

## **Description of the sampling sites along the rivers in the Criş/Körös<sup>1</sup> Basin**

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### *Introduction*

The multidisciplinary study carried out through the Criş/Körös project was followed by a database, which reflects the ecological condition of these rivers. On the basis of these primary data we can follow the tendencies of modification in the future according to the studies of the monitoring system. These studies will create the possibility of elaboration of some prognosis and of some environmental protection measures or to create the basis of the ecological projects. Of course these primary database call the attention to the questions of the of pollution and damage processes. Arranging the sampling sites of the chemical and biological samples we tried to take into consideration the study prospects of the monitoring system. According to these ideas before the expeditions and field works we studied each river in its parts. Taking into consideration the geological, geographical characteristics and the possible sources of pollution the sites were placed in that way to have a station before and after the primary pollution sources. In the same time we took into consideration the zones which exist in their natural condition with a high biodiversity. They deserve great attention according to their protection. We took into consideration the influences of the most important tributaries, where we also marked out sampling sites.

The research was done during expeditions and the whole team travelled from the quarters by cars along the rivers.

Between 5-18 August of 1994 the Crişul Alb/Fehér-Körös, Crişul Negru/Fekete-Körös, Kettős Körös and Hármás-Körös rivers were studied. During the expedition between 20-28 July of 1995 the Crişul Repede/Sebes-Körös and Barcău/Berettyó rivers were studied. On the enclosed map we give the position of the sampling sites. In some cases the numbering of these sites does not follow the river-run but respects the chronological order of their study. In their description we respect their succession along the rivers. There is mining exploitation in the catchment area of the Crişul Alb and Negru. This fact is not mentioned in the description of certain sites because the pollution has no marks. Most probable the heavy metal content of the organisms is due to this activity.

The organisers of the project "Crişul Negru, Crişul Alb 1994" and "Crişul Repede, Barcău 1995" asked the authors to study the bibliography in order to be able to make

1 The first name is Romanian, and the second Hungarian.

conclusions according to the tendencies of modification. For checking certain data many members of the team went back in the following years to some rivers and sampling sites in different periods of the year.

### *The description of the sites*

#### **Crişul Alb/Fehér Körös**

##### **Site CA 1 – Criş**

It is before Criş village, 5-6 km before the river spring where the riverbed has an 8.1 m width. The valley is wooded but many deforestation zones exist or zones with scrub vegetation. The river is in 80-90 % overshadowed by trees and bushes, which surround the riverbed. The course has a mountain-character with fast running water, that runs in a riverbed composed of coarse gravel and boulders in a silty matrix; in some places the native rock appears in slabs. On the stones of the riverbed a thin silty film, a few moss and algae can be observed. After the rocky forms in the riverbed smaller habitats appear with slower water run and with finer sediment. The maximum water deep is under 80 cm.

##### **Site CA 2 – Mihăileni**

It is situated about 10 km after the first site, close to Mihăileni. There is no vegetation on the river banks; the river course is completely changed. The watercourse is disturbed by the construction of the dam, close to the sampling site. Near the river exist big excavated holes filled with water. Only a thick layer of algae settled down on the stones. The constructions slowed down the river course and the riverbed was fragmented. Small gravel isles were created. The slow water run creates fine sediment on the stones favourable for the organic layer. The riverbed partly preserves big stones conserving the reophyl fauna.

