



Project no. **INCO-CT-2005-003659**

Project acronym: **ASSESS-HKH**

Project title: **Development of an Assessment System to Evaluate the Ecological Status of Rivers in the Hindu Kush-Himalayan Region**

Instrument: **Specific targeted research or innovation project**

Thematic Priority: **Specific measures in support of international co-operation;
A.2.1 Managing humid and semi-humid ecosystems**

Deliverable No. 11
**Current status of the HKH macroinvertebrate taxa catalogue
with ecological information**

Due date of deliverable: **Month 24**

Actual submission date: **Month 25**

Start date of project: **April 15th 2005**

Duration: **36 months**

Organisation name of lead contractor for this deliverable:
Masaryk University, Brno, Czech Republic

Revision [Final]

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	✓
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Authors:

Astrid Schmidt-Kloiber (BOKU – University of Natural Resources and Applied Life Sciences Vienna)

E-mail for correspondence: astrid.schmidt-kloiber@boku.ac.at

Karel Brabec (Masaryk University Brno, Czech Republic)

E-mail for correspondence: brabec@sci.muni.cz

This research work is funded by the European Commission under the 6th Framework Programme contributing to priority "Specific measures in support of international co-operation (INCO); A.2.1. Managing humid and semi-humid ecosystems".

Contract number: INCO-CT-2005-003659

Co-ordinator: Prof. Dr. Otto Moog, BOKU – University of Natural Resources and Applied Life Sciences, Vienna, Austria; E-mail: otto.moog@boku.ac.at.

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1. Introduction

In the description of work, WP6 - HKH Eco-data Management Tool - is described as follows:

Objectives: HKH Eco-data Management Tool (ECODAT)

The objective of WP 6 is to develop an ecological data management tool (ECODAT) that is either adapted from existing software from completed RTD projects to the specific requirements of the HKH scientists, or is based on a newly generated platform. It is intended to provide HKH scientists with a tool to produce relatively simple, but science-based evaluations of the ecological status of rivers and streams for water management authorities and policy makers and the general public.

The data management tool will consist of:

- A catalogue of macroinvertebrate taxa of the HKH region and ecological information needed for data analysis.
- An analysis software and database for processing the ecological assessment data to produce status calculations and graphical representation of results for three methods described in WP 5.

Several European projects currently address the implementation of the EU Water Framework Directive and provide an excellent basis for the development of biocoenotic river assessment, as well as valuable expertise and tools, that will directly contribute to the ASSESS-HKH Project. It is, however clear, that the specific needs and requirements in the target region will differ due to somewhat different climatic and ecological conditions. There are already some ecological assessment methods being implemented in the HKH region, notably in Nepal, that will also be considered in design of the HKH Eco-data Management Tool. A catalogue of macroinvertebrate taxa must be compiled from literature and expert knowledge in terms of taxonomy, ecological needs and species traits.

Detail and complexity of the software will most likely differ from that used in Europe or in the US. Either existing software will be used with minor adaptations or new software will be programmed on a scale, which is in scope with the ASSESS-HKH Project. The software will be adapted or programmed in close cooperation with the HKH partners to help reduce costs. The scale and complexity of the HKH Eco-data Management Tool will be kept within the allowed budget allocated at the beginning of the project and will be carefully planned accordingly. Additional non-computer tools will be developed to enable river assessment where computers are not available (e.g. flowcharts, folders and assessment keys).

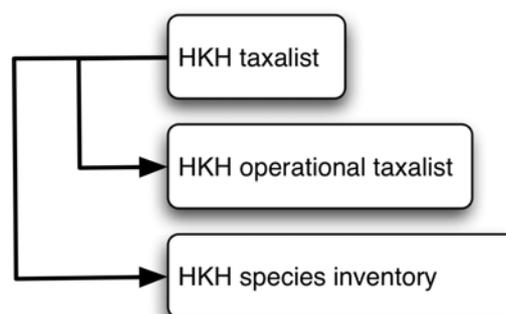
Within WP 6, Task 6.1 envisages the compilation of a macroinvertebrate taxa catalogue that should cover the HKH region. The macroinvertebrates serve as a basis for the assessment methodology as described in WP 5 – "ASSESS-HKH Methodology". Therefore, a substantial database on the taxonomical and ecological features of the taxa is necessary and should be compiled within this Task. Parts of the taxa catalogue will be based on the data collected in Task 4.3 (Microhabitat data collection and analysis). The gathered information will be part of the software (ECODAT) and will be available on the internet or also as hard copy.

2. Organisation of the HKH taxa catalogue

The general design of the HKH macroinvertebrate taxa catalogue follows basically the Austrian species inventory "Fauna Aquatica Austriaca" (Moog 1995, 2002). This volume is a comprehensive data source of ecological information concerning aquatic organisms in Austria. The reason behind is to provide a practice oriented tool using current methodologies for ecologically based environmental monitoring including species lists of benthic invertebrate categories, indices of saprobity, functional feeding group classifications and expected zonal distributions.

