TISCIA monograph series

The Someş/Szamos River Valley

A study of the geography, hydrobiology and ecology
of the river system and its environment

Editors
Sárkány-Kiss A. & J. Hamar

Szolnok-Szeged-Târgu Mureş

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Foreword

Multidisciplinary teams of experts, coordinated by both the Tisza Klub from Szolnok, Hungary, and the Pro Europa Liga from Târgu Mureş, Romania, have focussed their study on the tributaries of the Tisza since 1991. The aim of these investigations has been the assessing of the ecological condition by estimating the biodiversity, the consequences of biotope degradation and pollution as well as the foreshadowing of the human impact on aquatic ecosystems and on the ones neighbouring them. The first volume to comprise the experts' results came out in 1995 and hinged on the Mureş/Maros river basin.

The second volume "The Criş/Körös Rivers' Valleys" was published in 1997, and the current year marks the publishing of the volume here and of the one concerning the Upper Tisza. The present study is a remarkable and prestigious follow-up summing up the results of the team's work on the whole stream of the River Someş/Szamos in 1992 and 1996. The multilateral approach, including geological, geographical, pedological data, chemical analyses, different fields of biology and ecology, confer a monographic value on the study, making it into an excellent scientific instrument, both theoretically and practically. The remarkable amount of information comprised on these pages serves not only as the up-dating of the ecological data bank regarding this basin, but it can also provide a solid basis for implementing the monitoring of biodiversity, of human impact on this river, or even for foreshadowing future initiatives in the ecological rehabilitation or restoration of the seriously damaged sections. Thus, the information is accessible not only to specialists in various fields, but also to governmental institutions or environmental non-governmental organizations. The volume on „The Maros/Mureş River Valley" published in 1997 was the first meant for a wide dissemination. All the scientific volumes of the „Tiscia monograph series" will be doubled by their bilingual (Romanian/Hungarian) popular counterparts allowing thus a wide distribution to the unspecialized public.

The interest in the ecological corridors, the humid areas and especially the rivers is the very focus of scientists' attention, of environmental organizations and of governments everywhere. The reason for this need is a practical one. Rivers do not take into account the political state borders. They connect different countries, peoples, and cultures, carrying not only their fundamental life source, but also their waste. [RTF bookmark start: a][RTF bookmark end: a]In order to protect the green corridors it is absolutely necessary that neighbouring countries cooperate, setting themselves their basic aim to find out what the present condition of these green corridors is and what factors endanger them. It is also the motivation these campaigns are based on and realized, the value of their results and the scientific precision of the Romanian-Hungarian team of experts place them far beyond the confines of cross-border cooperation, providing a model of international validity.

It is no accident that the results presented in these volumes have aroused interest within the European programme NoLIMITS (Networking of Long-term Integrated Monitoring in Terrestrial Systems). The aim of the programme initiated within the European Network for Research in Global Change is to set up an integrated monitoring network for the environment, „...which addresses local, national, European and global scale requirements for policy-related data and information and to provide a focus for scientific collaboration related to research on environmental change and its consequences." This constitutes the basis for the promotion of a wide cooperation between the countries in Central and Eastern Europe in order for them to reach a common strategy of ecological action. The data within this book meet this project being able to serve as a practical binder in initiating the first contact of all the parties involved.

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Description of the sampling sites along the River Someş/Szamos[1]

Andrei Sárkány-Kiss, Nicolae Mihăilescu and Ioan Sîrbu

Introduction

The research of the River Someş was accomplished during two field campaigns organised by the Tisza Klub, Szolnok (Hungary) and the Pro Europa League, Târgu Mureş (Romania). During the first trip between 15-30 July of 1992 a preliminary examination of the river system was carried out in order to select the sampling sites. Travelling along the rivers, 16 sites were selected, taking into account the geological, geographical and hydrological features, and the main sources of pollution. The sampling sites were localised both upstream and downstream the main localities, in order to asses the effects of pollution. The sampling campaign took place between 1-22 August of 1992. The team was formed by specialists from different fields: chemists, pedologists, geologists-sedimentologists and biologists. The River Someş have different characteristics from other rivers and these are also emphasised by specific anthropogenic influences.

Between 1-21 August of 1996 the expedition was repeated almost with the same specialists and with some new ones.

Students from the Babeş-Bolyai University of Cluj, Lucian Blaga University of Sibiu and from the University of Bucharest also contributed to the success of the research work carried out in these two years. Many of the students wrote their diploma work on the basis of this study. Some of them have become specialists in the field and now they present their original results in this volume.

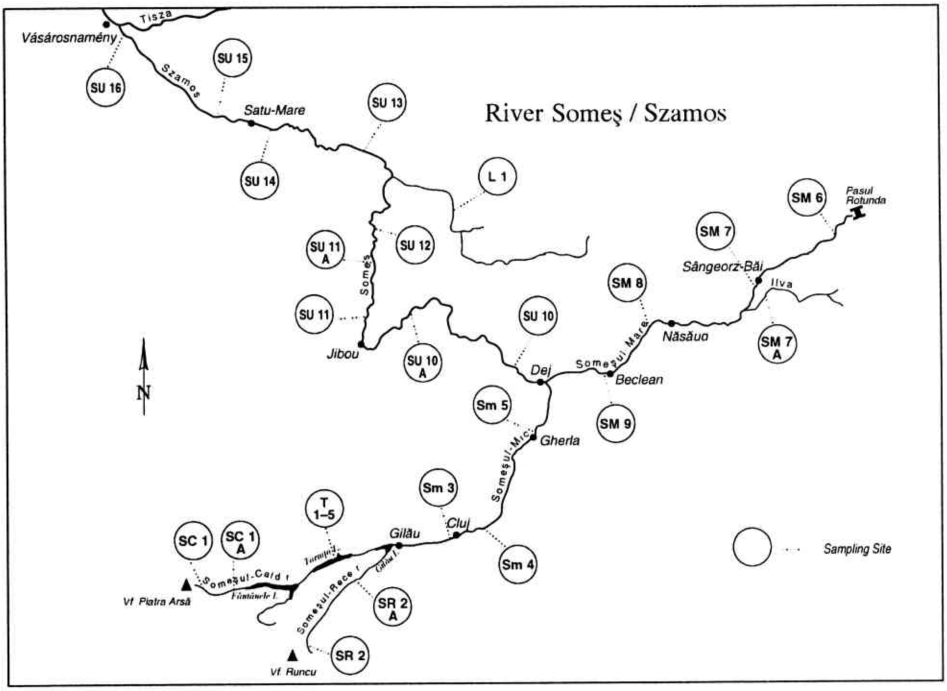
Codes and descriptions of the sampling sites (see Map)

River Someşul Cald/Meleg Szamos

Site SC 1 - Ic Ponor

The Someşul Cald comes to the surface from an endocarstic system at the entrance of the Cetaţile Rădesei Cave. After flowing through it the river enters the Someşul Cald gorges (Bazarul Someşului). The flow is very fast between these high walls formed by Triassic limestone and fill pits here and there. The average depth is about 0,10-0,20 m. At the level of the sampling site (after coming out from the gorges) the width of the riverbed is 5 m, on a bed formed by boulders and pebbles, in a coarse sandy matrix.

[1] The first name is Romanian, and the second Hungarian



Site SC 1 A - upstream of Smida

About 5 km downstream the gorges of the Someşul Cald the width of the bed is 15 m, with a depth of 0,20-0,50 m. The bed consists of rounded pebbles, on a course sandy matrix. The valley is larger, forming a mountainous plain in the river valley with terraces. The lower terrace is of 2,5 m, while the upper one is about of 6 m over the water level. The stream is crossed with artificial dams for trout.

The dam-lakes on the Someşul Cald/Meleg Szamos

The Someşul Cald river has three dam-lakes as it follows: Beliş, Tarniţa and Gilău, the latter one capturing also the water from the river Someşul Rece. In 1996 only the Tarniţa lake was studied, at the following places:

Site T 1 - Someşul Cald valley upstream the lake

The riverbed is about 5-6 m wide, and the depth is 0,20-0,40 m. The river keeps its typical mountainous aspect.

Site T 2 - The flowing zone into the lake

On the bank there are stones and boulders with coarse sand, fine deposits loaded with detritus here and there.

Site T 3 - Water samples were collected from the surface almost at half way of the lake and also samples of sediments and of benthos from a depth of 46 m with a Van Veen dredge. We tried to take out samples from the bottom, and the dredge rarely brought pieces of rocks to the surface or it did not bite anything. Only one of the 15 samples consisted of fine and silty sediments. Rocks form the greater part of the bottom.

Site T 4 - It is situated at the right side of T3, at a distance of 3 m from the bank. The depth is about 15 m, and the sediments are formed by fluid mud of greyish-brown colour, with detritus.

Site T 5 A - 200 m up to dam were collected plankton samples. Average depth of this sampling site was 60 m.

River Someşul Rece/Hideg Szamos

Site SR 2 - upstream the Blăjoaia cottage

The average width of the river is of 3 m, and its depth is of 0,15-0,40 m. Near the banks there is a terrace of 1-1,2 m, on which a Sphagnum bog develops, forming a thick layer of peat. The river meanders through the bog. Towards the Blejoaia cottage small waterfalls are formed against trout. The riverbed consists of boulders and pieces of rocks, disposed on coarse sand. Downstream there is a dam-lake silted up with fine sediments.

Site SR 2 A - situated at 7 km downstream Blejoaia, where the bed is of 10 m wide and of 0,10-0,15 m deep, with rocks and rounded gravels disposed on a fine sandy matrix.

There are two dams stopping the course of the water, the water led through underground tunnels into the dam-lakes from Someşul Cald Valley. In this way the river disappears twice, its bed remains dry. Downstream it is formed again by several brooks.

River Someşul Mic/Kis Szamos

Site Sm 3 - upstream Cluj, near Fântânile Clujului.

The riverbed is about 20-25 m wide, and of 1,20-1,30 m deep, being formed by coarse limestone's, the layer of which bend against the flow, consequently their heads have the aspect of ripple Marks. The bed in lothic zones is formed by gravels and in the neighbourhood of banks by muddy layers.

Site Sm 4 - downstream Cluj at the level of Someşeni village

The riverbed was straightened and enclosed between concrete walls. The riverbed is bouldery, towards the banks there are also muddy layers. The stones are covered with biotecton and filamentous algae. The water is overloaded with organic matter from communal and industrial wastewater. On the banks there are deposits of garbage, brought both by the locals and high-waters.

Site Sm 5 - downstream Gherla

It can be stated that the quality of the water is very low, having a black colour and an stinking smell. The flow is slower but in the middle it keeps rapid. The bed is gravely and pebbly. Toward the banks there are very thick layers of decaying organic mud, releasing H2S. The water is full of submerged vegetation which indicates a high degree of trophity. The benthos is dominated by masses of Oligochaeta, proving an excessive saprobity.

River Someşul Mare/Nagy Szamos

Site SM 6 - at the confluence with the Arin brook

The river has a mountainous aspect with a width of 5-7 m, and a depth of 0,20-0,70 m. The speed of flow is 1,3-1,4 m/s. The riverbed is formed by rounded boulders and pebbles on a sandy layer.

Site SM 7 - downstream Sângeorz Băi.

The valley has the shape of an alluvial plain. The banks are formed by small islands of coarse sand, the width being about 10-12 m, with a depth of 0,40-0,70 m. The bed is full of boulders and pebbles.

Site SM 7 A **-River Ilva**

As the Someşul Mare is polluted from Şanţ (downstream SM 6) with wastewater of mines, we tried to search for a tributary having a similar fauna to that of the former river. This comparison was not viable as the Ilva river has totally different geological characteristics, flowing on Helvetian sandstone plaques, being also polluted by communal wastewater and sawdust. Thus the lothic fauna is particular and totally different from that of the Someşul Mare. The sampling site was situated about 3 km above its confluence, where the width of the river is 10-15 m, and its depth is 0,10-0,15 m. The bed is consisted of pebbles with sand, on a grindstone plaque.

Site SM 8 - downstream Năsăud

The sampling station is situated 500 m downstream the rubbish dump of the town. This dump, situated on the riverbank, was flooded by the highwaters in February 1996. The riverbed is 30-40 m wide, with an average depth of 0,30-0,60 m, and pebbly. The height of the first terrace is of 2,5 m.

Site SM 9 - downstream Beclean

The width of the river is about 40-45 m and the depth if 0,50-1,0 m. The bed is formed of pebbles in a matrix of coarse sand and granule.

"United" Someşul/Szamos

Site SU 10 - downstream of Dej

The "united" Someşul is formed by the confluence of the Someşul Mare and the Someşul Mic. At this site the valley is wider, the riverbed has a width of 40-50 m and it flows on a layer of gravel disposed in sand. The first river terrace is in a height of about 2,5-3 m. The quality of the water and sediments is very low, because of the residual waters brought by the two rivers and the wastewater discharged at Dej. Along the riverbed there are thick and wide layers of decomposed mud, overcharged with organic matter.

Site SU 10 A-Letca

The valley of the river is surrounded by steep slopes. However, the bed widens to 60 m, the water is 1,6 m deep. It is formed by rounded pebbles disposed on medium-sized sand of greyish-black colour. In the lenithic zones there are thick layers of organic mud. The stones are overlaid with biotecton loaded with organic matter, which forms an sticky layer. The water has an unpleasant smell and has a brownish colour. There are some lothic zones which supplies the water with dissolved oxygen.

Site SU 11 - Someş Odorhei

The river is about 100 m wide, with a varying depths of 0,80-0.90 m. The flow of the water is turbulent and rapid, in a bed of rounded pebbles on a sandy bottom. Although the water still contains waste from the upstream sources, an obvious improvement can be observed due to the fast and turbulent course and to the low depths. The appearance of some stenobiotic groups, such as the Bryozoa, is a good proof of this. The thick layers of organic mud disappear, towards the bank the sediments being formed by fine sand.

Site SU 11 A - Ţicău

Although at this level, the valley forms a small gorge, there are zones with low slopes, where the flow is slow. Here and there steps appear causing a more turbulent flow. The average width of the bed is about 130 m, with a varying depth of 0,30-1,50 m. The pebbles imbedded in the sandy bottom do not allow the survival of the benthic species on the inferior parts. Since the polluting sources miss from Dej up to this level, the self-purification of the water takes place to a certain extent. Between Căşei and this reach the bacterial decomposing activity is prevailing, but their role will be taken over by other groups, such as Bryozoa and the Unionidae. Although sometimes on the surface of the water foam patches appear, indicating only a partial improvement of the quality of this river.

