories. An explanation for the poor result for Laboratory 2 may be that this lab did not send enough specimens of the group, and got material from another country sent in by another lab. These specimens are recorded in the country, but may not be common or well known in the lab's rivers. The specimens were, however, identified to correct genus with the exception of one specimen. This gave a Qi well below the level of acceptance. The one erroneously identified specimen from Laboratory 3 also made the Qi from this lab to drop below the level of acceptance.

## Caddisflies

The identification of the caddisflies was excellent for three of the labs, but below the level of acceptance for Laboratory 1 (Figure 5).

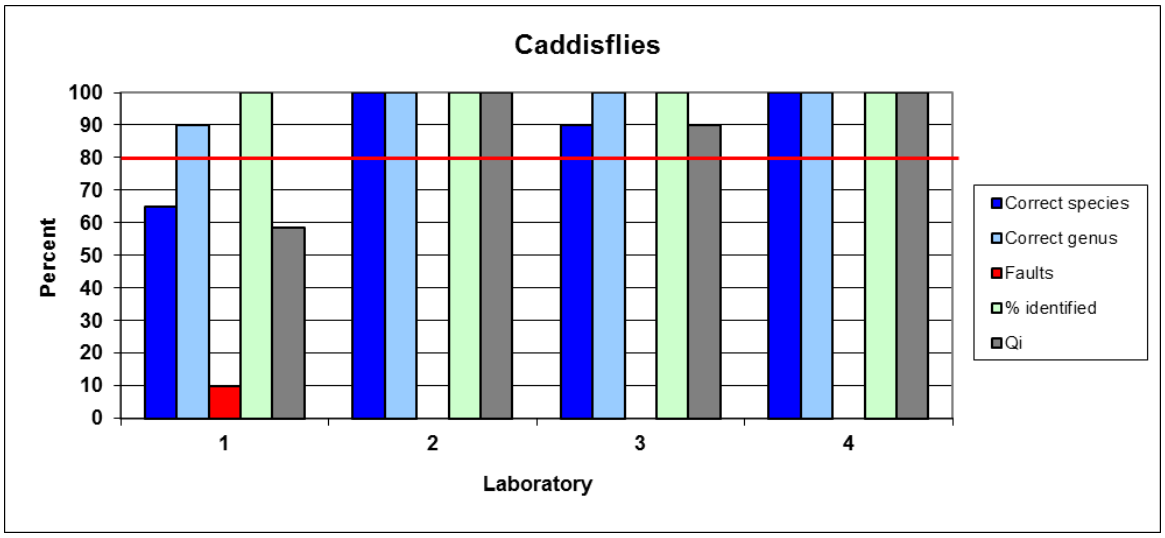


***Figure 5.*** *Results of the identification of caddisflies. The red line indicates the level of acceptance.*

## Other groups

In this intercalibration we have included water beetles (Coleoptera), larger crustaceans (Malacostraca), leeches (Hirudinea), molluscs (Gastropoda), alderflies (Megaloptera), Diptera etc. Both larvae and imagines have been included for some of the groups. Leeches, molluscs and larger crustaceans are sensitive to acid water and important for the evaluation of acidification. The tolerance of the species in Coleoptera, Megaloptera, Diptera is little known, but generally they are regarded as tolerant to acidic water and consequently have low importance for evaluation of acidity indices. However, all species will be important for invertebrate community analysis. Figure 6 and Appendix tables 1 – 4 shows the results of the identification of these groups.