##### **Site CA 3 – Brad**

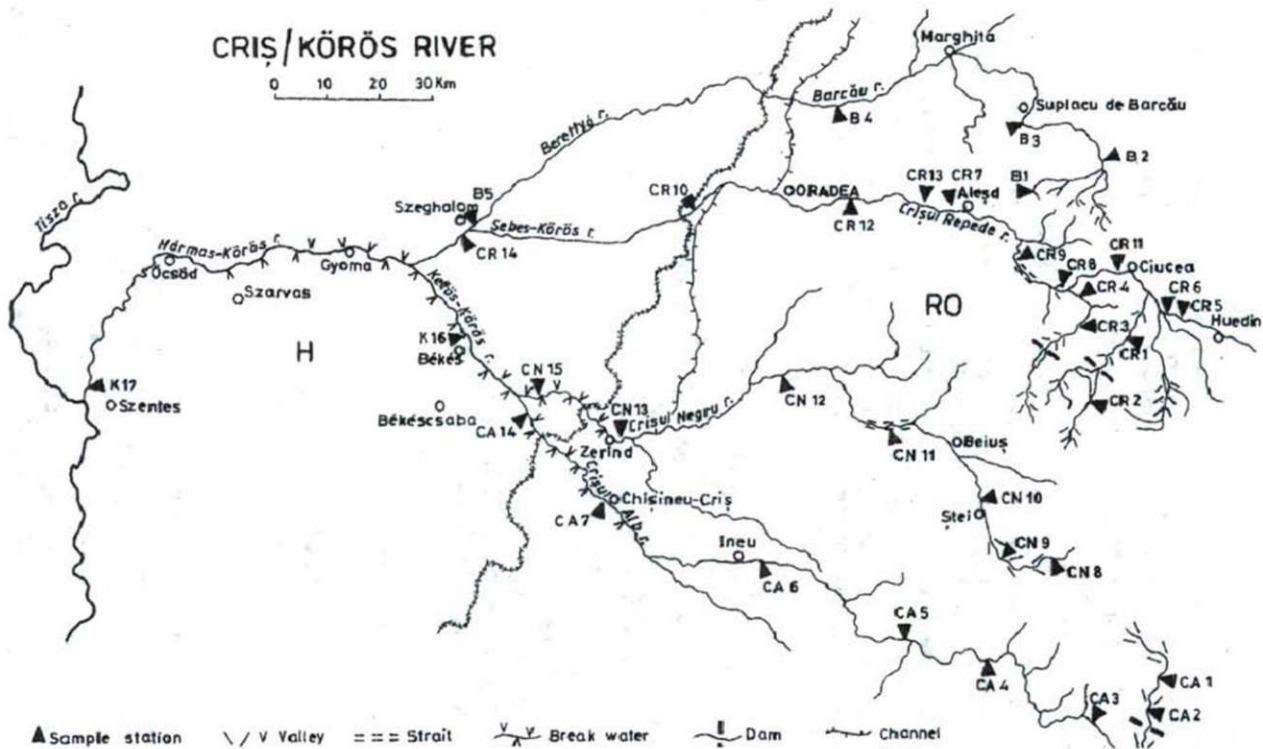
After Brad town the river width is 10 - 12 m. The river bank vegetation is the scrub that partially shadows the water. The river-bed is gravelled, but close to the right bank there can be found bigger stones, too. At Brad residual and wastewater flow into the river, and the water output cannot dilute it. The gravels are covered with a brown, smelly layer. Close to the banks the slower water run deposits muddy sediment rich in organic matters. Only the Hirudinea and Oligocheta species live in this sediment. During the floods the water level grows with 1 - 1.2 m that carries away the sediment and cleans the river bed.

##### **Site CA 4 – Aciuța**

Before Aciuța the valley becomes tighter and the slopes are covered by forests. The river width is 15 - 20 m. The left bank is steep, covered by boulders, where the water deep is 1.2 - 1.3 m. The right bank is less steep and the shallower water runs on gravelled sediment. The stones are covered with a uniform gravel and organic layer. In the slow watercourse the river deposits thick muddy sediment containing many rotten organic matters.

# CRIS/KÖRÖS RIVER

0 10 20 30 Km



▲ Sample station    \ / V Valley    == Strait    V Break water    ▭ Dam    - - - Channel



#### Site CA 5 - Almaş

Before Almaş the river runs in a wider valley. Agricultural lands border the riverbed, but the banks are covered with scrubs. The runway is 20 m wide and gravels on a sandy bed cover it. Here and there muddy sediment can be found but it contains less organic matters than it does at the previous site, so the benthon fauna is very varied.

#### Site CA 6 - Ineu

2 km before Ineu the river flows in a 25 m wide steep and deep river bed. Close by the riverbed the embankment ceases the flood area. Here hard clay layers form the riverbed. The floods deposit stony, gravel sediment on the bottom. The spring and autumn floods often mean 2-3 m growth of water level. In the narrow riverbed the speeded up water often moves away the sediment. The water deep is 0.5 - 0.6 m in the middle of the bed, but the holes in the clay can be 2-4 m wide. In the bank area the quiet water deposits muddy sediment. The biocenosis is very rich in this varied riverbed. The water contains many dissolved nutritive, it has a high trophic level proved by the presence of the rich macrophyta vegetation.

#### Site Ca 7 - Chisineu-Criş

Here the embankment continues on the both sides. The river is 25-30 m wide. On the right bank we can find big boulders, otherwise the sediment contains medium coarse gravel and fine-grained sand. In deeper waters, exceptionally of 1.5 m deep, it can be found muddy sediment, too. The current and the floods often move the sandy sediment so the benthonic fauna cannot settle down. The river section rich in submerged macrophyta forms an important habitat for the metaphyton organisms.

#### Site CA 14 - Gyula

The 2-3 m deep river flows slowly in channel, pressed between high banks. This reach resembles rather to a straight, artificial canal. On the river banks the wooded vegetation is poor, but the paludal flora is rich. The slow run favours the eutrophism, the water is greenish.