Site SU 12 - Sălsig

Leaving the gorge the Someş river meanders through a wide flood area, consisting of islands constituted by alluvial sediments. The depth is about 0,70-0,80 m, flowing on a gravely bottom. The quality of the water remains approximately similar to that of the gorge.

Site L 1 - River Lăpuş

The bed was studied in the Lăpuş gorge, at 1,5 km downstream the confluence with the Cavnic rivulet. In this small gorge the river forms deeper holes enclosed between rocky formations, while in wider sections flows faster in a pebbly and bouldery bed.

Site SU 13 - Pomi

The banks are of different height. The left bank and the middle of the bed is full of pebble deposits, and the right one shelters massive layers of black mud. The water is highly polluted due to several factors. About 7-8 km upstream the sampling site the Lăpuş river flows into the Someş and collects the Cavnic and Săsar tributaries. The former brings the residual water of mines and the latter is loaded with heavy metals discharged by the factories from Baia Mare. Consequently, the fauna is getting poorer and poorer.

Site SU 14 - Păuleşti

From this level the river gets into the Pannonic Plain. The river flows within dams built near the riverbed. The bed is formed by coarse sandy deposits of 0,7-2 cm in diameter. The quality of the water has slightly improved, but the slow flow does not help the process of self-purification. The biotope is not proper to sustain a stable community of benthos that could help this process.

SiteSU 15 Vetiş

Upstream Satu Mare the river is straight and dammed. Sandy deposits form the left bank, and the right one is artificially paved with boulders disposed on a layer of silt. These stones make possible the existence of a benthic fauna, while the silt and the wood fallen into the water shelter communities of insect larvae. The terrace is about 4-5 m tall but the high-waters often flood over them. The quality of the water decreased because of discharges of industrial waste-waters from Satu Mare.

Site SU 16 Vásárosnamény

The station is situated at 200 m upstream of the confluence with the River Tisza. The bed is surrounded by high dams, covered with gallery forests. Along the riverbanks, especially inside the meanders, there are sandy beaches. The bed consists of fine sand with huge amounts of brownish-grey mud. The bed is narrower but much deeper and the river leads its way through the alluvial sediments of the Tisza plain. The quality of the water between Satu Mare and the confluence with the Tisza is very low. Here the water is opaque not only because of the sediments but first of all because of the suspensions from the polluted waters.

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Hydrogeography of the Szamos/Someş-Kraszna/Crasna[1] river system

Mihály Andó

Introduction

The catchment area of the Szamos/Someş-Kraszna/Crasna is mostly in Transylvania, where we can see various distinct natural geographical formations. This natural feature required us to make a survey and a geographical evaluation with interdisciplinary theme-study method for an area bigger than the drainage basin in question, similarly to the studies of the „Tiscia monograph series" published so far. Therefore in certain sections of chapters in our study our survey and analysis include the whole Transylvanian Basin and its surrounding mountainous region.

Keywords: hydrogeography, River Szamos/Someş, River Kraszna/Crasna

II Geological structure of the Transylvanian Basin and its surrounding mountainous region

The mountain system of the Carpathians is broadly the youngest orogenic mountains in Europe. Its components formed via recurring crustal movements, folds, emersions, volcanic eruptions, marine and lacustrine deposit accumulation, from the end of the Palaeozoic era through the Mesozoic era to the end of the Tertiary.

In the region of the Carpathians and the basins surrounded by them, the range of the Variscan mountain system was situated in West and Central Europe in the Palaeozoic era. This mountain system broke in the Mesozoic era, and it partly emerged, partly subsided deep, and crumbled into pieces. The crystalline pieces emerged in the shape of horsts and inselbergs from the sea. The subsided parts were covered by the water of the Tethys Sea and deposited by a thick set of alluvial layers.

These deposits tightened on the crystalline pieces in the process of the recurring crustal movements and folds. These pieces played the role of a „last" in the orogenic movements, according to Gyula Prinz.

The Tethys Sea was transformed into an enclosed mediterranean sea when a powerful W-E movement of the eastern plate of the Atlantic Ocean began. So the Tethys Sea was wedged between the European (northern) and the African (southern) plates.

From the surface of the surrounding dried regions great amounts of alluvium and deposit moved in the basin of the sea during abrasion.

[1] The first name is Hungarian, and the second Romanian

During orogenic movements the sea gradually narrowed and shallowed from the end of the Cretaceous to the middle of the Tertiary. The deposits filling the basin folded during orogenic movements at the beginning of the Miocene, and the rim range, risen in the form of a wide flis belt, composed mainly of sandstone, enclosed the Carpathians into a uniform framework (Figure 1.).

I.

Figure 1. The eastern half of the Carpathian Basin at the beginning of the Pliocene (I) the Pannonian approximately 10 million years ago, and at the end of that (II) 1-1.5 million years ago (after J. Fink)

a. = Pannonian

b. = Upper Pleistocene

c = present beds

II.

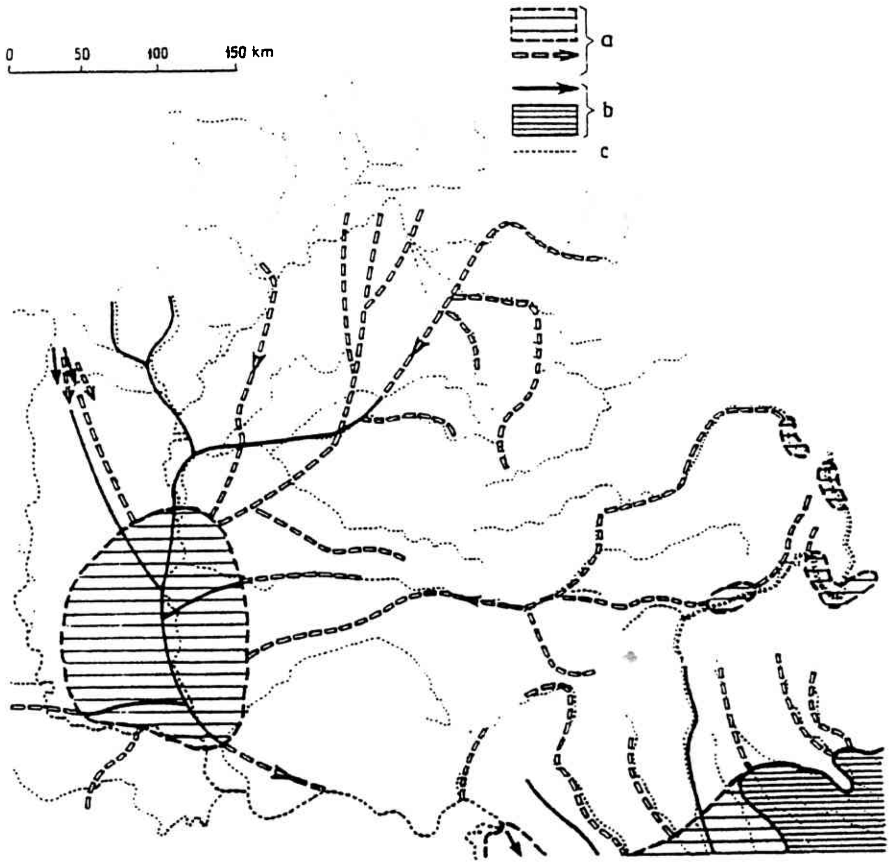

Figure 1. The eastern half of the Carpathian Basin at the beginning of the Pliocene (I) the Pannonian approximately 10 million years ago, and at the end of that (II) 1-1.5 million years ago (after J. Fink)
a. = Lower Pleistocene
b = ? Pleistocene
c. = present beds

The mass of the Carpathians is in places dissected by emersions, in other places by depressions lengthwise and transversely. All along the mountain range, thus, mountains higher than 2000 m and the low ranges of 1000-1200 m can be traced. In the eastern areas intramountainous, or intra-Carpathian basins of great importance, as well as the most significant and biggest basin along the Carpathians, the Transylvanian Basin, were created.

The river system of the Szamos/Someş-Kraszna/Crasna is situated in the northern system of the Transylvanian Basin. The basin came into existence at the time of the upward folding of the outer zone of the Carpathians and the surface effusion of volcanic lava zones.

The edge of the basin is enclosed by mountain masses of great size: the Eastern Carpathians, the Southern Carpathians and members of the eastern mountainous area.

The independent basin in Transylvania was created as a result of the division of the eastern range of the Carpathians into two branches. While the eastern branch runs as a continuation of the Maramuresh Carpathians through the Lápos/Lăpuş and the Radna/Rodna Mountains into the Mountains of the Székelyföld (Călimani, Gurghiu, Harghita, Perşani), the other, the western branch begins at the Lápos/Lăpuş Mts. and through the Preluca, Czikó/Ţicăn and Szilágyság/Sălaj crystalline shale enclaves, all along the range of the Meszes/Meseş Mountains it stretches into the huge mountain mass of the Királyhágó/Pădurea-Craiului, the Vigyázó/Vlădeasa, the Bihar/Bihor Mountains and the Transylvanian Ore Mountains (Erdélyi Érchegység/Munţii Metaliferi). The subsidence flanked by these two branches constitutes the Transylvanian inland, or basin, which is closed from south by the enormous central range of the Carpathian system bending back westward (Figure 2.)

Volcanic effusive rocks formed in the Tertiary and the mountains created by them can be found spread all along the above-mentioned Eastern Carpathians' inner concave sides facing west. For example the inner volcanic mountains of the eastern branch: the Lápos/Lăpuş Mountains, the eruptive masses of the Radna/Rodna Mts., which have their continuation in the gigantic range of the Hargita/Harghita, and farther away in the Persány/Perşani Mountains.

At the inner side (the more or less western or south-western turn) of the branch of the western mountain ranges the continuation is the isolated tiny volcanic points of eruption of the Meszes/Meseş mountain range as well as the sprawling volcanic mass of the Vigyázó/Vlădeasa.

The flowing volcanic lava mass of the latter was injected in, and filled up the radially faulted fissures of the crystalline mass of the Bihar/Bihor mountains. A similar phenomenon took place in the Transylvanian ore mountain system too, where the significant folds can be found on the fault lines of the eruptions lying in a southwestern direction, as well as in the Bánát/Banat region south of the River Maros/Mureş. Isolated from the 2 main eruptive lines mentioned above minor lava effusions can also be detected in the small range of the Cicsó/Culmea Brezei Mountains.

Only mainly at the edges of the Tertiary basin can we detect with few interruptions mountains built up with crystalline shales and Mesozoic strata, while from the Palaeozoic strata the Devonian layers, occurring in patches, play an inferior role.

Generally speaking, the Tertiary deposits are regular and simple in the northern part of the basin. All along the northern and western edge the older Tertiary layers, reclining with few exceptions on the edge mountains with a slight dip (5-20°) and surpassing it only at few points, slope facing the middle of the basin. As a result of this, ever younger Tertiary sediments follow one another closely from the edge towards the middle part.

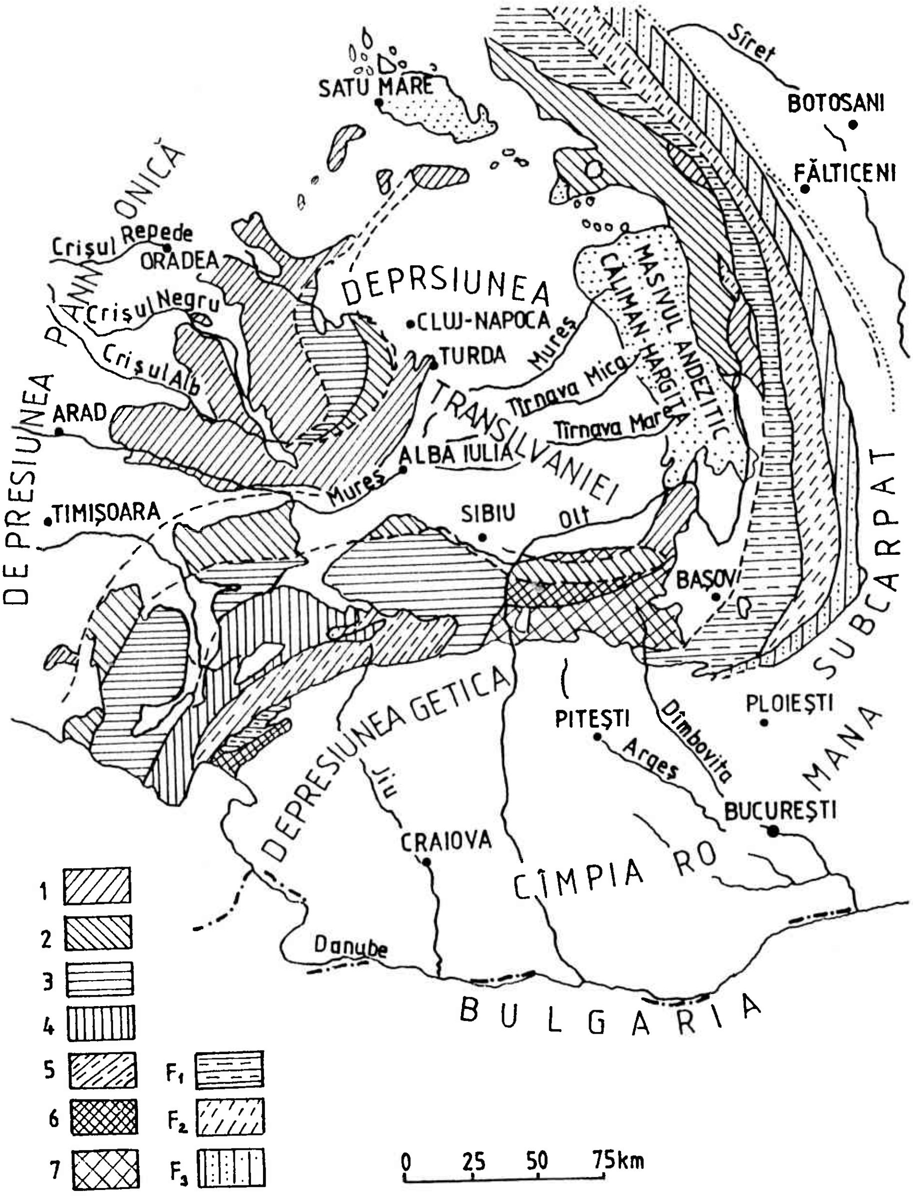

Figure 2. Structure of the Carpathians

1. Transylvanian cover
2. Bukovina/Bucovına cover
3 Geta cover
4. Retyezát/Retezat-Sivinıla cover
5 Kazán-Cserna/Cazan-Cerna cover
6. Vaskapu/Porţıle de Fıer cover
7 Bucsecs/Bucegi conglomerate
F1 = Sirıus sandstone
F2 = Fusaru cover
F3 = rım cover

We can find certain traces of considerable layer disorder, fold-faults, faults and folds in the northwestern quarter of the basin, along the edge mountains. There the fault lines and the fold axes run parallel with the edge mountains or with the line of strike of the nearest crystalline shale islands.