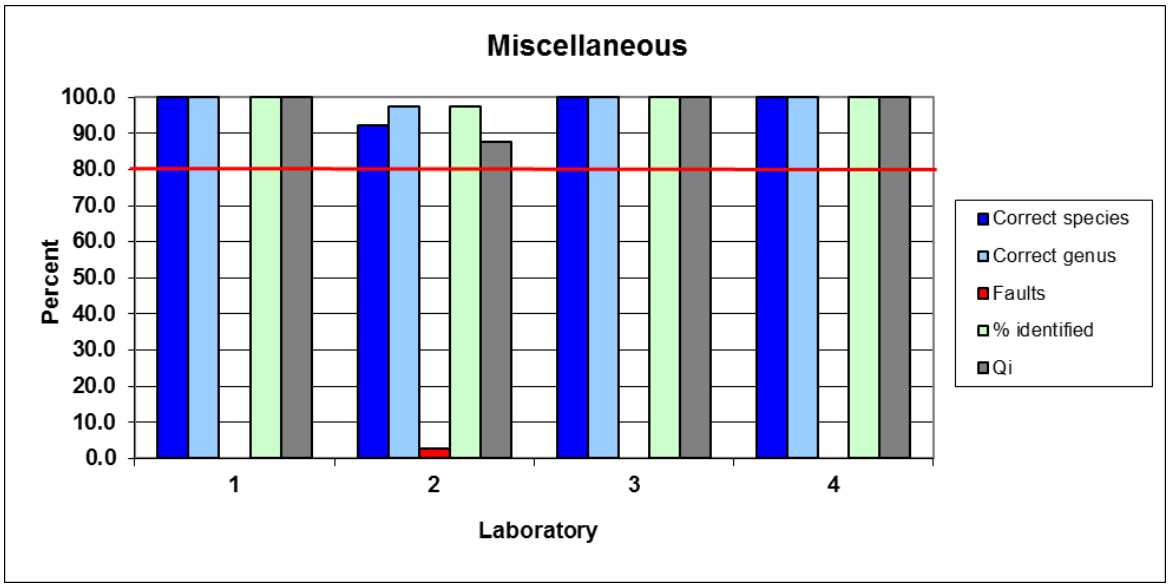


***Figure 6.*** *Results of the identification of miscellaneous groups. The red line indicates the level of acceptance.*

The identifications made by all laboratories were very good with only one error in Laboratory 2. This was a specimen sent in by the lab, but not identified. This may very well just be an error of lapse.

### Total number of species in the sample

A total of 269 individuals were sent to the four different laboratories. Of these, all but one specimen were reported back to the programme subcentre.

# 4 Evaluation and conclusion

The laboratories generally identified a high portion of the total number of species in the test samples. The mean skill of identifying species, genus and Qi score per laboratory is shown in Figure 7. The mean score ranged from just below the acceptance limit to 100 in Laboratory 4, which means that all identifications were correct. The slight dip below the acceptance limit for Laboratory 2 is a consequence of the Qi for the stoneflies in this lab where too many specimens were identified to genus only. This emphasizes the importance of sending an abundance of specimens to the programme subcentre, and to try to identify specimens to the species level.

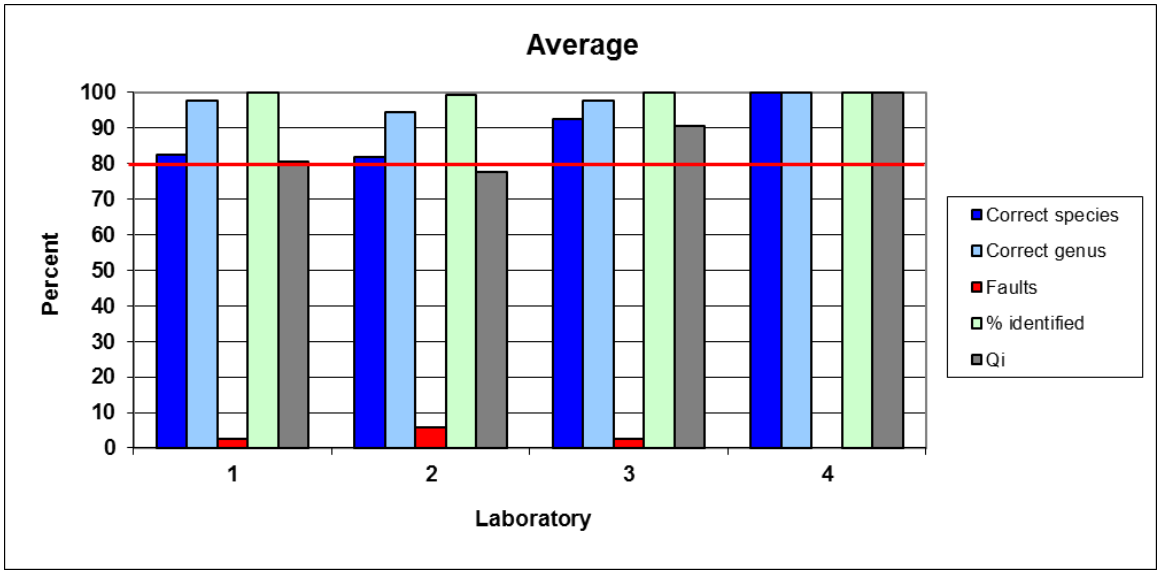


***Figure 7.*** *Mean skill in percent of identifying species and genus, and mean Qi for each laboratory. The red line indicates the level of acceptance.*