### **Crişul Negru/Fekete-Körös river**

#### Site CN 8 - Poieni

It is found before Poieni village 6-7 km from the river-head. The river is 5-6 m wide. The water speed is 0.7 - 0.8 m/sec. The riverbed is rocky without organic layer. In the quiet sections sandy sediment and few leaf accumulations can be found. The valley is wooded. In general it preserved its natural condition.

#### Site CN 9 - After Poieni (Optional site)

From 5 km of the first site the river is 6-7 m wide. The water is less rapid. The riverbed contains smaller boulders covered with a lot of periphyton.

#### Site Cn 10 - Ştei.

Due to the many localities the continuous forests are absent. The river is 10-15 m wide. The right river bank is steep, close to it deeper zones (1.2m) and rotten, muddy sediment rich in organic matter can be found. Close to the left bank the river is shallow and gravels

and boulders create the sediment. The household and the industrial wastewater destroy the quality of the water.

#### Site CN 11 – Borz

The river flows across a defile, its water accelerates. This is favourable for the oxidation of the organic pollution. The watercourse is 15-27 m wide. The rapid run zones and riverbed with boulders alternate with the deeper, muddy zones. The right bank is generally steeper than the left. The water is rich in nutritives. This is proved by the presence of the *Myriophyllum* species. The black colour of the boulders taken from the sediment reveals the organic pollution coming from the town. This colour is caused by the  $H_2S$  coming from an intensive bacterial activity ( $H_2S$  reacts with Fe compounds). Woods cover this Strait in 40-50%.

#### Site CN 12- Tinca

The river gets to the plain, agricultural lands lie in its valley. From now on the riverbed is restricted into embankments. The river is 35-40 m wide and it slows down. The riverbed is covered with coarse gravel and boulders embedded in the muddy sediment. They are completely covered with algae. The bank area is covered with thick layer of sandy mud. The submerged macrophyta vegetation is very rich.

#### Site CN 13 – Zerind

In the narrower (30-35 m) and relatively deep riverbed the water slightly accelerates. On the right bank area the river deposits muddy sand. On the steeper left bank the bed is covered with coarse gravels, this is emphasised by the rocks that strengthen the bank. The presence of the boulders becomes favourable habitats for the benthon grubs. In its gaps we found an *Astacus astacus*, but this species has only a sporadic occurrence.

#### Site CN 15 – Gyula

Before meeting the Crişul Alb the Crişul Negru reminds us of a ditch, too. The river is 2-3 m wide has a slow run and paludal vegetation is rich on the bank zone. The middle of the watercourse is sandy, the bank area is muddy.

### **Kettős-Körös river**

#### Site K 16 - Békés.

After the meeting of the river Crişul Alb and Crişul Negru the river has a very slow run before its inflow into the Tisza river. The water surface is completely covered by *Lemna* association. In the bank zone the riverbed is covered with muddy clay, in the middle it contains muddy sand.

### **Crişul Repede/Sebes-Körös river**

#### Site CR 1 - Drăgan Creek

The sampling site is situated 9 km before the inflow of the Drăgan creek into the Crişul Repede/Sebes-Körös river. The valley is covered with continuous forests. The riverbed is 10-15 m wide. The water speed is 0.8 m/sec. It is a uniform riverbed, formed by big boulders seated on a sandy bed. There is much detritus on the boulders (allochthonous organic matter), deposits of leaves and pieces of wood. The average depth of the water is

20-30 cm. A dam built on the upper section of Drăgan Creek gathers the water amount from the upper reach of the creek. Through an underground canal the water is directed to the dam lake in the Iad valley.

#### Site CR 2 - Dam lake of the Drăgan

At the upper part of the dam lake, at the inflow of the Zerna brook lies the sampling site. Where the brook flows into the lake it deposits a great amount of coarse sand and silty grains, and a large quantity of detritus (leaves, pieces of wood). The raising of the water level (the water level is controlled according to the energetic requirements) pushes the sediment inside the lake.

#### Site CR 3 - Iad Creek

After Remeti locality with 5 km we timed 0.95 m/sec water speed as it flowed out from the dam lake in a wide river bed. The water level and the water speed are fluctuating because of the energetic use of the dam lake. The substratum is composed of boulders or rocks covered by thick biotecton.

#### Site CR 4 - Iad Creek upstream confluence

Before its confluence with 500 m into the Crișul Repede the water speed is high, 1.3 m/sec, and the water temperature is very low, 10 °C. This is due to the low temperature water running off from the lower layers of the dam lake. The temperature changing can reach a difference of 10 °C. The arithmic run off causes an important water level fluctuation. The substratum is composed of boulders.

#### Site CR 5 - Șaula

After the spring with 5 km the river meanders on a hilly and plain area. The river is 3.5 m wide; the water speed is 0.3 m/sec. The bed is composed of coarse sand and gravel, with mud and organic debris. The organic matter comes from the paludal vegetation on the bank area, as well as from the swampy springs.