In the south of the Transylvanian Basin, especially at the eastern and southern edges we find most of the older Tertiary layers subsided and covered by younger Tertiary layers. Some broken off pieces of older deposits, however, have emerged or are stuck up here and there.

Lower Tertiary layers at the western and southern edges overlay unconformably the Mesozoic and Palaeozoic strata or directly the crystalline shales too.

This undoubtedly suggests that the emergence of the contiguous dry land did not only commence towards the end of the Mesozoic era in the southern and western quarters of the Transylvanian Basin, but it might have been in such an advanced stage before the Tertiary that a solid frame of the future basin was formed on this land. On the northern and eastern rim there could be only a few individual island masses of various size emerging from the embrace of the open sea, and therefore the Transylvanian Basin, which was to be enclosed later, could be an open sea gulf to the north and the east, forming a parallel strip with the eastern volcanic range.

Similarly, a second eruptive core formed inside the basin constituting the cones of the Avas/Oaş Mountains in Szatmár/Satu-Mare County. All the other Tertiary eruptive rocks, without exception, are situated within the above mentioned main eruptive line.

Structural and morphological evaluation of the mountain frame surrounding the Transylvanian Basin

1 Eastern Carpathians

It is the crystalline range of the Eastern Carpathians that the valley of Aranyos/Arieş-Beszterce/Bistriţa closing the Northeastern Highlands etched into beyond the Radna/Rodna Mts.. From there down south as far as the 1240 m high Törcsvár/Bran Saddle along the eastern border of Transylvania lies the significantly upfolded Eastern Carpathian mountain system. It is built up by a heavily upfolded sandstone (flis) belt, a very well-developed cliff belt with sporadic shreds of a puny border-Mesozoic cover, a crystalline belt covered on the outer side and a volcanic belt with excellent facies. The sandstone belt, poor in fossils, consists of Mesozoic and Tertiary sandstone, shale, marl and conglomerate. The period of its intense upfolding came connected to, but only after the upfolding of the same belt in the Northwestern and the Northeastern Carpathians in the Tertiary. Therefore orogeny in the Carpathians gradually spread and faded in space and time from north to east and later to south, which is also proven by the folding of the foreground of the Eastern Carpathians (the sub-Carpathian belt) at the end of the Tertiary (Pliocene). The formation of the volcanic range took place at the same time as the folding of the sandstone belt. Volcanism is of the Sarmatian and the Pliocene, but it extended even into the Pleistocene. Orostructural studies would formerly ascribe the creation of the central crystalline zone and the cliff belt to the development of one single large cover fold. Later research, however, discards the assumption of this cover fold and considers the crystalline range one single large Upper-Cretaceous anticline. The formation of the cliff belt is of the Tertiary.

Parallel to the upfolding of the mountain both its erosion and structural division were in process. Block surfaces, and among the blocks, basins formed. Tertiary orogenesis later caused the great elevation of the sandstone-belt blocks. Revived river activity, erosion etched deep valleys into the surface. The erosive activity of the rivers was not disturbed even by the ice age because the mountain masses with the exception of the Kelemen/Căliman Mountains did not rise above the Pleistocene ice-age snow line (Figure 3.).

The Tertiary volcanic range run parallel to the crystalline range. Andesite eruptions begin at the southern foot of the Radna/Rodna Mts. already, but extruded to form high mountains only in the Kelemen/Căliman Mts. The mountains are a series of volcanos, the highest point is a 2102 m high brim fragment of a large caldera (a collapsed volcanic cone), the formerly glaciated Pietros. The very rarely inhabited mountainous region is covered by vast forests. Around its foot there are a number of locations of volcanic tuff accumulation. It is these andesite tuffs that the Maros/Mureş etched its valleys through, and to the south of it comes the second member of the volcanic range, the mass of the Görgény/Gurghiu Mts. It consists, in fact, of two huge volcanos - the Fancsal/Fîncel and the Mezőhavas/Saca -, of the lava flows covering the slopes, and of the tuff accumulations. The heavily intersected, 1684 m high Fancsal/ Fîncel Peak is a steep ridge, which is separated from the exceptionally beautiful and regular, 1777 m high cone of the Mezőhavas/Saca by the deep valley of the Görgény/Gurghiu Stream. It is an enormous caldera with steep walls, which has been crosscut by the Székely/Secuiu Stream. The unbroken, fresh forms of the cone, an initial stage of erosion, the presence of the volcanic tuff that fell on the gravel field on the Upper Pleistocene terrace of the Maros/Mureş running at the foot of the volcano at Gyergyóremete/Remetea, and other proofs all testify that the volcanism of the Görgény/Gurghiu Mts. and the Hargita/Harghita did not end in the Tertiary, on the contrary, even ancient man might have witnessed the gradually weakening volcanic activity.

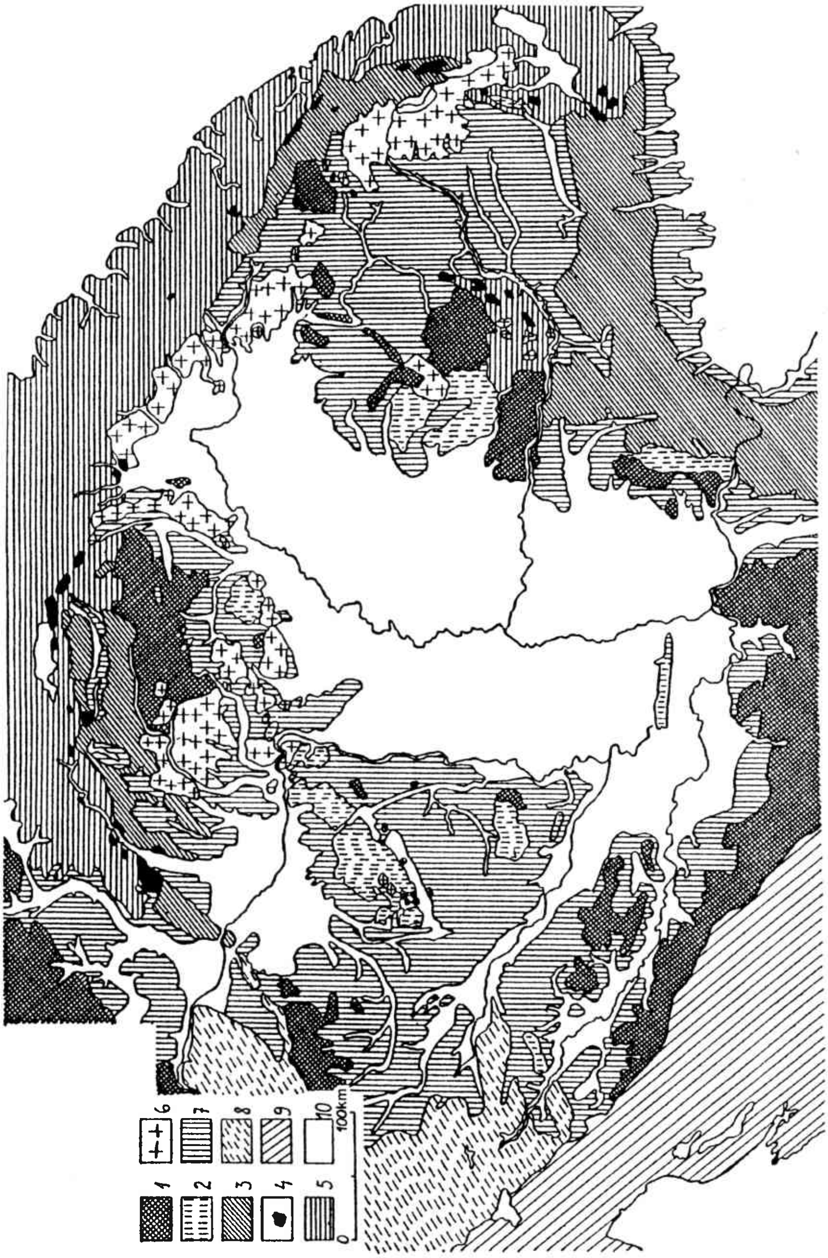

Figure 3. Structural map of the Carpathian Basin

1 Palaeozoic blocks, 2. Blocks covered by Mesozoic deposits,
3. The crystalline ranges of the Carpathians and the Southern Carpathians,
4. Carpathian limestone range, 5 Carpathian sandstone (flis) belt, 6. Tertiary volcanic mountain masses,
7. Tertiary hillocky and hilly areas, 8 the Alps, 9. the Dinaric Alps, 10. Plains, basins and flood plains

2 The Eastern Island Mountains

Lying between the valleys of the Maros/Mureş and the Visó/Vişeu, closing the Transylvanian Basin in the west, the indented Eastern Island Mountains, laid out in depth, are not, by far, a solid mountain wall like the one we encounter in the Eastern and Southern Carpathians. It is a block range of various height, history and fate, a group of the parts of the Variscan Magyar massif that remained on the surface, through which wide passages and gates lead from the Great Plain to the Transylvanian Basin between the individual blocks. In its eastern and northern parts, elevated high and without cover, it is the base mountain range that is on the surface represented by the Gyalu/Gilău and the Radna/Rodna Mts. In the Gyalu/Gilău Mts. it is in the form of wide block surfaces, in the Radna/Rodna Mts. it is intersected by ice-age glacial erosion, and characterized by bold shapes; in its western part in the Bihar/Bihor and the Bél/Codru Mountains as well as in Királyerdő/Pădurea-Craiului the subsided crystalline massif hardly surfaces. By contrast, large areas are covered by Mesozoic limestone layers and by the karstic, platform limestone mountains carved from them. Yet another type can be seen in the Hegyes/Highiş, the Drócsa/Drocea and the Szilágyság/Sălaj mountainous area. Low crystalline blocks and lumps resembling those of the island mountains between the rivers Dráva and Száva surface, from which the Mesozoic alluvial cover eroded long ago.

With regards to the creation of the Carpathians the Island Mountains underwent an especially significant change. At the time of the Cretaceous orogenesis not only its southern edge piled up and scales and covers formed in the southern part of the Bél/Codru and the Bihar/Bihor Mountains, but also a Carpathian-type mountain range, the Transylvanian ore mountains, lying in the same direction as the Eastern and Southern Carpathian ranges, folded up on the southeastern edge.

At the time of the Miocene orogeny it broke into many pieces, and the pieces settled at various levels. Along the fault lines the glowing, flowing rock dough, the lava broke up to the surface at a number of locations. It occupies an especially large area in the north of the Bihar/Bihor with the huge dacite cover of the Vigyázó/Vlădeasa (Figure 4.).

The first member of the range is the Transylvanian ore mountains between the valleys of the Maros/Mureş, the Fehér-Körös/Crişul Alb and the Aranyos/Arieş. Its northern part is even cut off by the Aranyos/Arieş. It is separated from the crystalline mass of the Zaránd/Zarand Mts. by the structural line that can be drawn from Körösbánya/Baia de Criş through Brád/Brad to the Maros/Mureş. East of the line rocks of Tertiary volcanism (andesite lava, tuff) cover the relief. This part is a wooded, gentle mountainous area, inside its mountains reefs, formed by a post-volcanic impact, hide the richest gold ores of Europe in the regions of Zalatna/Zlatna, Nagyág/Scărîmb, Brád/Brad, Abrudbánya/Abrud and Verespatak/Roşia Montană. Volcanism reoccurred in the Pliocene bringing basaltic lava to the surface. The two Detonata mountains were built up from this, with their great basalt of columnar jointing.

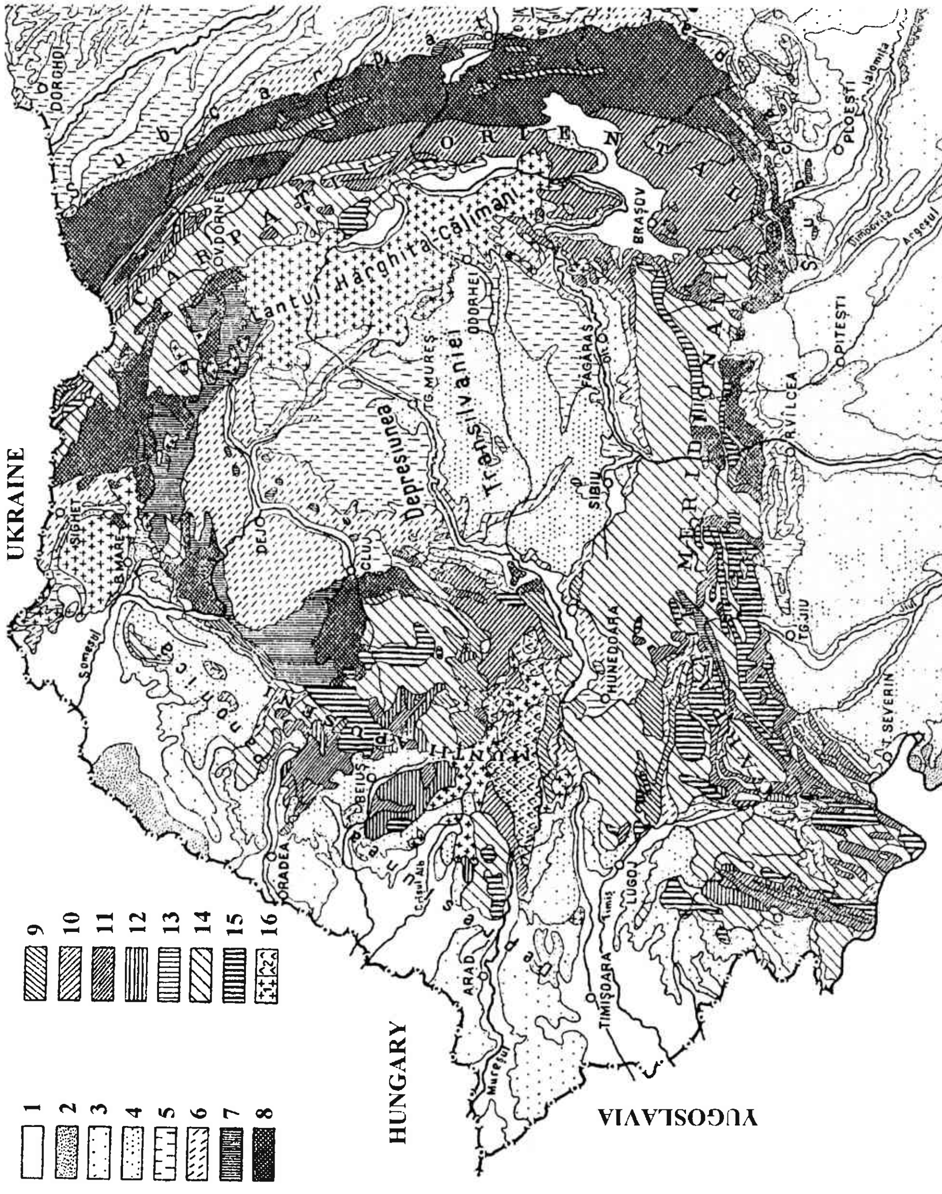

Figure 4. Simplified geological map of Transylvania by Harta geologica a RPR (Grigoraş 1961)