The biological intercalibration is important for harmonizing biological material/databases and will be of high value in projects where community analyses is in focus, or where the ecological status of waterbodies should be stated. The biological intercalibration under the ICP Waters programme was the first regular test aiming to test taxonomic skills in identifying benthic invertebrates. Today, similar tests are run by the the North American Benthological Society (http://www.nabstcp.com) and by the Natural History museum, London (Identification Qualifications – IdQ test. The invertebrate groups covered in the latter test are those used in the BMWP water quality score system (Armitage et al., 1983) and include groups used for monitoring freshwater environments under the EU water framework directive (Schartau et al. 2008). From 2017 and onwards, Uni Research Environment are also running a test similar to the ICP waters intercalibration for different Norwegian Laboratories.

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# 6 Appendix A. Responsible laboratories

Each participating laboratory is identified by a number, which is identical with the table number. Laboratories participating in the intercalibration of invertebrates in 2017 and their code numbers are:

1. Bomio & Fürst SA, Via Pobbia 16, 6514 Sementina, **Switzerland**.
   Responsible taxonomist: Dr. Sebastiano Schneebeli

2. Landesamt für Natur, Umwelt und Verbraucherschutz NRW, FB 55: Ökologie und Chemie der Oberflächengewässer, Leibnizstraße 10, 45659 Recklinghausen **Germany**. Responsible taxonomist: Dr. Reinhold Ludwig.

3. Swedish University of Agricultural Sciences, Dept. of Environmental Assessment, P.O. Box 7050, S-75007 Uppsala, **Sweden**. Responsible taxonomist: Dr. Magda-Lena Wiklund.

4. Estonian Environmental Research Centre, Tartu Department, Vaksali 17a, 50410 Tartu, **Estonia.** Responsible taxonomist: Dr. Triinu Punder

# 7 Appendix B. Species lists

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

| | Sample 1 | | | Sample 2 | |
|---|---|---|---|---|---|
| **Taxa:** | **Delivered** | **Identified** | | **Delivered** | **Identified** |
| **Ephemeroptera** | | | | | |
| *Baetis alpinus* | 1 | | | 1 | |
| *Baetis* sp. | | 1 | | 1 | 2 |
| *Ecdyonurus helveticus* | 1 | 1 | | 1 | 1 |
| *Eporeus alpicola* | 1 | 1 | | 1 | 1 |
| *Rhithrogena degrangei* | 1 | 1 | | 1 | |
| *Rhithrogena* sp. | | | | 1 | 2 |
| **Plecoptera** | | | | | |
| *Amphinemura sulcicollis* | 1 | 1 | | 1 | 1 |
| *Amphinemura* sp. | | | | 1 | 1 |
| *Isoperla rivulorum* | 1 | | | 1 | 1 |
| *Isoperla* sp. | | 1 | | | |
| *Nemoura mortoni* | 1 | 1 | | 1 | 1 |
| *Perla grandis* | 1 | 1 | | 1 | 1 |
| *Perlodes intricatus* | 1 | 1 | | 1 | 1 |
| *Protonemura rimborum* | 1 | 1 | | 1 | 1 |
| *Rhabdiopteryx neglecta* | 1 | 1 | | 1 | 1 |
| **Trichoptera** | | | | | |
| *Allogamus uncatus* | 1 | 1 | | 1 | 1 |
| *Drusus annulatus* | | | | 1 | |
| *Melampophylax mucoreus* | 1 | | | | 1 |
| *Drusus melanchaetes* | 1 | | | | |
| *Drusus biguttatus* | | 2 | | | |
| *Drusus discolor* | | | | 1 | 1 |
| *Hydropsyche modesta* | 1 | 1 | | 1 | 1 |
| *Oligotricha striata* | | | | 1 | 1 |
| *Philopotamus montanus* | 1 | 1 | | 1 | 1 |
| *Rhyacophila praemorsa* | | | | 1 | |
| *Rhyacophila* sp. (s. stricto) | | | | | 1 |
| *Rhyacophila torrentium* [1] | 1 | 1 | | 1 | 1 |
| *Rhyacophila tristis* | 1 | | | 1 | |
| *Rhyacophila stigmatica/hirticornis* [1] | | 1 | | | 1 |
| *Rhyacophila* gr. *dorsalis* | 1 | | | | |
| *Rhyacophila sp. (*s. stricto) | | 1 | | 1 | 1 |
| *Wormaldia copiosa* | 1 | 1 | | 1 | 1 |
| **Miscellanous** | | | | | |
| **Odonata** | | | | | |
| *Aeshna* sp. | 1 | 1 | | 1 | 1 |
| **Coleoptera** | | | | | |
| *Esolux* sp. | 1 | 1 | | 1 | 1 |
| *Hydraena* sp. | 1 | 1 | | 1 | 1 |
| **Diptera** | | | | | |
| *Atherix* sp. | 1 | 1 | | 1 | 1 |
| *Hexatomia* sp. | | | | 1 | 1 |