There was the common agreement at the Bangladesh meeting (December 2005) that for the development of the HKH macroinvertebrate taxa catalogue three different lists will be produced in the course of the project following the scheme in Figure 1.

Figure 1: The three levels of the HKH taxa catalogue



2.1. Level 1 - HKH taxalist

The HKH taxalist is the basic list that contains any available information on benthic invertebrate records in the HKH countries. The HKH taxalist is to be seen as a working list. The main function of the HKH taxalist is to store all recorded taxa before taxonomic specialists validate them.

2.2. Level 2 - HKH operational taxalist

The HKH operational taxalist is condensed from the HKH taxalist. It contains species, "working species" and higher taxonomic groups that were found in the macroinvertebrate samples of all ASSESS-HKH partner countries. The operational taxalist represents the state of the art that can be achieved by taxonomic generalists or people who treat the routine samples for bio-monitoring. This list is used for the ASSESS-HKH methodology development and thus is an integrative part of the ECODAT software.

2.3. Level 3 - HKH species inventory

The HKH species inventory contains only those taxa (preferably species) that were verified by taxonomic experts or by published literature. The HKH species inventory is based on literature reviews and own records of the ASSESS-HKH partners. The inventory represents the scientific state of the art and thus is a valuable contribution to the knowledge on biodiversity of the HKH countries.

3. Steps towards the HKH taxa catalogue

3.1. Preparatory work

The work on the HKH taxa catalogue started with screening of the available information on macroinvertebrate taxa inventories in the HKH region and with contacting specialists who have experiences with taxonomic and assessment investigations relevant for the HKH region and the ASSESS-HKH project aims respectively.

Each Asian partner selected a person responsible for taxa catalogue issues. This person has to be in close contact with the workpackage leader (Masaryk University, MasUniv). The workpackage leader collected information about literature, taxonomic experts and progress in WP 6 issues from the Asian partners via a questionnaire circulated in December 2005.

The literature research conducted by partners served different purposes:

- to gather information on available references dealing with taxonomy
- to review the information provided in the literature
- to undertake quality control on the usefulness of the information provided
- to include ecological information into database

A list of references related to taxa records and macroinvertebrate studies within the target region was compiled by WP leader in cooperation with all project partners.

Additionally to the partners' literature review, taxonomic and ecological information of macroinvertebrates was collected by a representative of KU (Hasko Nesemann) in Senckenberg Museum library in Frankfurt a. M. (Germany). The collected literature was submitted to the project co-ordinator's office in Vienna for the workpackage leader to refer to.

3.2. Digital compilation of the HKH taxa catalogue

Starting point for the digital compilation of the HKH taxa catalogue in MS Excel was provided by the Kathmandu University (KU), who compiled substantial information by collecting a taxalist containing 254 families, 1451 genera and 3616 species of macroinvertebrates from the HKH region.

This Excel file was sent to the following experts with the request for completion and revision: H. Nesemann (KU), T. Soldan (associated with MasUniv), K. Brabec (MasUniv) and S. Sharma (KU).

This taxalist was then further converted into a MS Access database by BOKU. This database serves as an essential background tool for the HKHdip software, which is used to generate a common and harmonised database for the storage of all sampled data of the HKH region.

The database structure of the HKH taxa database builds on similar taxa databases that were compiled during previous EU projects (AQEM, STAR, Euro-limpacs). The database mainly consists of the following tables:

- taxagroup: contains information on higher taxonomic groups, mainly orders
- family
- subfamily
- species: contains genus and species name, author and year of description, shortcode, comment
- catalogue: contains information of the distribution of the taxa in the different HKH countries

The taxa database was further completed with higher taxonomic units. During the identification process at the Taxonomy Workshop in Kathmandu (August/September 2006) it turned out that not all taxa could be determined to species level. Therefore taxagroups and working taxa were added to the taxa catalogue to assure the working process.

The HKH taxa catalogue now comprises 8044 taxa (5403 species or working names, for those species which are not described up to now). Numbers of families, genera and taxa are shown in Table 1.

Table 1: Numbers of families, genera and taxa per higher taxonomic unit in the current HKH taxalist

	family	genus	taxa
Porifera	1		1
Turbellaria	2	3	4
Nematoda	1		2
Gastropoda	19	36	115
Bivalvia	6	9	63
Polychaeta	2	4	12
Oligochaeta	10	29	107
Hirudinea	6	21	63
Hydrachnidia			1
Crustacea	13	19	21
Ephemeroptera	17	76	271
Odonata	21	80	272
Plecoptera		75	178
Heteroptera	15	49	109
Homoptera	1	83	240
Hemiptera	25	190	563
Orthoptera	1	1	2
Megaloptera	1		1
Planipennia			1
Coleoptera	67	654	2420
Hymenoptera	21	94	290
Trichoptera	29	186	1159
Lepidoptera	1	1	3
Diptera	57	478	2142
Bryozoa	3	3	3
Blattaria	1		1

3.3. Inclusion of taxonomic experts

At the 3rd Steering Committee meeting in Germany (March 2006) a basic list of desired top taxonomic experts of worldwide reputation who should contribute to the ASSESS-HKH project was established. These experts were then contacted and three of them attended the sampling in Bhutan, as there is only very little zoological knowledge available from this country.