1. Alluvium, 2. Dune sand, 3. Pleistocene, 4. Upper Miocene-Pliocene, sandy and marls, 5. Sarmatian, sandy and marls, 6. Badenian, marls, limestones and tuffs, 7. Oligocene and Egerien, marls, limestones and, 8. Paleogene, marls, limestones and sandy, 9. Middle and Upper Cretaceous, limestoness, sandstons and marls, 10. Lower Cretaceous, predominantely limestones, 11. Triasic-Jurasic, predominantely limestones, 12. Carboniferous-Permian, conglomerats, sandstons, 13. Silurian-Devonian, 14. Crystalline rock, 15. Intrusive magmatic rocks, 16. Extrusive magmatic rocks (1) Terciary, (2) older

Northeast of the line from Körösbánya/Baia de Criş to Szászváros/Orăştie the Cretaceous sandstone folds interspersed by Jurassic limestone cliffs surface from under the volcanic rocks. Among the limestone cliffs the biggest and most beautiful are the Vulkán (1266 m), the Csáklya/Cetii (1233 m) and the Székelykő/Piatra Secuiului (1130 m). The composition of the mountain range is varied, so its shapes are picturesque, especially in its northern part, where the mountain range is broken through in the form of epigenetic limestone ravines, by the Aranyos/Arieş (the scenic Borév/Buru Pass), by the Hesdát/Haşdate (Torda/Turzii Gorge) and by the Túr/Tur (Túr/Tur Gorge). Beyond the Túr/Tur Gorge Tertiary deposits of the Transylvanian Basin cover the mountain range.

In the western continuation of the Transylvanian Ore Mountains we can find the low, wooded, sideways elevated crystalline block mountains of the Zaránd/Zărand. The northern and western slopes of the 600-800 m high mountains are overlain by andesite tuff. These gently undulating hills are the famous wine producing Aradi Hegyalja. On one of the broken-off pieces of the mountains that end with a fault in the west are the ruins of Világos/Şiria Castle, while in the southern part the Maros/Mureş etched an epigenetic valley cutting off Lippa/Lipova Castle from its area.

The wide, tectonic valley basin of the Aranyos/Arieş separates the Gyalu/Gilău Mts. from the Transylvanian Ore Mountains. This is a quite considerably folded, wide block-type mountain range consisting of crystalline shale. Its middle part is occupied by a large granite stock. The Kalotaszegi Basin/Depresiunea Huedin, part of the Transylvanian Basin, runs deep into its northern quarter. The formations of the flat block surface are determined by the rock composition, by the different qualities of soft crystalline shale and hard granite, which are manifested by erosion. Streams etch terraced valleys of slight dip into soft shales, and narrow gorges into hard granite. On the wonderfully even alpine pastures of the wooded mountains - with an average height of 1200-1600 m, and with the highest point, Nagy Havas/Muntele Mare, 1827 m - livestock is grazed. Concerning the landscape, what is nice here is the deep valleys of the Hideg-Szamos/Someşul Rece and the Meleg-Szamos/Someşul Cald and the Jára/Iara Stream.

The northwestern part of the Gyalu/Gilău Mts. and partly the neighbouring area of Bihar/Bihor are covered by Tertiary dacite lava. The hard dacite lava (hence the term „dacogranite" for the rock of the dacite mine at Kissebes/Poieni) covers all kinds of rocks. It is the Jád/Iad, Dragán/Drăgan and the Sebes/Sebeş streams that etched deep valleys into it. Wooded tablelands alternate with alpine pastures. The highest point of the area is the 1838 m high Vigyázó/Vlădeasa with faint marks of Pleistocene glaciation.

The Belényes/Beiuş Basin, the Gyalu/Gilău Mts. and the Transylvanian Ore Mountains surround the Bihar/Bihor Mountains proper. Its base is a heavily folded and abraded crystalline shale massif; a huge cover of Permian and Mesozoic alluvial deposits (mainly limestone) lie on its surface. The limestone layers of the overthrust cover are rich in karstic phenomena (Szkerisóra/Scărişoara ice-grotto), but are barely surveyed yet. The Meleg-Szamos/Someşul Cald ravine is outstanding with its romantic beauty, with a number of caves and the famous Oncsásza/Onceasa bone cave, with a great many of dolinas and sinkholes on the top. The highest peak of the wooded, rarely inhabited mountain range is the 1849 m high Nagy-Bihar/Bihor with faint marks of glaciation. Its southern neighbour, the wide Gajnatető/Găina (1486 m) is famous for the variegated Romanian „maiden fairs".

The Belényes/Beiuş Basin, filled with Tertiary strata and covered by loess, separates Bihar/Bihor and the 1114 m high Bél/Codru Mountains (Moma-Codru Mts.). Inside it the subsided Variscan crystalline shale base mountains are covered by a Permian and Mesozoic (Triassic and Jurassic limestone) layer, which is heavily folded in the southern edge. The Permian sandstone settled in the north and west, the limestone in the northeast and south. The southwestern corner of the range is also covered by andesite tuff. The limestone cover is considerably karstic. The periodic karst spring, the Izbuk at Kalugyer/Izbucul de la Călugări is notable.

In the western foreground of the Bél/Codru Mountains there is a mild, loess-covered hillocky area built up with Pannonian layers, and it connects in the north to the Tertiary hillocky region of Nagyvárad and environs, and the Érmellék/Câmpia Erului. From it emerges the 500-550 m high limestone plateau of the wooded, rarely inhabited Királyerdő/Pădurea-Craiului, which is rich in karstic phenomena (some limestone cave, formerly a cave, of the Sebes/Sebeţ).

From the valley of the Sebes Körös/Crişul Repede to the Radna/Rodna Mts., the region of the Szatmár/Satu-Mare and the Szilágyság/Sălaj hillocky and hilly areas are covered by Tertiary layers. They are Eocene limestone tables, Oligocene deposits, which were nearly transformed into a mountainous area by uneven elevation and the creation of valleys. At the western side of the hilly area they are loess-covered, sandy, argillaceous Pannonian deposits from the region of Nagyvárad/Oradea, through the wine producing downs of Érmellék/Câmpia Erului to the Nagybánya/Baia Mare Basin. The landscape, especially between the Meszes/Meseş, Réz/Plopişului and Avas/Oaş Mountains, reminds us approximately of the Transdanubian hillocky areas of Zala and Somogy. It is the „rough, old Szilágyság" with the wide valley basin of the Kraszna/Crasna, the Szamos/Someş and the Berettyó/Barcău; a wide gate area towards the Transylvanian Basin. The Tertiary hillocky area slopes along the fault line towards the Câmpia Tisei/Great Plain. The rich spas of Püspökfürdő/Baile 1 Mai and Félixfürdő/Băile Felix bubble up beside the fault.

From the Tertiary hillocky area three wooded blocks, the 758 m high Réz/Plopisului, the 990 m high Meszes/Meseş and the 575 m high Avas/Oaş Mountains emerge. The base of all three is crystalline shale with a Tertiary cover on it. The Réz/Plopişu is almost uncovered, in the Meszes/Meseş and the Avas/Oaş there is Eocene limestone lying on the block of the crystalline shales. The nearly 1000 m high Meszes/Meseş emerges steeply from the Szamos/Someş valley along the fault. The fault line is indicated by volcanism. Beside the regular, cone-shaped Várhegy of Mojgrád/Moigrad are the relics of the Roman Porolissum.

In the continuation of the Meszes/Meseş, crystalline rocks surface even beyond the Szamos/Someş valley, in the western and eastern part of the Eocene and Oligocene tableland between the Szamos/Someş and the Lápos/Lăpuş, at the bend of the Lápos/Lăpuş. This small crystalline rock is indicated as the Preluka/Preluca Mountains by certain maps, while the tableland itself between the Transylvanian Basin and the Kővár/Chioar Basin is indicated as the Ilosva/Dealurile Suplai Mountains. This is a 600-800 m high table intersected by valleys. It is densely scattered with villages, but on the ridges there are a lot of forests, too. The Ilosva/Dealurile Suplai Mountains slope onto the Lápos/Lăpuş Basin in the north. At its northeastern edge, between the Gutin/Gutâi and the Cibles/Ţibleş, the watershed tableland, which is built up by the Lower Tertiary deposits of the Tisza/Tisa and the Szamos/Someş, emerge like a mountain range. This is the Lápos/Lăpuş Mountains. The peacefully lying Eocene and Oligocene strata rise up to 1000 m, there are separate volcanic cones (Gutin/Gutâi, Priszlop/Prislop, Cibles/Ţibleş) sitting on them.

Between the Ilosva/ Dealurile Suplai Mountains and the Meszes/Meseş Mountains lies the Zsibó/Jibou Basin, and between the Ilosvai Mountains, the Lápos/Lăpuş, the Gutin/Gutâi and the Avas/Oaş lies the nice Kővár/Chioar Basin. The two are connected together by the Szamos/Someş valley in the Cikó/Ţicău Pass (Figure 5.).

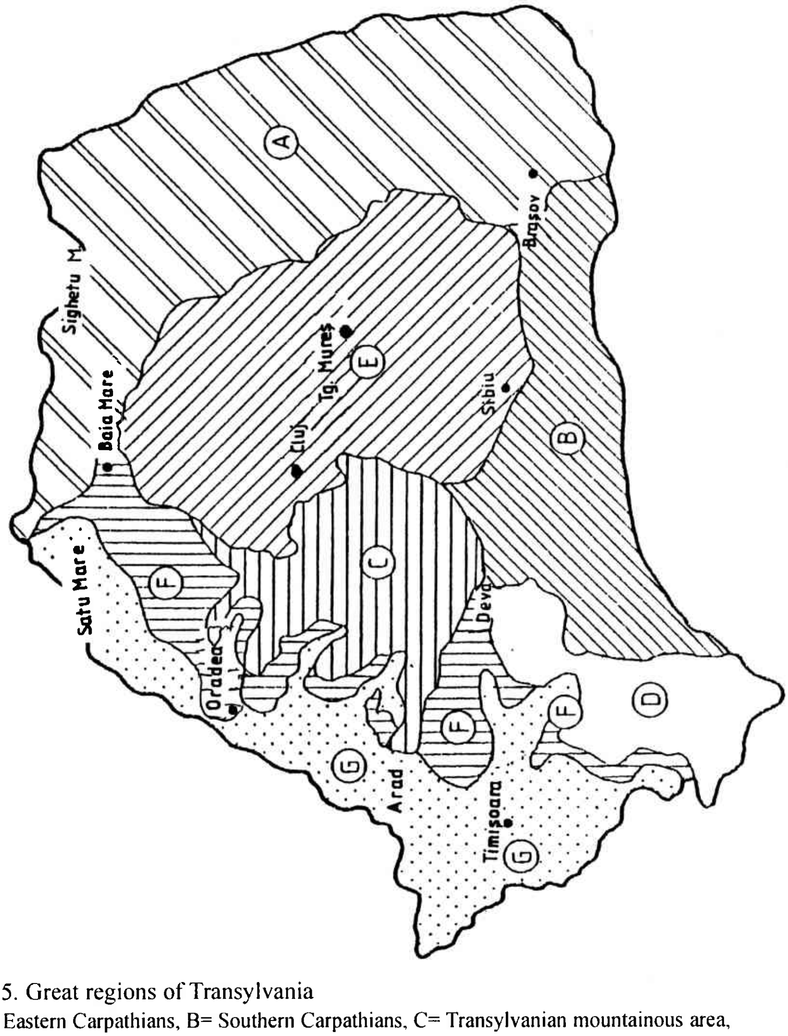

Figure 5. Great regions of Transylvania

A= Eastern Carpathians, B= Southern Carpathians, C= Transylvanian mountainous area, D= Bánság/Banat mountainous area, E= Transylvanian Basin, F= Western hilly area, G= Great Plain (after the monograph Geografia României, vol I)

The last, easternmost and highest member of the Eastern Island Mountains is the Radna/Rodna Mts.. It is built up predominantly by crystalline shale. Its sharp watershed ridge spreading E-W, surpassing 2000 m (Nagy Pietrosz/Pietros 2305 m, Ünő-kő/Ineu 2280 m) was significantly glaciated in the Pleistocene ice age. There are large trough valleys, tarns, firn fields and moraine mounds here. The lower regions are covered by vast forests. At the eastern end of the mountains the 1257 m high Radna/Rodna Saddle lead over to the valley of the Aranyos-Beszterce/Bistrița-Aurie.

The Transylvanian Basin

In the mountain framework described previously the Transylvanian Basin occupies more or less a middle position, whose northern half bears the River Szamos/Someş and its river system.

The basin narrowing from south to north is surrounded by mountainous border areas all around. With the uneven subsidence of the Tisia massif, among the Carpathian basins it was the Transylvanian Basin that subsided the least and whose subsidence stopped first. That is why the height of its surface is greater than the others'. Average height of the basin is 500-600 m, and because the low surface of the Great Plain is the erosion base of its rivers, the surface of its basin-filling layers was broken into pieces by the river valleys, and an erosive hilly region with deep valleys formed.

The basin was in wide and open contact in the northwest with the basin and the sea of the Great Plain until the Lower Tertiary. In the Miocene this contact was very narrow, and was probably confined to the narrow strait which stretched from the Déva/Deva region to the present upper valley of the Fehér Körös/Crişul Alb. In the Lower Miocene, therefore, the inland sea of the basin came into such conditions that it received less fresh water than the amount that evaporated from it. The water loss was replaced by salt water flowing in through the strait, so the sea water of the basin slowly became saturated salt solution, the salt even precipitated and quite thick rock-salt beds came into existence at the bottom of the basin in the argillaceous sea sediments.