[1] As *Hyporhyacophila*

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

| | Sample 1 | | | Sample 2 | |
|---|---|---|---|---|---|
| **Taxa:** | **Delivered** | **Identified** | | **Delivered** | **Identified** |
| **Ephemeroptera** | | | | | |
| *Alainites muticus* | 1 | 1 | | | |
| *Baetis rhodani* | | | | 1 | 1 |
| *Ecdyonurus torrentis* | 1 | 1 | | | |
| *Epeorus assimilis* | | | | 1 | 1 |
| *Ephemera danica* | | | | 1 | 1 |
| *Ephemerella muticus* | 1 | 1 | | | |
| *Paraleptophlebia submarginata* | | | | 1 | |
| *Habroleptoides confusa* | | | | | 1 |
| *Potamanthus luteus* | | | | 1 | 1 |
| *Rhitrogena hercynia* | 1 | 1 | | | |
| *Serratella ignita* [2] | | | | 1 | 1 |
| *Torleya major* | 1 | 1 | | | |
| **Plecoptera** | | | | | |
| *Amphinemura borealis* | | | | 1 | |
| *Amphinemura* sp. | | | | | 1 |
| *Brachyptera risi* | | | | 1 | 1 |
| *Brachyptera seticornis* | 1 | 1 | | | |
| *Isoperla difformis* | 1 | 1 | | | |
| *Leuctra hippopus* | | | | 1 | |
| *Leuctra* sp. | | | | | 1 |
| *Protonemura meyeri* | 1 | | | 1 | |
| *Protonemura* sp. | | 1 | | | 1 |
| *Rhabdiopteryx acuminata* | 1 | | | | |
| *Brachyptera risi* | | 1 | | | |
| *Taeniopteryx nebulosa* | 1 | 1 | | | |
| **Trichoptera** | | | | | |
| *Allogamus auricollis* | 1 | 1 | | | |
| *Brachycentrus montanus* | | | | 1 | 1 |
| *Goera pilosa* | 1 | 1 | | | |
| *Hydropsyche pellucidula* | | | | 1 | 1 |
| *Lepidostoma hirtum* | 1 | 1 | | | |
| *Melampophylax mucoreus* | | | | 1 | 1 |
| *Micrasema minimum* | 1 | 1 | | | |
| *Micrasema setiferum* | | | | 1 | 1 |
| *Philopotamus montanus* | 1 | 1 | | | |
| *Polycentropus flavomaculatus* | 1 | 1 | | 1 | 1 |
| *Oecismus monedula* | | | | 1 | 1 |
| *Silo nigricornis* | | | | 1 | 1 |
| *Silo pallipes* | | | | 1 | 1 |
| *Synagapetus iridipennis* | 1 | | | | |
| Agapetinae | | 1 | | | |
| *Tinodes waeneri* | 1 | 1 | | | |
| **Miscellanous** | | | | | |
| **Gastropoda** | | | | | |
| *Ancylus fluviatilis* | | | | 1 | 1 |
| *Anisus vortex* | 1 | 1 | | | |
| *Bithynia tentaculata* | 1 | 1 | | | |
| *Physa fontinalis* | | | | 1 | 1 |
| *Valvata piscinalis* | | | | 1 | 1 |