- Coleoptera: Dr. Manfred Jäch
- Trichoptera: Prof. Dr. Hans Malicky, Dr. Wolfram Graf

After the general sampling in the HKH countries different taxonomic experts were contacted to help with the identification of species:

- Mollusca, Hirudinea, Crustacea, Oligochaeta: MSc Hasko Nesemann
- Ephemeroptera: Prof. Tomas Soldan
- Plecoptera: Dr. Wolfram Graf, Dr. Ignac Sivec
- Trichoptera: Dr. Wolfram Graf
- Heteroptera: Dr. Herbert Zettel
- Coleoptera: Dr. Manfred Jäch
- Decapoda: Dr. Dirk Brandis
- Chironomidae and other Diptera: Dr. Berthold Janecek

The expert knowledge as well as the information gathered during the identification process was used to compile taxonomic keys for the HKH region. These keys served as the scientific base on the Taxonomy Workshop in Kathmandu (August/September 2006), which was conceived to raise the taxonomic knowledge of the HKH partner institutions. The following keys were produced:

- Key to Plecoptera prepared by W. Graf, I. Sivec and A. Schmidt-Kloiber
- Key to Ephemeroptera prepared by T. Soldan
- Key to Trichoptera prepared by W. Graf, H. Malicky and A. Schmidt-Kloiber
- Key to Odonata prepared by A. Hartmann
- Key to Diptera I prepared B. Janecek
- Key to Diptera II prepared by K. Brabec and R. Rozkosny
- Key to Coleoptera prepared by T. Huber, W. Graf and A. Schmidt-Kloiber
- Key to Heteroptera prepared by T. Huber, W. Graf and A. Schmidt-Kloiber
- Key to Mollusca prepared by H. Nesemann
- Key to Oligochaeta prepared by H. Nesemann
- Key to Hirudinea prepared by H. Nesemann

Top taxonomists, who either visited the HKH region or got material for determination described new species, which are currently prepared to be published in different scientific Journals. These species will be included into level 3 of the taxa catalogue within the next year.

The following taxonomic experts compiled taxalists that were already included into the HKH taxa catalogue:

- Mollusca, Hirudinea, Crustacea, Oligochaeta: MSc Hasko Nesemann
- Coleoptera (Hydrophilidae): Dr. Alfred Komarek (taxalist)
- Chironomidae and other Diptera: Dr. Karel Brabec, Prof. Rudolf Rozkosny

4. Outlook

The extension of the HKH taxa catalogue is one of the major topics throughout the last year of the project. The following steps will be conducted:

- Level 2 of the taxa catalogue (HKH operational taxalist) will be finalized. This step will be performed during the development of the ASSESS-HKH methodology, namely the design of a multimetric index to assess the ecological quality in HKH rivers. Throughout this process the HKH taxalist will be reduced to an operational level based on the taxonomical and ecological knowledge in the HKH countries. The HKH operational taxalist will contain the best achievable taxonomical level that can be achieved by taxonomic generalists.
- Level 3 of the taxa catalogue (HKH species inventory) will be completed. Each species in the current HKH taxalist will be checked regarding its appearance in a scientific publication or its occurrence in the HKH region approved by one of the taxonomic experts. Further top taxonomists will be contacted.
- Regarding the compilation and inclusion of ecological background knowledge on taxa into the HKH taxa catalogue, which will be used within the HKH ECODAT (HKHindex), the following actions are planned:
 - ecological classifications available in European databases (mainly within www.freshwaterecology.info) will be reviewed and evaluated; whenever possible this information will be extended to the Asian fauna (e.g. feeding types of different families or genera)
 - analyses results of the additional microhabitat sampling (AMS) will be integrated into the HKH taxa catalogue (e.g. current or micro-habitat preferences of selected taxa/species)
 - top taxonomists and experts will be contacted to contribute to the compilation of autecological preferences of HKH taxa/species
- All data will be included into the MS Access database. All data will be available for all partners at the end of the project. The databases will further be included into the modules of the HKH ECODAT tool, namely into HKHdip and HKHindex.

5. Relevance for the HKH region

A specific challenge in the HKH region is the widely unknown taxonomy of the organism groups potentially relevant for biomonitoring. The HKH taxa catalogue, especially the HKH species inventory and the taxonomic keys produced for the Taxonomy Workshop serve as essential and valuable contribution to the knowledge of the fauna and the biodiversity in the HKH region.

Through the use of European technical and taxonomical know-how and associated taxa database management the HKH project contributes to creating a research infrastructure for future research activities in the field of aquatic biodiversity in this region.