The basin and its environs went through a considerable surface development in the Tertiary. The recurring regional subsidence and elevation resulted in a deposit fill of quite heterogeneous composition. One significant change of these occurred along the northwestern rim at the end of the Cretaceous and the beginning of the Tertiary. It was then that the varied unit strata, already containing sandy, gravelly deposits from dry land, came into being and was present in significant thickness at the western coast of the Transylvanian Eocene bay. This considerable accumulation shows the activity of the rivers as well, which cooccurred with the redistribution of the deposit.

Huge mud drifts formed, behind which lagoons and sea swamps came into existence filled partly with semi-salt water and partly with fresh water swamp deposit.

The other important change in the relief took place about the middle of the Middle Eocene, again at the northwestern coastal area. It was the result of rather the filling up of the coastal belt by sea deposits in the course of time than the elevation of this area.

The water from precipitation flowing in from the land carried a great deal of alluvium again, containing large pieces as well, into the shallow coastal belt, and through creating drifts lagoons and coastal swamp areas were formed again. Because of the continued subsidence of the coastal area, towards the end of the Middle Eocene it was the salt water of the sea again that flooded the former coastal swamps. It was from this sea that the upper coarse lime layers deposited along the coast.

A slow emergence of the coastal line of the Transylvanian sea bay began to manifest itself in the Oligocene, which cooccurred with the change of the semi-salt and freshwater fauna. Similarly, the commencement of the Tertiary volcanic activity falls on the beginning of the Middle Oligocene because it was then that quartz trachytoid and probably trachytoid volcanic lava broke to the surface.

Consequently, the Transylvanian Basin closed to the east as well in the Upper Oligocene, lost its direct contact with the mediterranean open sea, but might have been connected with the northeastern European sea to some extent. In the first stage of the Miocene, namely the Aquitanian stage, the same conditions of deposition continued in the now Transylvanian inland sea, and as a result, deposits still containing carbon settled at the eastern foot of the Meszes/Meseş range.

From the beginning of this stage, however, intense mountain elevation restarted, which resulted in the termination of the contact with the northeastern open sea as well. After that the Transylvanian inland sea retained its communication with the mediterranean sea only through the Hungarian mediterranean sea bay.

The Lower Mediterranean Nádaskóród/Coruş sand and the Hídalmás/Hida layers deposited in the already completely enclosed Transylvanian inland sea, which could only communicate with the mediterranean inland sea of the Hungarian Basin through some fissures of the Meszes/Meseş Mountains and in the southern part of the ore mountains, and which was perfectly closed off in the north and east from the open sea situated in the northeast.

At the beginning of the Upper Mediterranean stage the lateral thrust operating from the south reached its peak in the old mountain ranges of the Transylvanian Basin, which brought about the commencement of the intense activity of the andesite volcanos on the fault lines. Volcanic activity was started by the enormous dacite eruptions of the Vlădeasa in the northwest, continued with the eruptions of the dacite and biotite andesite of the Radna/Rodna Mts.. The dacites settled on the bottom of the inland sea with a tremendous amount of ash and volcanic substance, forming a sequence of Upper Mediterranean deposits. Apart from the volcanic substance argillaceous marl silt and argillaceous sand, washed in from the dry land surrounding the basin, deposited abundantly on the bottom of the inland sea, interspersing time and again the thin interbedded layers of the ash of the future dacite eruptions.

The Transylvanian inland sea had to be closed off for a long time from the ocean for the thick rock-salt and gypsum beds to form. The salt water of the completely enclosed inland sea slowly evaporated under the influence of the then tropical climate, and after the salt solution reached saturation the gypsum and later the rock-salt had to precipitate from it in the deepest regions of the basin, and blended together in the deepest part of the basin because of the leaching effect of rainwater, and thus formed substantial beds.

This era was followed by the incursion of the ocean again, and the basin was filled with salt water again even in the Upper Mediterranean. The incursion of the sea may probably have taken place from the Hungarian inland sea, along the line of the Maros/Mureş. The sea covering the already settled salt beds with its silt now started slowly to freshen together with the enclosed Hungarian inland sea, and, according to the quite unique mixed organic remains held in the silt deposits above the salt beds, it deposited layers resembling very much the abyssal sediments of the present Black Sea.

At the same time, dacite lava eruptions may have happened again and again, followed by eruptions especially rich in ash, which settled in the upper layers, too, as tuff. The activity of the small volcano of the Csicsó/Ciceu Mountain and the formation of the dacite mountains of the Transylvanian Ore Mountains, especially of the Csetrás range, fall approximately on the end of this era.

With the coming of the Sarmatian the Transylvanian inland sea maintained a contact with the Hungarian inland sea only along the line of the Maros/Mureş, and was freshened more and more by the increasing amount of precipitation of the dry land.

Most of the Pontic freshwater inland lake, however, drained along the line of the Maros/Mureş towards the end of this era, but at the eastern and western bases of the Persány/Perşani Mountains some freshwater lakes of considerable size remained longer, and from them an abundance of sediments settled again in the first half of the following stage, the Levantian. Among these sediments there are not only lacustrine marl, clay silt and lignite, but also a great amount of basalt detritus from the Olt and andesite detritus of Hargita/Harghita, partly separately and partly mixed together. This indicates that the volcanic activity of the prevailing pyroxene andesites of the southernmost peak of Hargita/Harghita and the basalts along the Olt falls on this last stage of the Tertiary, and it must have lasted until the end of the Tertiary, if not extending even perhaps into the Quaternary.

The catchment area of the Szamos/Someş-Kraszna/Crasna

The wide alluvial valley of the Maros/Mureş divides the Transylvanian Basin into two, which are physiographically different. North of the Maros/Mureş sprawls the Mezőség/Câmpia Transilvaniei; in the west as far as the dacite tuff hill range from Torda/Turda through Kolozsvár/Cluj to Dés/Dej, in the north as far as the foot of the Ilosva/ Dealurile Suplai Mountains, and in the east as far as the eruptive range of tuff hills of the Kelemen/Căliman-Hargita/Harghita. The Mezőség/Câmpia Transilvaniei is a hillocky area with an average height of 400 m. There is no sign of regularity in the relief. The hillocks are situated irregularly among the valleys, in a way that the watercourses divided them. The often soggy valleys are meadows, the hillsides are plough-lands, the flat hill ridges, on the other hand, are barren, scattered pasture areas, hence the term Mezőség/Câmpia Transilvaniei.

The Almás/Almaş Basin lying surrounded by the Meszes/Meseş Mountains and the dacite tuff hills of Kolozsvár-Dés/Cluj-Dej also belong to the Mezőség/Câmpia Transilvaniei proper. In it Oligocene and Eocene deposits come to the surface all around from under the Miocene sediments. It is for the most part the drainage basin of the Almás/Almaş Stream.

A characteristic feature of the relief of the Mezőség/Câmpia Transilvaniei is that the valleys meander capriciously, without any regularity between the randomly situated hill ridges of Miocene salt substances, marl, sandy layers and tuff. The hill ridges are arid, the flora on it is scanty because of the infertility of the soil. In the valleys with impermeable argillaceous soil small ponds and puddles stagnate.

The Transylvanian Basin lacks the substance so characteristic of the interior of the Carpathian Basin in the cold and dry ice age, loess. There are, though, loess-like substances here and there at the foot of the slopes and on the river terraces, but they are not typical: they are stratified, polluted and mainly flood-plain deposits (Figure 6.).

These clays, including the Pannonian ones, but especially the mediterranean salt clay and the Oligocene clay are impervious rocks. If they get wet they will become plastic, mouldable, and the great phenomena creep and landslide take place.

Solifluction was an important factor in the ice age concerning the transportation of mass and the decrease of the difference in levels. The dust that fell on the clayey slopes could not become loess because the impervious soggy clay, which was frozen in winter and thawed in summer, slowly moved like a mud slide on the slopes under gravitational force, and because of the alternation of freeze and thaw with a vermicular motion, down to the foot of the slopes together with the dust mass that fell on the surface, and from there the watercourses transported them off.

The large-scale movement of substance under gravitational force, landslip can at various places be detected. This phenomenon occurs especially in the northern quarter of the basin, where the „Mezőség/Câmpia Transilvaiei substances" are situated on the surface or under the thin Sarmatian-stage cover.

Layers at the edge of the basin lie peacefully, in the interior parts, however, folds of NW-SE direction formed (so-called domes) which contain rock-salt and a valuable hydrocarbon compound (natural gas).

Ice ages occurring in the Pleistocene forced the rivers of the Transylvanian Basin to change tract. They filled up the bottom of their valleys with gravel. Then in the interglacial periods the rivers etched into the sedimented bottom of the valleys, and transformed them into terraces. Within the basin terraces 3 (Middle Pleistocene) and 4 (Lower Pleistocene) can be found in 15-23 and 43-60 m high relief facies in the river valleys.

Distinctively well-formed terraces can be detected in the Nagyág/Săcărâmb Basin, situated in the northern border area of the basin. We can also find the Cikói crystalline shale block in the Lapos Mountains consisting of crystalline shale, which our geological maps and several descriptions designate as the Preluka/Preluca Mountains, and the Cretaceous-Eocene-Oligocene watershed tableland, indicated in turn as the Lápos/Lăpuş Mountains by geological maps, separating the Transylvanian Basin from the Maramuresh Basin, and including the adjoining Oligocene (Chattian-stage) erosive hilly area and the Lápos/Lăpuş valley basin.

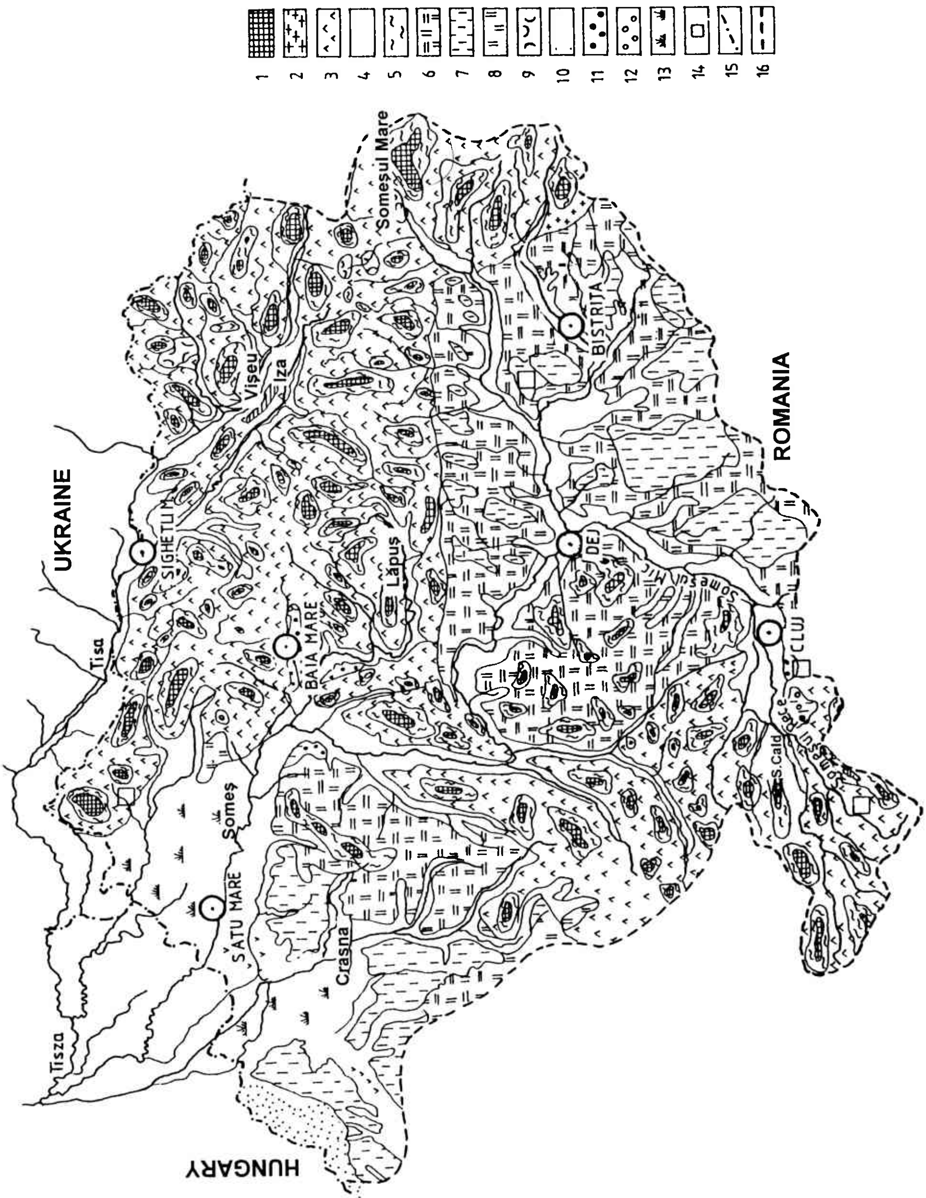

Figure 6. Genetic features of the Quaternary sediments in the catchment area of the Szamos/Someş-Kraszna/Crasna

1 marine sedimentary formations, 2. volcanic complexes, 3 delluvial formations, 4. alluvial formations, 5. colluvial formations, 6. elluvial and delluvial formations, 7. delluvial and prolluvial formations, 8. prolluvial formations, 9 glacial deposits, 10. lolic deposits, 11. deposits formed on lower terrace, 12 deposits formed on upper terrace level, 13. swamp deposits, 14 Palaeolithic deposit, 15 Mezőség/Câmpia Transilvaniei measures, 16. depth of ground water

From now on, we are going to give an account of the terraced valley formation as standard, which holds for the whole region of the basin as well! Where the basins and the slopes of the mountain ranges are surrounded by argillaceous marly deposits (deep-sea Upper and Middle Oligocene deposits) there are erosive hilly regions that have sliding slopes, and Tertiary and Quaternary terraces formed in the river valleys. For example while the tops of the Oligocene erosive hilly region north and south of the Lápos/Lăpuş Basin are 500-600 m high above sea level, the height of the middle of the basin is only 300-350 m. The terrace gravel of the river overlay the eroded surface of the subsided Oligocene (and partly - in the southwest and west - Eocene) deposits in the interior of the basin. So the basin is the same type as the Tertiary terraced basins of the Carpathian Basin, like the Gömöri, the Nógrádi etc. terraced basins; even the Nagybánya/Baia Mare terraced basin situated in the northwestern vicinity of the Lápos/Lăpuş Mountains belongs to this group. It is precisely the terraces of the basin that testify that the relief did not subside any more at the end of the Pliocene, on its surface an accumulative plain did not form, but sedimentation was replaced by the erosive activity of the rivers.