[2] As *Ephemerella*

| | | | | | |
|---|---|---|---|---|---|
| **Hirudinea** | | | | | |
| *Erpobdella octoculata* | | | | 1 | 1 |
| *Erpobdella vilnensis* | 1 | 1 | | | |
| *Glossiphonia complanata* | | | | 1 | 1 |
| *Glossiphonia nebulosa* | 1 | 1 | | | |
| **Oligochaeta** | | | | | |
| *Haplotaxis gordioides* | | | | 1 | 1 |
| *Stylodrilus heringianus* | 1 | 1 | | 1 | 1 |
| **Malacostraca** | | | | | |
| *Asellus aquaticus* | 1 | 1 | | | |
| *Chelicorophium curvispinum* | | | | 1 | 1 |
| *Echinogammarus berriloni* | 1 | 1 | | | |
| *Gammarus fossarum* | | | | 1 | |
| *Gammarus pulex* | | | | | 1 |
| **Heteroptera** | | | | | |
| *Aphelocheirus aestivalis* | | | | 1 | 1 |
| **Coleoptera** | | | | | |
| *Anacaena bipustulata* | 1 | 1 | | | |
| *Elmis aenea* | 1 | | | | |
| *Elmis* cf. *aenea* | | 1 | | | |
| *Elmis maugetii* | | | | 1 | |
| *Elmis* cf. *maugetii* | | | | | 1 |
| *Esolus angustatus* | 1 | | | | |
| *Haliplus lineatocollis* | | | | 1 | 1 |
| *Haliplus* sp. | 1 | 1 | | | |
| *Hydraena gracilis* | | | | 1 | |
| *Hydraena* sp. | | | | | 1 |
| *Ilybius fuliginosus* | | | | 1 | 1 |
| *Limnius perrisi* | | | | 1 | 1 |
| *Orectochilus villosus* | | | | 1 | 1 |
| *Oulimnius tuberculatus* | 1 | | | | |
| *Oulimnius* cf. *tuberculatus* | | 1 | | | |
| *Riolus cupreus* | 1 | | | | |
| *Riolus* cf. *cupreus* | | 1 | | | |
| *Riolus* sp. | | | | 1 | 1 |
| **Megaloptera** | | | | | |
| *Sialis lutaria* | 1 | 1 | | | |
| **Diptera** | | | | | |
| *Atherix ibis* | | | | 1 | 1 |
| *Ibisia marginata* | 1 | 1 | | | |
| *Liponeura cinerascens* | 1 | 1 | | | |
| *Prodiamesa olivacea* | 1 | 1 | | | |
| *Prosimulium tomosvaryi* | 1 | 1 | | | |
| *Simulium argyreatum* | | | | 2 | 2 |
| *Simulium variegatum* | | | | 1 | 1 |

