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River Basin Management Tools:
Training Courses in River Assessment

Final Report
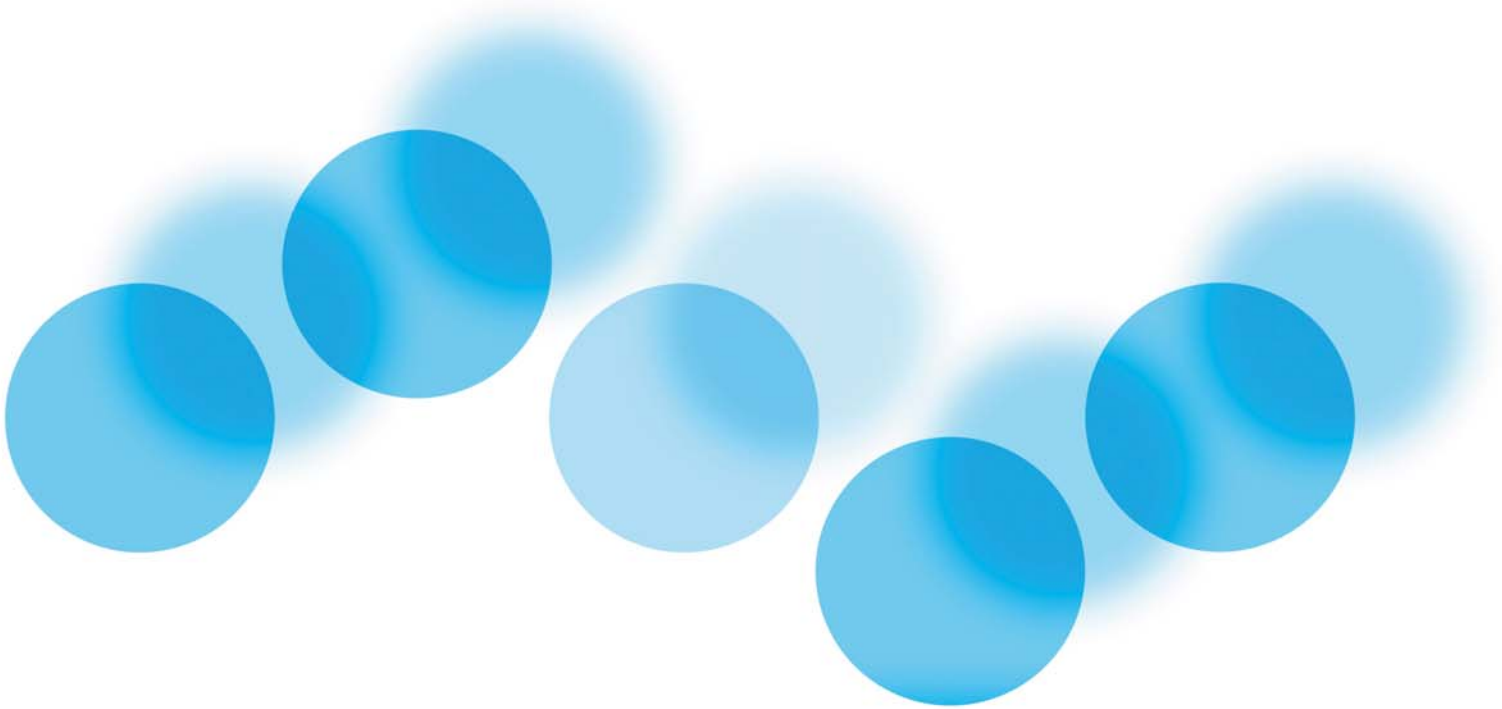
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1.   INTRODUCTION

The WFD requires all Member States to develop and implement a range of WFD compliant methods for assessing biological quality elements and the ecological status. In general, these methods have not been in routine use in Danube Basin countries and there is a need to provide a training course to ensure consistency of approach to the sampling and analysis of benthic macroinvertebrate data. The compilation of consistent data is a crucial step in River Basin Management and monitoring, as only comparable sets of biotic and abiotic data provide the basis for a joint analysis. Methodological differences, i. e. sampling and sorting techniques and identification levels inevitably introduce significant variability in datasets. This undesired variability is considered 'noise' and hampers the detection of the 'signal', for example, the biota's response to human impact or other stressors. By application of standardised sampling and sample processing methods, the noise can be significantly reduced.