The river created six terraces in the Lápos/Lăpuş Basin. All the terraces are typical, transitory terraces abundant in gravel. (Figure 7.).

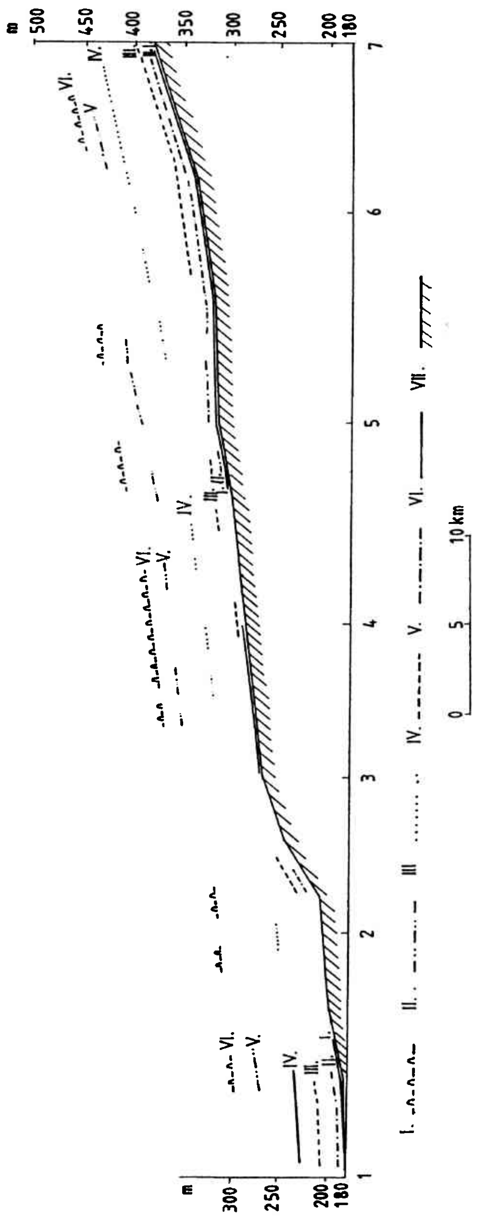

Figure 7. Longitudinal profile of the terraces of the Lápos/Lăpuş Between Oláhlápos/Lăpuş and Kovás/Coaş, and the present water level at certain locations

1. Kovás/Coaş 180 m, 2. The ruins of Kővár/Igniş 211 m, 3. Buny/Buni Valley 271 m,
4. Ferry at Erdőszállás/Sălniţa 287 m, 5. Domokos/Dămăcuşeni 338 m, Oláhlápos/Lăpuş 384 m,
Terrace types: I. Holocene, II Upper Pleistocene III. Middle Pleistocene, IV. Lower Pleistocene, V. at the beginning of the Pleistocene VI. at the end of the Pleistocene, VII. present water level of the Lápos/Lăpuş

Terrace 1

Both this erosion and accumulation characterize it on the present flood-plain (accumulation at high water mark, erosion at low and middle water mark). The terrace is an amphibious formation, indeed. Part of it is cultivated, and because its height above the surface of the river is 1-1.5 m, it can be called a terrace in the morphological sense, too. On the left bank of the river there is a wider strip, more than 1 km wide. Its substance is very similar in size and composition to the present deposit of the river. It is mainly much-rolled andesite gravel of various size, but quartz gravel and local gravel were also mixed in it, especially from the marly, gravelly Eocene and Oligocene strata of the southwestern stretch of the basin. Apart from gravel quicksand and silt play only an inferior role in the terrace composition.

Terrace 2, or Upper Pleistocene terrace

The valley bottom of the last ice age formed into a terrace only after the Wurmian ice age, in the postglacial period. The terrace constitutes an almost uniform surface that remains in both narrow and wide zones. Only the valleys of the affluents coming from the south intersect it on the left of the Lápos/Lăpuş. The Upper Pleistocene terrace is 4-5 m above the 1-1.5 m high alluvial terrace, so above the river a 6-7 m high bench, covered by a thick layer of adobe, rises, and behind it we reach another adobe-covered bench, which is 6 m higher and has an energetic rim. Its height, therefore, is 12 m above the river. The right-bank realizations of terrace 2 may be considered absolutely unimportant because of the powerful landslides, while on the left bank an 8-10 m high ice-age terrace surface with a steep edge rises above the river.

Terrace 3

Terrace 3 is most probably one gravelled up in the Riss ice age and etched in the last interglacial period. Its remnants in characteristic facies rise 12-14 m high above the river level on both the right and the left banks. The composition of the terrace is completely andesite gravel; only ice-age adobe overlay the top of it, which at places reaches 5 m thickness. The adobe contains mainly decayed andesite gravel.

Terrace 4

The terrace, retaining traces of sedimentation in all ice ages and the interglacial etching of the Mindelian-Riss, in typical facies with dominating features that gives the basin almost its character, characterize the beautiful terrace peninsula between the valleys of the Lápos/Lăpuş and the Szőcs/Suciu Stream on the left bank of the Lápos/Lăpuş. The more than 6 km long and at places nearly 1 km wide terrace field interspersed by branch ravines has an energetic rim. Its dip is even, the edge of its plain surface is 50 m above terrace 2, so 59 m above the river. Its exposure is scant; what it has is feeble. In the walls of the dry valleys splitting its edges we can see that its composition is heavily decayed andesite gravel. What is also evidence of the terrace's great age is that it is abundant in quartz gravel, too. The gravels are somewhat smaller and softer than those of terrace 3. The ice-age adobe formed from the falling dust overlay the gravel in a 3 m-thick layer. Absolute height of the terrace surface is 400-410 m above sea level. For that matter, terrace 4 rises from the alluvium of the Lápos/Lăpuş with a quite slight slopingness, first to 45 m, but its height further increases inward, and reaches 50-55 m above the river. On its slope the decayed andesite gravel of the Lápos/Lăpuş, mixed together with the slope detritus of solifluction, can be found at many places.

Terrace 5

It presents itself in various spots in the Lápos/Lăpuş Basin as a Lower Pleistocene formation. It rises onto a 23 m wide adobe-covered slope above the plateau of terrace 4. The composition of the terrace is heavily decayed andesite, its gravelly surface is 80-85 m high above the water surface of the Lápos/Lăpuş.

Terrace 6

It exists in a lower number, mostly as a gently sloping narrow edge at the bottom of the 500 m high Oligocene tops. It is 23-30 m further above terrace 5, so 105-110 m high above the river. In the Lápos/Lăpuş valley and basin we have not found river terraces older than terrace 6 from the end of the Pliocene, neither have we found any on the etched, meandering valley section or in the Nagybánya/Baia Mare Basin. Its either because they have eroded or, what is much more probable, because the Lápos/Lăpuş valley is not older than the Middle Pliocene or the last third of the Pliocene.

All the 6 terraces follow the present dip-line of the river regularly. There is no trace of subsequent fragmentation or possible arching that can be derived back to tectonic movements.

The disappearance of the Tertiary sea, the Pliocene subsidence of the Great Plain and the activity commencing parallel to these processes provided an opportunity to the formation of all the terraces.

Climatic features

1 Macro-synoptic conditions

The Atlantic and Mediterranean climatic effects making the climate milder exert their influence to the least degree in the catchment area of the Szamos/Someş, even in the entire territory of Transylvania. The continental features of its climate are sharp and distinctive. When giving a brief characterization of its climate we must, in any case, take into account the circumstance that its middle is an enclosed dry basin, in which the winds arrive as eddy-winds from every direction, and its borders are high mountains richer in precipitation than the basin, but having a severe climate. The continental character is most powerful in the Transylvanian Basin and in the high enclosed basins of the mountains. The winter in Transylvania is colder than in the Câmpia Tisei/Great Plain, but the summer is cooler (Dfbx- and Dfbxc climate).

So climatically the region is a border area, a meeting point of temperate western, oceanic and extreme eastern, Eastern European continental climates. Intermediate temperate continental climatic features prevail.

In this area air masses streaming from various climatic centres of impact exert their influence. The most frequent one is the Atlantic influence, called western, oceanic cyclones, which is present all year, and lasts for several days alternating. It provides 45% of all the influences. In winter it makes the severe, freezing weather milder, and brings ample precipitation. In summer it makes the climate changeable, brings abundant precipitation especially to the northern quarter of Transylvania.

The direction of the polar influence is NW-SE, and it provides 30% of all the influences. Mixed with the wet north-Atlantic air masses it causes considerable decrease in temperature, clouding and showers. One of its northern variants sometimes stretch over Transylvania in spring, summer and autumn.

Hot tropical air currents amount to 15% of all the influences. It causes great warming up. Its south-southwestern variant is an air mass streaming from the Mediterranean Sea bearing humid „mediterranean" cyclones, while the southeastern one is an anticyclone causing the broiling weather of dry summers. The mediterranean cyclone is more frequent in winter, but it sometimes appears at the end of summer and the beginning of autumn in the southwest. Its influence manifesting itself in abundant precipitation can mainly be felt in Temesköz.

In winter, the air passing over the Mediterranean Sea makes the weather milder, and it often causes ample snowfall in Transylvania.

Air masses streaming from any centre of impact may have several variants, such as the Azorean anticyclone, the Greenland anticyclone, the Iceland cyclone, the Scandinavian anticyclone, the North African anticyclone and the Arabian cyclone. The Azorean high and the Iceland low often move combined both in summer and winter, which causes a powerful weather front activity in Transylvania, too.

The Siberian anticyclone is a winter phenomenon. It causes a great fall in temperature all over Transylvania.

The relief of Transylvania characterized by distinctive units greatly influences and changes the characteristics and effects of the air currents. The influence of the relief is dual here, too. On the one hand, local vertical temperature-based climatic zones form, caused by the differences in height, at levels between 100 m and 2544 m. These differences in climate and relief are reflected by the vegetation levels of different composition in the Southeastern Carpathians. On the other hand, the mountains and mountain ranges rise like dykes and block the air currents. This relief effect manifests itself especially in the oceanic air currents. Air currents rising on the western slopes of the Transylvanian mountainous area cause clouding and orographic precipitation, whereas on the eastern slopes of the mountain range, on the slopes facing the Transylvanian Basin, the föhn effect, characterized by dry descending air currents occurs.

Similarly, the Eastern and Southern Carpathians block the air currents as well. The western side of the Eastern Carpathians is wetter than the eastern side, and its northern part receives much more precipitation than the middle or the southern part. It is because of the „Szilágyság/Sălaj Gate", where above the low relief humid air masses are able to advance east almost undisturbed.

On the mountain and high-hill relief characterized by distinctive units the valleys and basins alter the direction and effect of the air currents. Temperature inversion and the föhn effect are frequent, and insolation is different on the side slopes of the valleys lying in an E-W direction.

Conditions of temperature

On a relief laid out in depth, like the area of Transylvania, the distribution and manifestation of meteorological and climatic factors like solar radiation, temperature, winds, atmospheric pressure, humidity and precipitation show a different, changing picture. Annual solar radiation is 120-122 kcal/sq. cm on the plain area of the Körös/Crişul and in Temesköz/Câmpia Timişului, an average of 115-117 kcal/sq. cm on the hilly region of the Transylvanian Basin, and it is lower on average in the mountainous area, because the effects of the relief laid out in great depth and the orientation of the slopes play a more powerful role.

Depending on the degree to which the relief is laid out in depth, differences appear in the distribution of temperature as well. The air is coldest at the alpine level of high mountains. Above 2000 m annual mean temperature is 2 °C (Figure 8.).

Annual mean temperature reduced to sea level is 8-10 °C, in reality it is, of course, lower, because with every 100 m of elevation there is a temperature drop of 0.5 °C. The Eastern and the Southern Carpathians are very cold regions. Mean temperature of the hottest month does not reach 20 °C and it is about -3 °C of the coldest one.

Mean annual fluctuation is therefore similar to that of the Câmpia Tisei/Great Plain, it is even less in the western quarters of the Southern Carpathians and in the region of the Lower Danube, 22-23 °C (mediterranean impact). It is highest in the Gyergyó/Giurgeu Basin: 25.8 °C. Annual absolute fluctuation is similar to that of the Câmpia Tisei/Great Plain, too. In Nagyszeben/Sibiu 36 °C was the highest and -35 °C the lowest temperature ever measured. So the difference is 71 °C. The course of monthly fluctuation is not so uniform as in the Great Plain. The maximum of March and the minimum in June still exist, but the maximum of October (Indian summer) disappears. Daily fluctuation is usually lower than in the Câmpia Tisei/Great Plain. In winter it is 3.1-6.4 °C on average, depending on the location in question: a mountain top or a basin. Late frosts may occur even in June, early ones even in September. The number of days with frost exceeds 100.