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

| | Sample 1 | | | Sample 2 | |
|---|---|---|---|---|---|
| **Taxa:** | **Delivered** | **Identified** | | **Delivered** | **Identified** |
| **Ephemeroptera** | | | | | |
| *Arthroplea congener* | | | | 1 | 1 |
| *Baetis rhodani* | | | | 1 | 1 |
| *Caenis horaria* | | | | 1 | 1 |
| *Caenis luctuosa* | 1 | 1 | | | |
| *Caenis rivulorum* | | | | 1 | 1 |
| *Centroptilum luteolum* | 1 | 1 | | 1 | 1 |
| *Ephemera vulgata* | 1 | 1 | | 1 | 1 |
| *Ephemerella aroni* [3] | 1 | 1 | | 1 | 1 |
| *Heptagenia dalecarlica* | | | | 1 | 1 |
| *Heptagenia sulphurea* | 1 | 1 | | | |
| *Leptophlebia vespertina* | 1 | 1 | | | |
| *Nigrobaetis niger* | 1 | 1 | | 1 | 1 |
| **Plecoptera** | | | | | |
| *Dinocras cephalotes* | | | | 1 | 1 |
| *Diura nanseni* | 1 | 1 | | | |
| *Leuctra nigra* | 1 | 1 | | 1 | |
| *Capnopsis schilleri* | | | | | 1 |
| *Nemoura flexuosa* | | | | 1 | |
| *Nemoura cinerea* | | | | | 1 |
| Nemurella pictetii | | | | 1 | 1 |
| *Protonemura meyeri* | 1 | 1 | | | |
| *Siphonoperla burmeisteri* | | | | 1 | 1 |
| *Taeniopteryx nebulosa* | 1 | 1 | | 1 | 1 |
| **Trichoptera** | | | | | |
| *Apatania wallengreni* | | | | 1 | |
| *Apatania* sp. | | | | | 1 |
| *Arctopsyche ladogensis* | | | | 1 | 1 |
| *Brachycentrus subnubilis* | | | | 1 | 1 |
| *Chimarra marginata* | | | | 1 | 1 |
| *Cheumatopsyche lepida* | 1 | 1 | | | |
| *Ecclisopteryx dalecarlica* | | | | 1 | 1 |
| *Ecnomus tenellus* | 1 | 1 | | 1 | 1 |
| *Hydropsyche pellucidula* | | | | 1 | 1 |
| *Hydropsyche silfvenii* | | | | 1 | |
| *Hydropsyche nevae* | | | | | 1 |
| *Hydropsyche siltalai* | | | | 1 | 1 |
| *Ironoquia dubia* | | | | 1 | 1 |
| *Lepidostoma hirtum* | 1 | 1 | | | |
| *Molanna angustata* | 1 | 1 | | | |
| *Molannodes tinctus* | | | | 1 | 1 |
| *Neureclipsis bimaculata* | | | | 1 | 1 |
| *Notidobia ciliaris* | 1 | 1 | | | |
| *Oecetis testacea* | 1 | 1 | | | |
| *Philopotamus montanus* | 1 | 1 | | | |
| *Polycentropus flavomaculatus* | | | | 1 | 1 |
| *Rhyacophila nubila* | 1 | 1 | | | |
| *Sericostoma personatum* | 1 | 1 | | | |

[3] As *Ephemerella aurivilli*

| | | | | | |
|---|---|---|---|---|---|
| **Miscellanous** | | | | | |
| **Gastropoda** | | | | | |
| *Bithynia tentaculata* | 1 | 1 | | | |
| *Gyraulus albus* | | | | 1 | 1 |
| *Radix bathica* | | | | 1 | 1 |
| *Theodoxus fluviatilis* | 1 | 1 | | | |
| **Malacostraca** | | | | | |
| *Asellus aquaticus* | 1 | 1 | | 1 | 1 |
| *Gammarus pulex* | 1 | 1 | | | |
| **Odonata** | | | | | |
| *Erythromma najas* | 1 | 1 | | | |
| *Pyrrhosoma nymphula* | | | | 1 | 1 |
| **Coleoptera** | | | | | |
| *Elmis aenea* | 1 | 1 | | | |
| *Haliplus* sp. | | | | 1 | 1 |
| *Hydraena gracilis* | | | | 1 | 1 |
| *Hygrotes versicolor* | | | | 1 | 1 |
| *Limnius volckmari* | 1 | 1 | | | |
| *Nebrioporus depressus* | | | | 1 | 1 |
| **Diptera** | | | | | |
| *Dicranota* sp. | 1 | 1 | | 1 | 1 |
| *Limnophora* sp. | 1 | 1 | | 1 | 1 |
| *Tipula* sp. | 1 | 1 | | | |