The AQEM training courses aimed at teaching such a standardised methodology for river assessment by using benthic macroinvertebrates. The courses were given at three venues with different groups of delegates representing a total of 13 Danube countries. The courses provided both theoretical and practical training, the latter being demonstrated at 1–2 sites in the hosting countries.

The consortium of AQEM consultants together with Schulung Fliessgewaesser GbR, Duisburg, Germany, organised three training courses, each of which with a duration of three days, in cooperation with the Danube Regional Project (DRP) and the International Commission for the Protection of the Danube River (ICPDR). A training course comprised training on i) sampling and ii) processing macroinvertebrate samples, iii) identification of specimens, iv) preparation of taxalists v) application of the AQEM assessment software 'ASTERICS', vi) interpretation of results, and vii)on common techniques to analyse multivariate data to support the interpretation of results (compare Annex 1). The whole practical procedure was demonstrated and applied at wadeable sampling sites in the field, which were previously selected by the host organisation. A Multi-Habitat Sample was taken at each site and was used to demonstrate further sample processing, i.e. lab sorting and identification. If feasible, an additional modified Multi-Habitat Sample was taken at a partly or non- wadeable sampling site, for example, at a large, deep and/or turbid river.

2.   WORK PROGRAMME

The work programme comprised three training courses given for participants from eleven GEF eligible countries (alphabetical order): Bosnia, Bulgaria, Croatia, Czech Republic, Hungary, Moldova, Romania, Serbia, Slovakia, Slovenia and Ukraine (compare Table 1). The nomination of delegates and the organisation of the training courses was lead by members of the ICPDR/DRP and supported by the host organisations. Table 1 provides the list of training courses, host organisations, and number of delegates per country. The overview shows that, even if none of the course was given at full capacity, 38 out of 44 possible delegates participated in the training courses (86 %).

The host organisations were also responsible for the practical organisation of the training courses. In cooperation with the AQEM consultants, the course material was prepared and the required equipment was compiled. The host organisation provided suited facilities for the presentation of lectures and for the lab processing and identification of benthic macroinvertebrate samples.

Table 1: Dates, venues, trainers and delegates of the AQEM training courses. (Number of participants per country given in brackets)

Course	Date	Host	Venue (*trainers*)	Participating countries
1	28–30 June 2006	VITUKI Budapest, Hungary	Miskolc, Hungary (*Feld/Lorenz*)	Hungary (4) Bosnia (4) Serbia (4)
2	29–31 August 2006	Romanian Waters Authority – Somes-Tisa Water Directorate	Cluj-Napoca, Romania (*Feld/Sunder-mann*)	Romania (4) Bulgaria (4) Moldova (4) Ukraine (2)
3	12–14 September 20006	VUVH Bratislava	Bratislava, Slovakia (*Sundermann*)	Slovakia (4) Slovenia (3) Czech Republic (2) Croatia (3)

The participants and detailed contact details are given in Annex 2–4.

3.   THE AQEM TRAINING COURSE PROGRAMME

The detailed course programme was discussed with the ICPDR/DRP and was finished prior to the first training course in Hungary. The programme is given in Annex 1.

A training course comprised three full days divided into:

1.   one day theoretical background of methods and application
2.   one day practical demonstration and application in the field and
3.   one day dedicated to practical data analysis and interpretation, supplemented by lectures on theoretical data preparation and common techniques of multivariate analysis

The practical data analysis and interpretation was done with the AQEM assessment system software 'ASTERICS'. The latest version ASTERICS 3.1 was applied to the sample(s) taken during the field trip of each training course. The application was shown step by step and provided space for technical questions and general discussion of the method and the interpretation of results. The programme, hence, covers both theoretical background and practical application of the AQEM sampling and assessment method.

A handout was compiled individually to help the participants understanding the lectures easier. The handout contained paper copies of all presentations to take quick notes and a CD-ROM with additional material on the course, e.g. the software ASTERICS, examples of taxalists and journal publications on the AQEM method. The comprehensive course material is attached electronically on CD-ROM in Annex 5.

3.1. DEVIATIONS FROM THE COURSE PROGRAMME

During the first course in Miscolc, Hungary, only slight deviations from the scheduled course programme were necessary because of a collapse of the power supply at the venue near Miskolc on the first morning. The host organisation quickly arranged an alternative venue at the Regional Inspectorate in Miskolc, which was used for the first morning session. The additional arrangements caused only a slight delay, which was compensated during the entire training course.