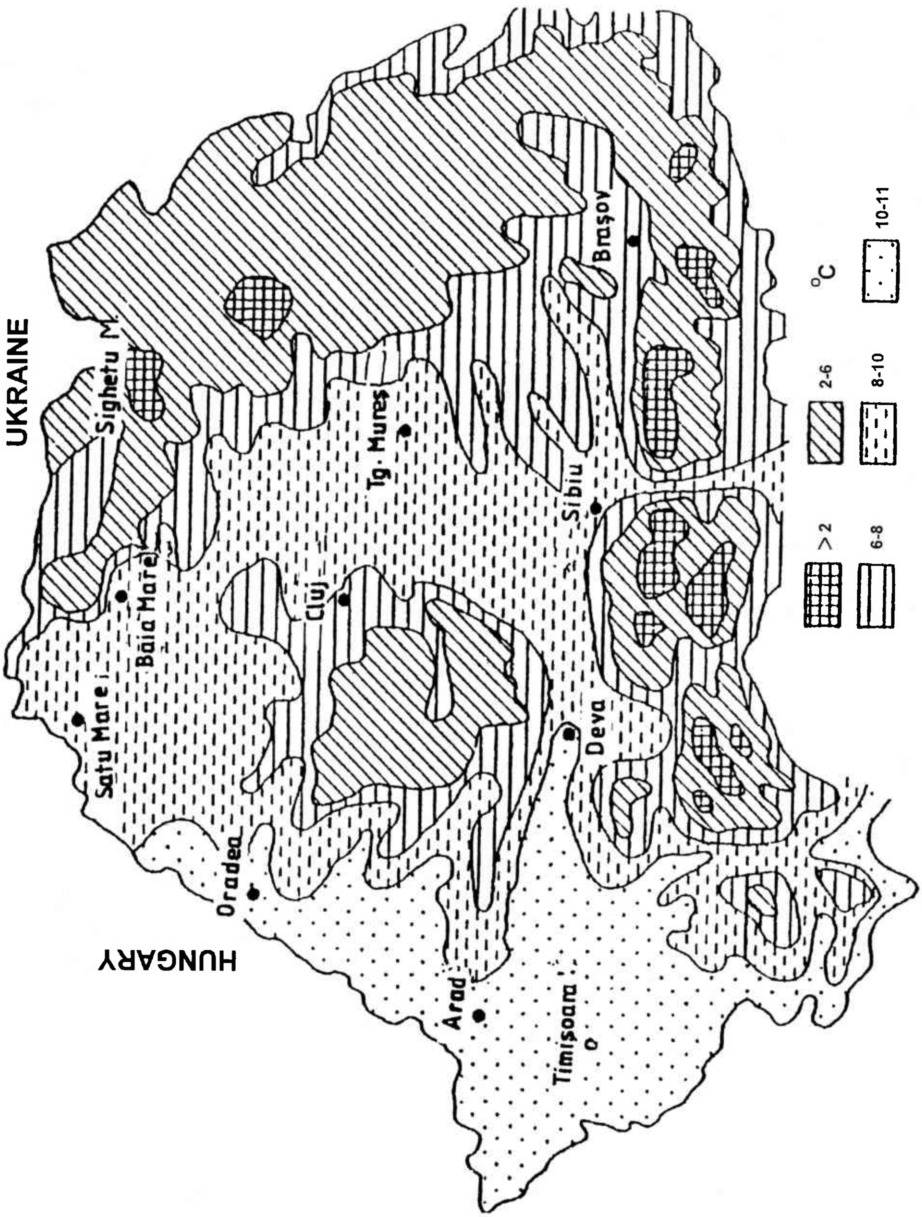

Figure 8. Regional distribution of annual mean temperature in Transylvania (after the study book Geografia României for form XII)

Regional distribution of precipitation

The amount and the spatial distribution of precipitation reflect the relief of Transylvania accurately. The interior of the Transylvanian Basin, the Csík/Ciuc and the Gyergyó/Giurgeu enclosed basins are driest, and the mountainous areas, especially the Southern Carpathians are wettest. The outer slopes of the Eastern Carpathians receive more water (mediterranean impact) than the inner ones. Average annual precipitation is 600-1200 mm; the same figure is 550-600 mm in the Transylvanian Basin, in the Mezőség/Câmpia Transilvaniei, 600-700 in Csík/Ciuc and Gyergyó/Giurgeu, 650-750-800 mm in the Brassó/Braşov basins as well as in Szilágyság, 800-850 mm in the Eastern Carpathians, in Bihar/Bihor and in the Szilágyság/Sălaj-Crasna hills, 900 mm in Hargita/Harghita, in the Radna/Rodna Mts. and on the western side of the middle of Bihar/Bihor, and 1000-1200 mm in the Southern Carpathians (Figure 9.).

The early-summer rainfall maximum presents itself quite intensely. 40% of the annual precipitation falls in summer, the secondary maximum of October is absolutely insignificant because of the powerful continentality. On average half the number of days with precipitation are snowy.

A distinctive local wind is the eddy-wind-like, dry cold eastern wind passing over the Eastern Carpathians and arriving in the Transylvanian Basin with great vehemence, called 'nemere'.

Certain regions of the centre of the basin, such as the Szamos/Someş Tableland and the Mezőség/Câmpia Transilvaniei regions bear the climatic features of the Transylvanian Basin (Figure 10.,11.). Accordingly, the climate of the Mezőség/Câmpia Transilvaniei in Transylvania bears the temperate continental climatic features of the Transylvanian Basin. In its area no great differences appear in the figures of the meteorological and the climatic elements. In the western parts annual mean temperature is between 8 and 9 °C, whereas it decreases to 7 °C in the east. Precipitation is less in the west, the annual mean is about 500 mm, while in the east it increases to 600-700 mm. Despite the fact that most precipitation falls in summer (90-250 mm), this amount of water is not enough to counterbalance evaporation. Therefore, there is a great water loss in both the water output of the rivers and the ground water reserve. This water loss of some 100 mm increases dryness in Mezőség/Câmpia Transilvaniei in Transylvania. Western, northwestern winds prevail. The comparatively little precipitation as well as the great size of aquifers and permeable layers of the surface all decrease the figure of surface drainage. That is the reason why a denser drainage network could not form.

Thanks to the unique influence of Transylvania the meteorological and climatic elements and factors determine the formation and division of different regional climate types. Accordingly, three main regional climate systems take shape, within these, areas reflecting different climatic features exist according to the altitudinal levels. At high altitudes cold, mountain climate prevails, frequent strong winds are characteristic of these regions. On the hilly areas we can distinguish two climatic regions: the climatic regions of low and high hilly areas. Considerable differences do not occur in the climate of the border areas of the Câmpia Tisei/Great Plain.

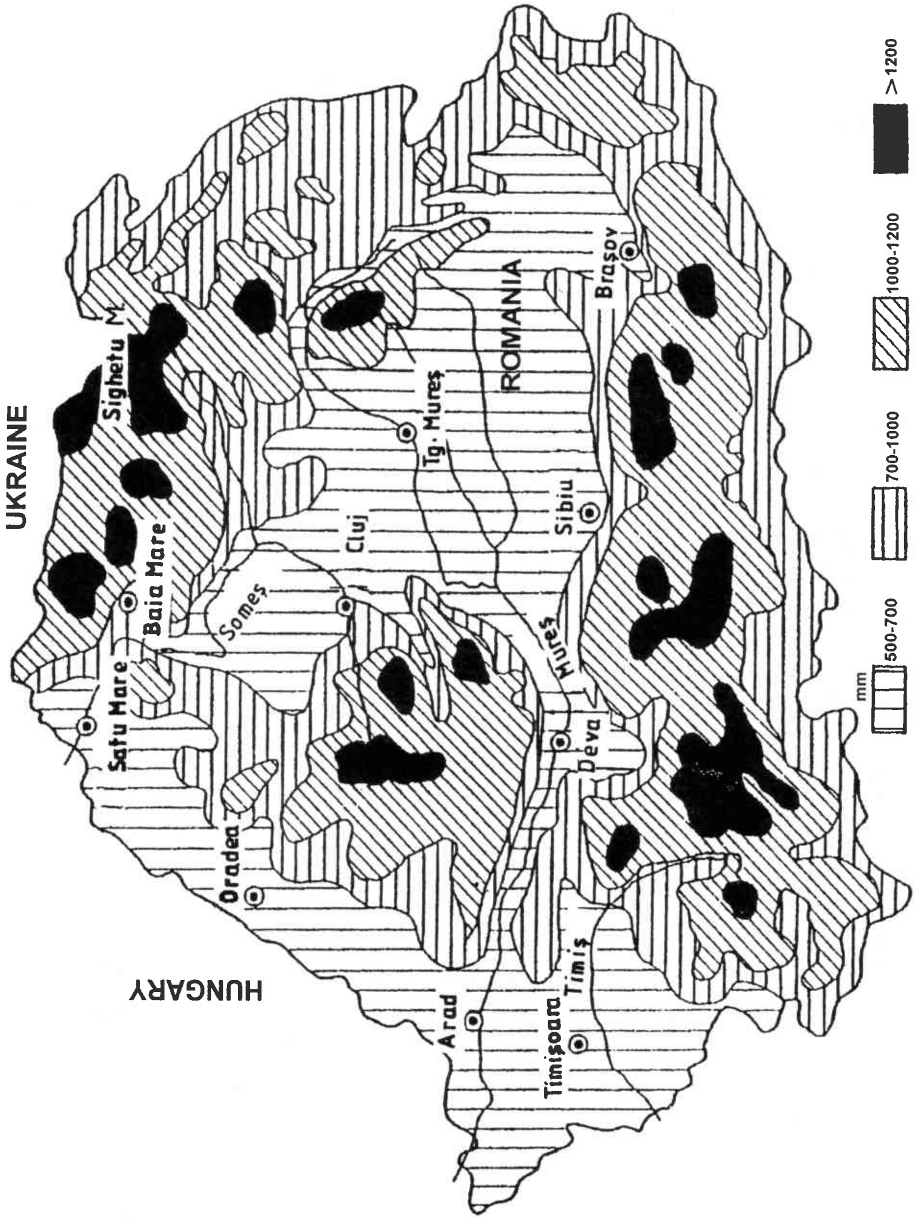

Figure 9. Regional distribution of annual precipitation in Transylvania (after the study book Geografia României for form XII)

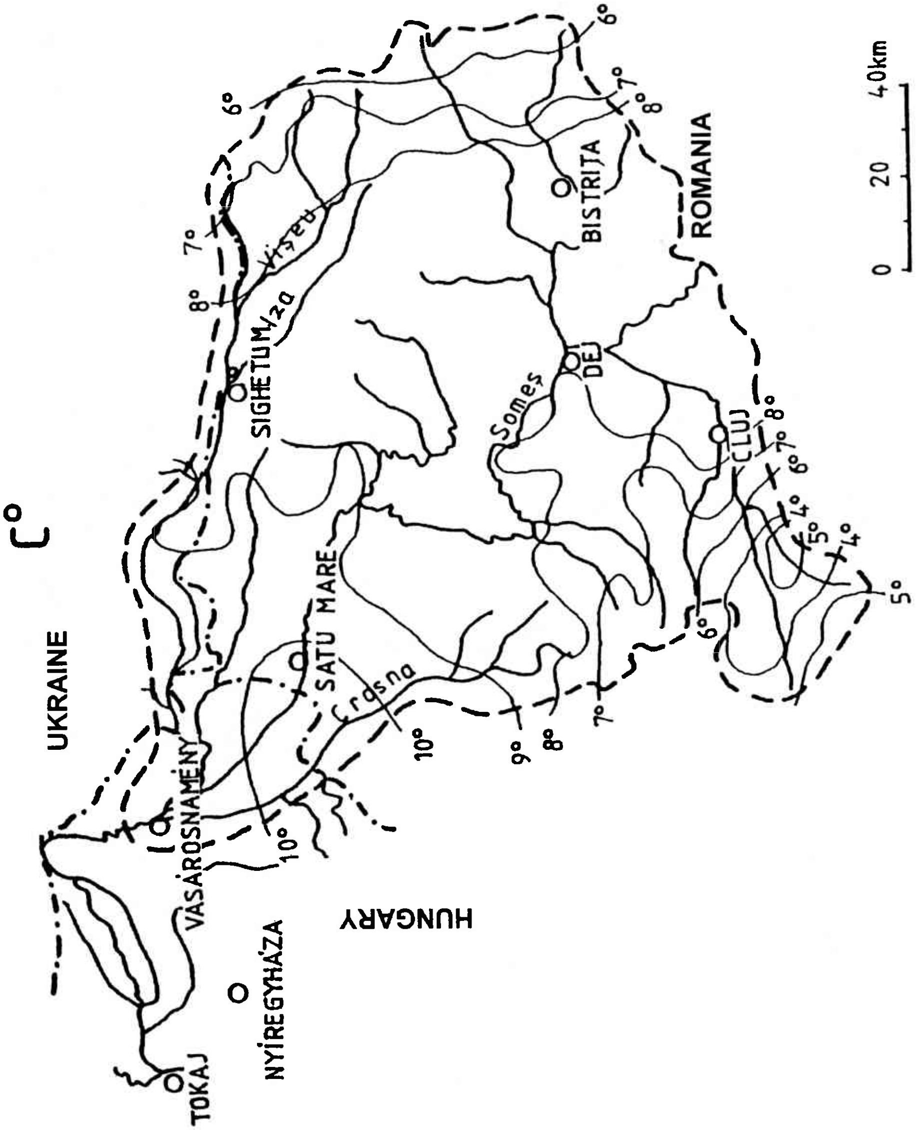

Figure 10. Regional distribution of annual mean temperature and precipitation in the river system of the Szamos/Someş-Kraszna/Crasna

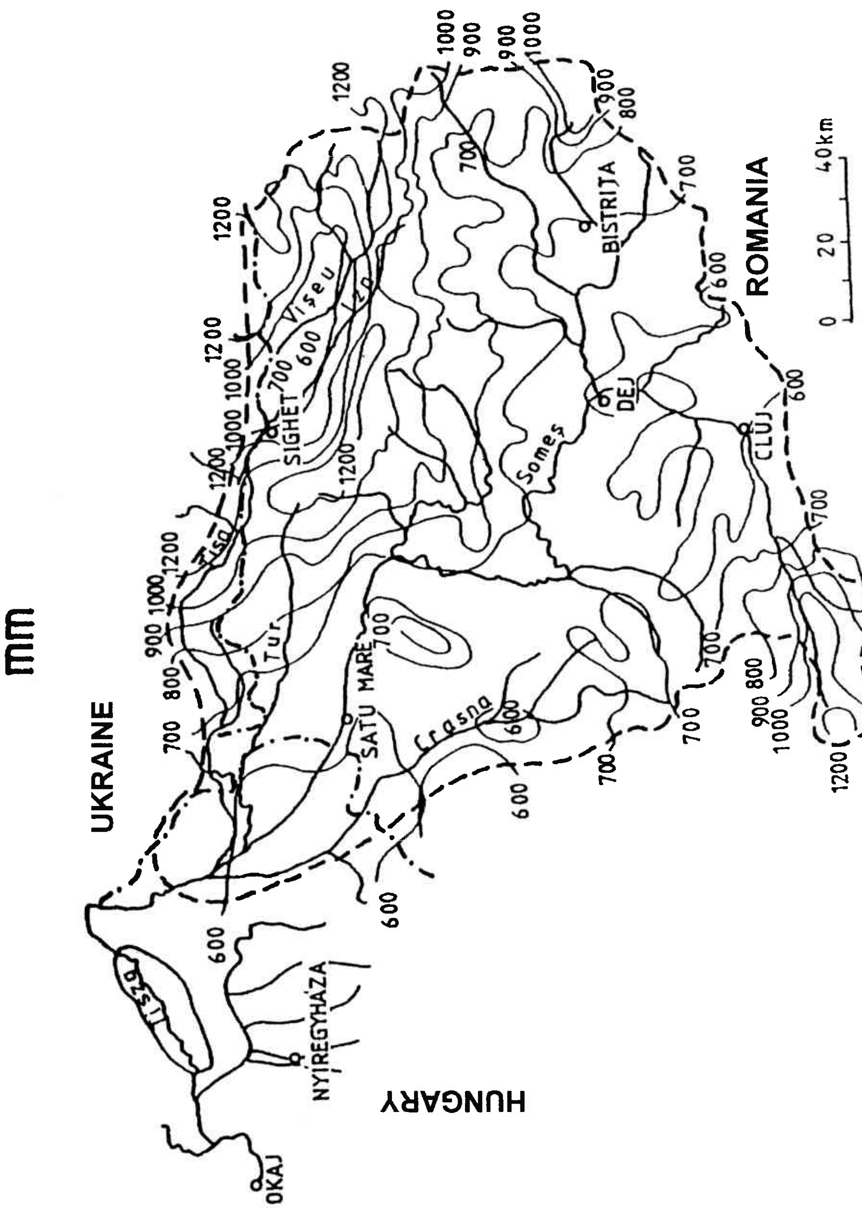

Figure 11. Regional distribution of annual mean temperature and precipitation in the river system of the Szamos/Someş-Kraszna/Crasna

Hydrological features of the basin

The interplay of the relief, climate and the composition of the rock quality of the region determined the formation of a drainage network with a comparatively dense and unique distribution in Transylvania. The direction of the watercourses was greatly influenced by the location and surface of the large relief groups. The rivers of a well-developed, roughly radially spreading drainage network drain the waters of the Transylvanian mountainous area. In the Eastern Carpathians the rivers flow in two directions: east, beyond the Carpathians and west, crossing the Transylvanian Basin to the plain of the Tisza/Tisa. The two exceptions are the River Olt leaving Transylvania southward, and the Bodza bending southeast.