#### Site CR 6 - Bologa.

The river is 5-8 m wide; the water speed is 0.5 m/sec. The right bank is composed of big granite boulders, the riverbed is covered by gravels, here and there by coarse sand. Only along the left bank a 30-60 cm zone is covered by muddy sediment. The arborescent vegetation shadows the riverbed on the bank.

#### Site CR 11 - Ciucea

The river approaches the Apuseni mountains, the water speed is higher, 0.6 m/sec. Forests cover the valley. The river is 10-17 m wide. The riverbed is composed of big, rounded boulders and coarse sand. Grained sandy sediment is found only at the quiet bank zone. In the banks area *Potamogeton crispus* is present. This refers to the presence of the nutritive, which disintegrated from the organic matters on the upper reach.

#### Site CR 8 - Stâna de Vale

The wooded valley becomes narrower, and the river has mountain characteristics. The riverbed is 17 m wide; the water speed is 0.64 m/sec. The substratum is unequally covered with gravels, without grained sediment.

#### Site CR 9 - Vadu Crişului

The river arrives in a limestone strait; the river is 25-30 m wide. The water speed is high, 1.5 m/sec. Along the steeper right bank the water is deeper than 2 m. The riverbed is composed of boulders and native rock, rounded big boulders can be found only along the left bank.

#### Site CR 7 – Aleşd

After Aleşd town the valley widens, the continuous forests are absent; the bank area vegetation is poor. The water quality is destroyed by run off of the household wastewater. The river is 45 m wide, the water speed is 1.33 m/sec in the current. The riverbed is uniform, covered by gravels, the grained sediment is absent because of the rapid flow.

#### Site CR 13 - Aleşd dam lake

We preserved the fieldwork name of the sampling site, although this site lies after Aleşd in the neighbourhood of the second dam lake and Tileagd village. The bank of the lake is largely cemented, the maximum deep before the dam was 12.5 m, during the study. The substratum of the recently built dam lake is slightly covered, only a few representatives of benthonic associations were found. The river deposits a great amount of muddy sediment in the upper part of the lake. After the lake the river is directed to a cemented canal from its old bed, which means unfavourable conditions for the aquatic organisms. Only a little water is in the old bed, the gravels are covered with filamentous algae, in spite of it varied benthonic fauna can be found.

#### Site CR 12 – Fughiu

The river flows on a plain area, agricultural lands border it. The river is 50-60 m wide. Here and there the water speed is high (1.2 - 1.6 m/sec), but in the slow reaches the water deep can exceed the 2 m. The river bed is composed of gravels and boulders, the banks area is muddy. Here is built the third dam lake, the works move a great amount of sediment on the flood area, so holes and ditches full with water were formed temporary after is greenish.

#### Site CR 10 - Cheresig

The sampling site is 30 km after Oradea town after the piggy at Cheresig, close to the Hungarian -Romanian border. The river flows in a deep bed, between narrow banks. In the deep waters we found grained, muddy sediment, while in the shallow waters we found compressed gravel-sand sediment. The water is turbid, greenish and lightly stinks because of the wastewaters. This refers to eutrophical condition. In the shallow waters macrovegetation developed.

#### Site CR 14 – Szeghalom

Before the river meets the Kettős-Körös the river is 60-70 m wide, the paludal vegetation is rich, here and there willows grow on the banks. The water speed is 0.3 - 0.4 m/sec. The riverbed is uniform, regulated.

## **Barcău/Berettyó River**

### **Site B 1 - Trout farm**

After the trout farm the Barcău river have the characteristics of a mountain brook. It has a totally shadowed course. The river is 5 m wide. The substratum is composed of boulders on coarse sand.

### **Site B 2 – Boghiş**

The river is partially shadowed by the scrub vegetation, but continuous forests do not cover the valley. The riverbed is composed of coarse sand and muddy river banks.

### **Site B 3 - Suplacu de Barcău**

The river flows in a clayous, narrow, deep bed. In the middle the deep reaches the 1.5 m depth. The riverbed is covered with thick muddy sediment in the bank area. In spite of the pollution we have found an *Astacus astacus* species.

### **Site B 4 – Sântimreu**

Marghita town strongly pollutes the river, and the petroleum pollution is very strong, too. The *Sphaerotilus natans* settlements prove the presence of the organic matters. At the sampling site the situation is better, in the muddy sediment we found some *Sphaerium riviculum* mollusca species.

### **Site B 5 – Szeghalom**

The riverbed is deep, it is regulated between banks, and rich paludal vegetation can be found in the bank area. On the banks thick muddy sediment is deposited. The marks of the great oil pollution of 1994 are still visible. Stirring the muddy sediment the iridescent petroleum spots still float on the water surface.

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