The second course in at Cluj-Napoca, Romania, was held as scheduled before.

For the last course in Bratislava, Slovakia, a considerable deviation from the scheduled programme was necessary, as one of the trainers became ill shortly before the course. Instead of postponing the course, the host organisation, the AQEM trainers and the ICPDR/DRP organisers agreed on running the course with one trainer only. This circumstance required to reschedule the course programme, however, the course contents remained unaffected. The first day was split up into a theoretical morning and a practical afternoon session. For the afternoon session, the field trip was brought forward. The second day was also split up into theoretical and practical sessions. The programme for the third day nearly remained as scheduled.

4. FEEDBACK

In order to evaluate the quality of the course and to find out whether the expectations of delegates were covered sufficiently, a short feedback session closed each training course. Several topics concerning the course contents and materials, for example, presentations, field trip, Multi-Habitat Sampling, handout and field protocols were mentioned on a slide to stimulate the discussion and to encourage the participants to give their feedback. A feedback summary is given in Table 2.

During the first course, valuable feedback was given concerning the proportion of theoretical background information (i. e. presentations) and analytical sections. The delegates would have appreciated more practical analytical training, such as data analysis and interpretation using standard multivariate analysis and basic statistical analysis (e.g., correlation and similarity analysis). However, lessons on advanced statistical analysis were cut from the original four-day programme, as the training courses had to fit into a three-day schedule. At the expense of these lessons, more focus was laid on basic assessment and the rationale of multimetric assessment systems instead.

During the second course in Romania, several participants responded the need of taxonomic workshops, as the taxonomic state-of-the-art in eastern Europe is to be improved in terms of taxonomical basics. Checklists of the benthic macroinvertebrate fauna lack in many countries as is also true for determination keys, particularly those on larval stages. Moreover, the international exchange of taxonomic knowledge should be promoted in order to harmonise taxonomies and to improve the international knowledge. According to many participants, taxonomic basics were neglected too much in the past.

Besides some other minor recommendations, the overall feedback was very positive and enthusiastic. The delegates found the course contents to be well balanced and extremely valuable for fulfilling future monitoring tasks in their countries. They enjoyed the clear and comprehensible presentations and the compact compilation of information. This includes the printed handout (script) with all presentations and the CD-ROM that additionally provided software, protocols, tools, manuals and publications addressing the AQEM method and related projects (STAR).

Table 2: Results of the feedback sessions (n.a. = no response on this issue)

Topic	Miskolc, Hungary	Cluj-Napoca, Romania	Bratislava, Slovakia
Common feedback on course and organisation			
Overall assessment method	good assessment method, but some participants criticised MHS to oversee rare habitats and to yield much material,	good assessment method	good assessment method, sorting of the material may take too much time
Presentations	good and clear presentations	good and clear presentations	good and clear presentations
Filed trip and practical exercises	good field trip and clear demonstration of the methods, some participants would have liked more time to demonstrate the method in non-wadeable rivers	good field trip and clear demonstration of the methods	good field trip and clear demonstration of the methods
Balance of theory and practice	good balance, starting from theory over practical and going back to theory, also good balance of practice and discussion	good balance	good balance
Trainers	good and clearly speaking trainers, open for discussion	good and clearly speaking trainers	good and clearly speaking trainer
Organisation	the participants explicitly acknowledged the organisers (ICPDR/DRP and host organisation) for their joint effort to arrange the AQEM training courses		
Future activities	some participants mentioned their interest in national training courses to advise a larger group of national and regional water researchers and managers; the interest for an analytical (statistical) workshop was high	some participants mentioned their interest in national training courses to advise a larger group of national and regional water researchers and managers	further interest in national training courses to advise a larger group of national and regional water researchers and managers, participants stressed the need for training courses of other biological quality elements