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

| | Sample 1 | | | Sample 2 | |
|---|---|---|---|---|---|
| **Taxa:** | **Delivered** | **Identified** | | **Delivered** | **Identified** |
| **Ephemeroptera** | | | | | |
| *Alanaites muticus* | 1 | 1 | | | |
| *Baetis digitatus* | 1 | 1 | | | |
| *Baetis rhodani* | | | | 1 | 1 |
| *Caenis luctuosa* | 1 | 1 | | | |
| *Caenis rivulorum* | | | | 1 | 1 |
| *Ephemera danica* | 1 | 1 | | | |
| *Ephemera vulgata* | | | | 1 | 1 |
| *Habrophlebia lauta* | 1 | 1 | | 1 | 1 |
| *Heptagenia flava* | 1 | 1 | | | |
| *Heptagenia sulphurea* | 1 | 1 | | | |
| *Leptophlebia marginata* | 2 | 2 | | | |
| *Nigrobaetis niger* | | | | 1 | 1 |
| *Paraleptophlebia submarginata* | | | | 1 | 1 |
| **Plecoptera** | | | | | |
| *Amphinemura borealis* | | | | 1 | 1 |
| *Isoperla difformis* | 1 | 1 | | | |
| *Isoperla grammatica* | 1 | 1 | | 1 | 1 |
| *Leuctra hippopus* | 1 | 1 | | 1 | 1 |
| *Nemoura avicularis* | 1 | 1 | | 1 | 1 |
| *Nemoura cinerea* | | | | 1 | 1 |
| *Protonemura meyeri* | 1 | 1 | | | |
| *Rhabdiopteryx acuminata* | 1 | 1 | | | |
| *Taeniopteryx nebulosa* | | | | 1 | 1 |
| **Trichoptera** | | | | | |
| *Brachycentrus subnubilis* | 1 | 1 | | | |
| *Ceraclea annulicornis* | 1 | 1 | | | |
| *Cheumatopsyche lepida* | 1 | 1 | | | |
| *Glyphotaelius pellucidus* | | | | 1 | 1 |
| *Hydropsyche angustipennis* | | | | 1 | 1 |
| *Hydropsyche pellucidula* | 1 | 1 | | | |
| *Hydropsyche siltalai* | | | | 1 | 1 |
| *Lepidostoma hirtum* | 1 | 1 | | | |
| *Limnephilus rhombicus* | 1 | 1 | | | |
| *Lype phaeopa* | 1 | 1 | | | |
| *Lype reducta* | | | | 1 | 1 |
| *Micrasema setiferum* | | | | 1 | 1 |
| *Odontocerum albicorne* | 1 | 1 | | 1 | 1 |
| *Oligostomus reticulata* | 1 | 1 | | | |
| *Plectrocnemia conspersa* | 1 | 1 | | 1 | 1 |
| *Polycentropus flavomaculatus* | 1 | 1 | | | |
| *Polycentropus irroratus* | | | | 1 | 1 |
| *Potamophylax latipennis* | | | | 1 | 1 |
| *Rhyacophila fasciata* | 1 | 1 | | 1 | 1 |
| *Rhyacophila nubila* | | | | 1 | 1 |
| *Sericostoma personatum* | | | | 1 | 1 |
| *Silo pallipes* | 1 | 1 | | 1 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Miscellanous** | | | | | |
| **Gastropoda** | | | | | |
| *Bithynia tentaculata* | 1 | 1 | | | |
| *Lymnaea stagnalis* | 1 | 1 | | | |
| *Physa fontinalis* | | | | 1 | 1 |
| *Theodoxus fluviatilis* | | | | | |
| **Hirudinea** | | | | | |
| *Erpobdella octoculata* | 1 | 1 | | | |
| *Glossophonia complanata* | 1 | 1 | | | |
| *Helobdella stagnalis* | | | | 1 | 1 |
| **Malacostraca** | | | | | |
| *Asellus aquaticus* | 1 | 1 | | | |
| *Gammarus pulex* | | | | 1 | 1 |
| **Odonata** | | | | | |
| *Gomphus vulgatissimus* | | | | 1 | 1 |
| **Coleoptera** | | | | | |
| *Elmis aenea* | 1 | 1 | | | |
| *Elmis maugetii* | | | | 1 | 1 |
| *Limnius volckmari* | 1 | 1 | | | |
| *Normandia nitens* | 1 | 1 | | | |
| *Oulimnius tuberculatus* | 1 | 1 | | | |
| *Riolus cupreus* | | | | 1 | 1 |
| **Megaloptera** | | | | | |
| *Sialis fuliginosa* | 1 | 1 | | | |
| **Diptera** | | | | | |
| *Atherix ibis* | 1 | 1 | | | |
| *Anthoca vitripennis* | | | | 1 | 1 |
| *Tipula (Emodotipula) obscuriventris* | 1 | 1 | | | |

# Reports and publications from the ICP Waters programme

All reports from the ICP Waters programme from 2000 up to present are listed below. Reports before year 2000 can be listed on request. All reports are available from the Programme Centre. Reports and recent publications are also accessible through the ICP Waters website; http://www.icp-waters.no/

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