Table 2, continued

Topic	Miskolc, Hungary	Cluj-Napoca, Romania	Bratislava, Slovakia
Detailed feedback on course contents			
Typology	too much time spent on typology, was already well-known	clear and interesting presentation	clear and interesting presentation
Site selection	too much time spent on site selection	n.a.	clear and interesting presentation
Multi-Habitat Sampling	good method as it can be standardised, useful but rare habitats are overseen and much material will be gathered and has to be sorted out	good method, also modification for non-wadeable rivers, habitat estimation clear and useful	good method, applicable in wadeable as well as in non-wadeable rivers, enables a standardised sampling
Sub-sampling and sorting	good and practicable method to reduce time and effort, but sub-sampling as shown may destroy animals and hamper proper identification	practicable method, shall be applied in future monitoring, however, destroys some specimens and hampers identification	good and practicable method, although sorting was considered fairly time consuming
Identification	most participants like identification to species level and yet apply it, but identification keys lack for many macroinvertebrate groups (larvae!), more taxonomical effort is needed in all countries	very useful as the training course showed a lack of taxonomical knowledge in many countries (lack of determination keys, etc.), should be enhanced in the future (taxonomist's workshops)	very useful as the training course showed a lack of taxonomical knowledge in many countries (lack of determination keys, etc.), should be enhanced in the future (taxonomist's workshops)
ASTERICS assessment software	very good tool to calculate the metrics and to assess rivers, helps interpretation of a taxalist, shall be applied for future monitoring	very good and interesting tool, shall be applied for future monitoring	very good and interesting tool in order to gain basic information for the assessment of streams

Table 2, continued

Topic	Miskolc, Hungary	Cluj-Napoca, Romania	Bratislava, Slovakia
Detailed feedback on course contents, continued			
Metric calculation	n.a.	it was good to learn more about the rationale of multimetric assessment	very good for training the application of the ASTERICS software
Multimetric Index	n.a.	good	good
Interpretation of results	very useful and comprehensible	n.a.	very useful in order to derive appropriate mitigation measures
Multivariate statistics	very useful and important to understand the theory behind multimetric assessment, should be part of an additional training course applying real monitoring data from participating countries	very useful and important to understand the theory behind multimetric assessment, should be part of an additional training course applying real monitoring data from participating countries	very useful and important but to few presentations within the three-day training course, topic should be extended and participants should have the possibility to do some exercises on their own

5. RECOMMENDATIONS

For transferring feedback into action, the AQEM trainers would like to state the following recommendations to promote and support future river monitoring and assessment in the Danube countries:

• Irrespective of the monitoring method of choice, should the **rationale of bio-assessment** be further **trained to key persons**, i.e. particular to regional biologists responsible for the analysis and summary of regional monitoring programmes (usually based at inspectorates, directorates or national authorities). This includes multivariate statistical analysis to identify environmental impacts and to support the proper interpretation of results.

• An additional **data analysis and interpretation training course** should be organised to train analytical biologists in analysis their own (national/regional) data. This refers to any kind of bio-assessment, to different biological quality elements (BQE), and to typological aspects, such as the validation of abiotically-derived (top-down) typologies using biological data (bottom-up). The validation is crucial for the development and application of bio-assessment systems and should be finished before assessment systems are developed! But, at present, the validation of river typologies is an exception within the Danube catchment.

• Data storage and fosterage may become a problem, where appropriate concepts lack at the time the monitoring programmes start. As future monitoring data will definitely be necessary to develop and refine (existing) bio-assessment approaches, the data should be handled in a way that makes analysis most comfortable and easy. This includes the necessity to harmonise storage systems at national and international levels, if data analysis is run at these levels. At the moment, we do not see this requirement, i.e. a **joint database**, to be fulfilled.

• Many Danube countries provide excellent taxonomic expertise. The taxonomic tradition in, for example, Slovakia, the Czech Republic, Hungary and Ukraine is deeply associated with research at the species level. But species-level research requires a good and sound knowledge of the species and their ecological background, in particular on the determination of the different stages: eggs, larvae, nymphs, pupae, adults. As numerous participants of the training courses responded the need to foster and enhance taxonomic knowledge in the Danube countries, we recommend to initiate a **taxonomic workshop**. The workshop should aim two major objectives, i.e. to provide a forum for taxonomists to exchange their knowledge and to set up a network of taxonomists to coordinate and promote future activities on taxonomy.

• Even if cross-border coordination is already extensively taking place in eastern Europe (Romanian and Moldovan biologists responsible for the cross-border Prut river basin jointly participated in the second training course!), there should be a consistent institution available for coordinating the implementation in the Danube countries. The institution (secretariat) should provide knowledge and funding to frequently bring together water managers and monitoring biologists. The institution should aim at **coordinating the "working level"**, i.e. the level that includes field and lab work and appropriate scientists from regional water authorities and labs, respectively.

ANNEXES

ANNEX 1   DETAILED COURSE PROGRAMME

ANNEX 2   PARTICIPANTS MISKOLC, HUNGARY (28–30 JUNE 2006)

ANNEX 3   PARTICIPANTS CLUJ-NAPOCA, ROMANIA (29–31 AUGUST 2006)

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ANNEX 5   CD-ROM WITH DETAILED COURSE MATERIALS

ANNEX 1

DETAILED COURSE PROGRAMME

1st day

09:00	<u>Introduction</u>
09:30	<u>Stream typology, selection of sampling sites</u>

- River typology according to the WFD

- The Danube river section types, national stream typologies

- How to assign the appropriate stream type?

- How to determine an appropriate and representative sampling stretch?

10:30	<u>Tea/coffee break</u>
11:00	<u>Sampling, sorting, sample processing</u>

- Field Multi-Habitat Sampling (MHS): Equipment, habitat estimation, allocation of sample units, hand-net sampling, particularities, regional adaptations, sampling protocol

- Lab sample processing: Equipment, sorting, sub-sampling, sorting protocol

13:00	<u>Lunch</u>
14:00	<u>Identification</u>

- Equipment, identification keys

- The operational (standardised) taxa list – minimum and maximum demands on specialists for identification

- Data handling (storage, software), preparation of taxa lists, demands of the assessment software

15:00	<u>Tea/coffee break</u>

15:30   <u>Multimetric assessment and assessment software</u>

- General concept and development of the multimetric assessment system (AQEM/UBA, Germany)

- Examples of different taxa and taxonomical groups, ecological information, species traits, indicative potential as a basis for (multimetric) assessment systems

- Design and application of the AQEM European stream assessment program, Version 3.1[1]

- Interpretation of assessment results

17:00   <u>Repetition and Discussion</u>

18:00   <u>End of 1st day</u>

19:00   <u>Dinner</u>

2nd day

07:30   <u>Field trip to a common stream type</u>

- Sampling, sampling protocol, pre-sorting

- Sampling exercise (sample will be processed later on in the lab)

12:00   <u>Lunch</u>

13:00   <u>Lab sorting</u>

- Sample processing and sorting in the lab, sub-sampling

14:30   <u>Determination of the sample taken in the morning</u>

(all participants together)

- Joint determination of the (sub-sampled) sample

15:00   <u>Tea/coffee break</u>

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[1] The current version ASTERICS 3.1 (former AQEM European assessment software) is available for free at http://www.fliessgewaesserbewertung.de (Short registration may be needed for download to ensure proper support.) ASTERICS is the <u>A</u>QEM/<u>ST</u>AR <u>E</u>cological <u>R</u>iver <u>C</u>lassification <u>S</u>ystem.

16:00   Multimetric assessment

-   Run of the AQEM software ASTERICS

-   Interpretation of assessment results and further interpretation of
    metrics

-   Assessment and interpretation of further examples

18:00   Repetition and Discussion

18:30   End of 2nd day

19:30   Dinner

3rd day

08:00   Continuation of sorting, identification (previous day), assessment

-   preparation of taxa list

-   calculation of metrics and indexes with ASTERICS 3.0

10:30   Tea/coffee break

11:00   Overview of data exploration methods and multivariate data analysis

-   Simple classification and ordination

-   Ordination of abiotic data – Principle Components Analysis (PCA)

-   Ordination of biotic data – Non-metric Multidimensional Scaling
    (NMS)

12:30   Lunch

13:30   Analysis: Examples

-   Top-down-bottom-up stream typology Germany. (NMS)

-   Common gradient analysis to identify stressors and their impact.
    (PCA)

-   Identification of hydromorphological degradation (gradient
    analysis). (PCA)

15:00	Tea/coffee break
15:30	Development of a multimetric index

- Correlation analysis and graphical validation

- Candidate and core metrics

- Definition of class boundaries (percentiles, anchor points, etc.)

- Normalisation and combination into multimetric index

16:30	Final discussion
17:00	End of course

ANNEX 2

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ANNEX 5

CD-ROM WITH DETAILED COURSE MATERIALS

WORKING FOR THE DANUBE AND ITS PEOPLE