The most common surface is the one created by the watercourses in the entire region of Transylvania, the Carpathians, the Transylvanian Basin, Szilágyság, the western hilly area and the Great Plain. In this group the watercourses have played a decisive role since the end of the Tertiary.

The beginning in the shaping of the relief was the formation of the watercourses, drainage networks and catchment areas. In the Carpathians the transversal watercourses etched through the mountain ranges at various locations and determined the formation and development of transverse valleys.

According to the spatial location of the drainage basins, to its relation to the main catchment area and to the climatic effects controlling and influencing the water output, the drainage network of Transylvania divides into different groups (Figure 12.).

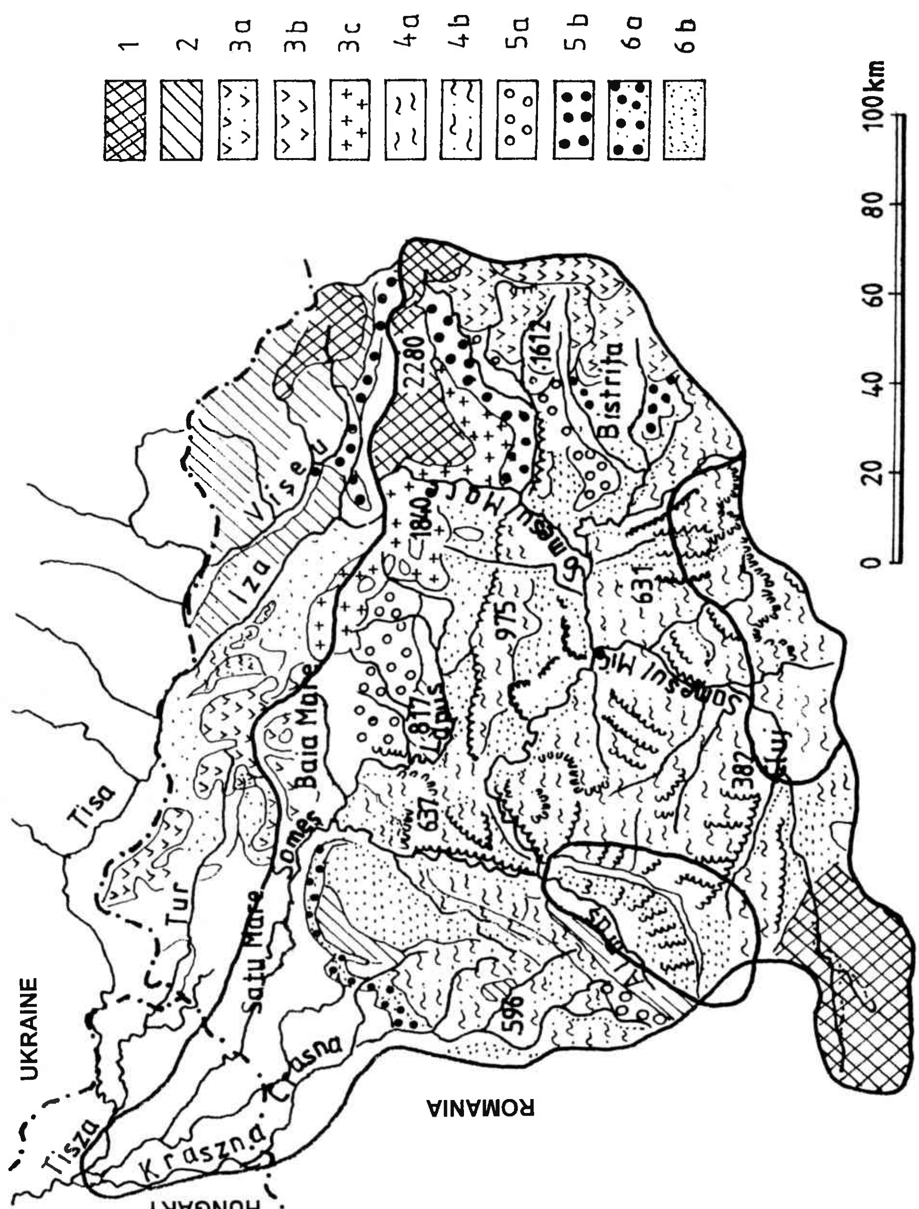

Figure 12. Topographic features of the drainage basin of the Szamos/Someş and the Kraszna/Crasna Edited by Andó M.

1. crystalline rock high mountains (1500-2000 m), 2. low folded mountains (500-1500 m), 3. a. low volcanic cratogens, 3. b. volcanic cones, craters, 3. c. volcanic mountains and plateaus, 4. a. high hill formations (700-1200 m), 4. b. low hill formations (150-300 m), 5. a. elevated piedmonts of hilly areas, 5. b. structural tablelands, 5. c. terraced tablelands, 6. a. accumulation plains in front of mountains, 6. b. flood plains, sandy plains

The northwestern group includes the tributaries of the Tisza/Tisa: the Visó/Vişeu, the Iza, the Szaplocna/Săpânţa, the Mára/Mara and the Túr/Tur Stream. They flow towards the Upper Tisza/Tisa and the Szamos/Someş from the northern slopes of the Gutin/Gutâi, the Cibles/Ţibleş and the Radna/Rodna Mts. and from the Avas/Oaş Mountains.

The western group is three large river systems, including the drainage basins of the Szamos/Someş, the Maros/Mureş and the Körösök/Crişuri. The Maros/Mureş crosses the entire region of Transylvania. The river of the Gyergyó/Giurgeui Mountains breaks through the intramountainous section of Maroshévíz/Toplița -Déda/Deda, and enters the Transylvanian Basin at Déda/Deda. Its water output and significance are increased by several tributaries of various size: the Görgény, the Nyárád, the Kis- and Nagy-Küküllo/Târnava Mică and Mare, the Sebes/Sebeţ Stream and the Sztrigy/Strei on the left, on the right the main watercourse of the Mezőség/Câmpia Transilvaniei, the Ludas/Luduş Stream, a large tributary rising in the Móc region, the Aranyos/Arieş, the Fel-Gyógy/Geoagiu Stream and the Ompoly/Ampoi. The two large branches of the Szamos/Someş flowing in from opposite directions, the Nagy and the Kis-Szamos/Someşul Mare and Mic unite at Dés/Dej. The Nagy-Szamos/Someşul Mare drains the waters of tributaries rising in the Radna/Rodna and Borgó/Bârgău Mts., and the Kelemen/Căliman Mts.: the Ilva/Ilva, the Les/Leşu, the Sajó/Şieu, the Rebra/Rebra, the Beszterce/Bistrița, the Árnyas/Anieş and the Szalóca/Sălăuța. The Kis-Szamos/Someşul Mic drains and transports the waters of the Hideg- and the Meleg-Szamos/Someşul Rece and Cald, flowing through the eastern side of the Transylvanian mountainous area, the waters of the Papfalv/Popeşti Stream and the Nádas from the region of the Szamos/Someş Tableland situated in the Transylvanian Basin, and the waters of the Füzes/Fizeş Stream from the Mezőség/Câmpia Transilvaniei in Transylvania, to Dés/Dej, towards the Nagy-Szamos/Someţul Mare. Below Dés/Dej its largest tributaries are the Almás/Almaţ and the Egregy/Agrij on the left and the Lápos/Lapuş on the right. Two major rivers of Szilágyság are the Berettyó/Barcău and the Kraszna/Crasna. The former is the tributary of the Körös/Crişul, the latter is of the Szamos/Someş. The Körösök/Crişuri, are significant watercourses flowing through the western side of the Transylvanian mountainous area. They drain and transport the waters of the Réz/Plopiş Mountains, the Vlădeasa, the Bihar/Bihor Mountains, Királyerdő/Pădurea Craiului, the Bél/Codru Mountains, the Transylvanian Ore Mountains and the Zaránd/Zărand Mountains into the River Tisza/Tisa.

Streams	Distance from mouth, km^2	Catchment area, km^2	Characteristic water discharge, m^3/s			Gauging station
			low water	average	flood	
Someşul Mare	24	4371	2	44	1760	Beclean
Someşul Mic	82,2	1192	0,5	13,4	2010	Cluj
Şieu	7	1809	0,6	13,4	950	Şinterag
Fizeş	41,1	439	0,04	1,1	50	Fizeşu G.
Someş	294,8	8845	3,7	68,5	2200	Dej
Almaş	23,1	552	0,035	1,6	165	Hida
Sălaj	1,8	457	0,005	2,27	780	Sălsig
Lăpuş	8	1487	0,54	20,8	1350	Lăpuşel
Szamos	47,6	15282	15	120	2360	Csenger
Kraszna	22,8	2976	0,04	3	260	Kocsord

Table 1. River regime of the Szamos/Someş-Kraszna/Crasna and their tributaries

The southwestern group includes the minor watercourses of the Bánság/Banat and Temesköz/Câmpia Timişului The largest one is the Temes/Timiş, the Béga/Bega is second, of which bed was made navigable a long time ago, and the next is the Berzova/Bârzava.

It is only the River Olt that belongs to the southern group in Transylvania. It drains the waters of some 13,500 sq. km. Its catchment area stretches over regional units of different relief. Its river-head area is in the crystalline range of the Eastern Carpathians, in the Gyergyó/Giurgeui Mts.

The primary formative effect of the watercourses is valley formation in Transylvania as well. Most of the Transylvanian river valleys divide into three: the upper section is in the mountains, the middle section is in the hilly areas, and the lower section, especially in the case of the major rivers, is the plain or the comparatively wide valley plains.

The valley plains are present almost everywhere along the Transylvanian rivers, they are only absent in the mountainous sections and the gorge portions. In the enclosed intramountainous basins and on the valley plains there are a number of fields of peat and peat bog with stagnant water.

The relief formations of the watercourses, the valleys, valley plains, terraces and the aggradation plains play a significant part in Transylvania, too, concerning the economy and land development. Regarding the course and the degree of the longitudinal river profile the drainage of stagnant waters, and by that increasing the utilization value of the areas in question, are necessary at several basin and valley sections.

The density of the drainage network is not uniform in Transylvania. It is higher in the mountainous areas: the figure is 0.8-1 km/sq. km on the land of the Lápos/Lăpuş-Avas/Oaş in the Bihar/Bihor Mountains, in the Kelemen/Căliman Mts., the Northern-Görgény/Gurghiu Mts. and the Szárkő/Ţarcu Mountains. At other locations of the mountain range it is 0.6-0.8. The same figure is 0.4-0.6 in the Transylvanian Basin, the Szilágyság/Sălaj hilly area, along the Alsó-Homoród/Homorodu de Jos and the western hilly area. It is 0.2-0.4 km/sq. km on the plains of the Temes/Timiş and the Körösök/Crişuri. Density is lowest in the plain regions south of Arad, where it barely reaches 0.2 km/sq. km.

River regime: The Transylvanian rivers are fed mainly by rainwater. The proportion of snow-broth and the contribution of ground water are very small. The consequence of this is fluctuating river regime, water output. At times of ample precipitation water output may rise to the level of flooding, which was the case in 1970 and 1975. On the basis of the chronological realization of the river regimes we can distinguish various types of river regime.

One of such types includes the river regime of the western rivers of the Transylvanian mountainous area, of the rivers of the northern volcanic ranges (the Avas/Oaş, the Gutăi, the Cibles/Ţibleş) as well as the rivers of the Bánság/Banat mountainous area. These rivers are characterized by an increase of the water output in spring lasting 1 or 2 months (March-April). It is followed by a decrease of the water output connected with the dry weather between July and November. During wintertime floods, resulting from snow-broth output frequently occur.

Decreases of water output come in winter at levels higher than 1000 m and in summer and autumn at lower altitudes.

The second type exists in the Eastern and Southern Carpathians and on the eastern slopes of the Transylvanian mountainous area. With rivers having their river-head areas at lower altitudes than 1600-1800 m low levels of water are a regular occurrence in winter concerning this type. The frequency of a rise of water levels from snow melt and rainwater in spring hardly reaches 10-20%. The main sources feeding the rivers are snow and rainwater; the amount of ground water is small, except for the rivers of the intracarpathian basins, where ground water exceeds 35% of the annual mean water output.

Orohydrographical conditions of the catchment area of the Szamos/Someş and the Kraszna/Crasna

The drainage basin of the Szamos/Someş is much larger than that of the Upper Tisza/Tisa, some 15,880 sq. km (19./31.o.). While the catchment area of the River Tisza/Tisa is virtually open in the west-southwest, that of the Szamos/Someş is closed from the humid air masses in the same direction by the 1836 and 1849 m high peaks of the Bihar/Bihor Mountains and in the south by the ring of the Southern Carpathians. The drainage basin of the Szamos/Someş is, for that matter, closed by the 1800-2300 m high peaks of the Radna/Rodna Mts. in the north and by the peaks of the Eastern Carpathians in the east (Figure 13.).

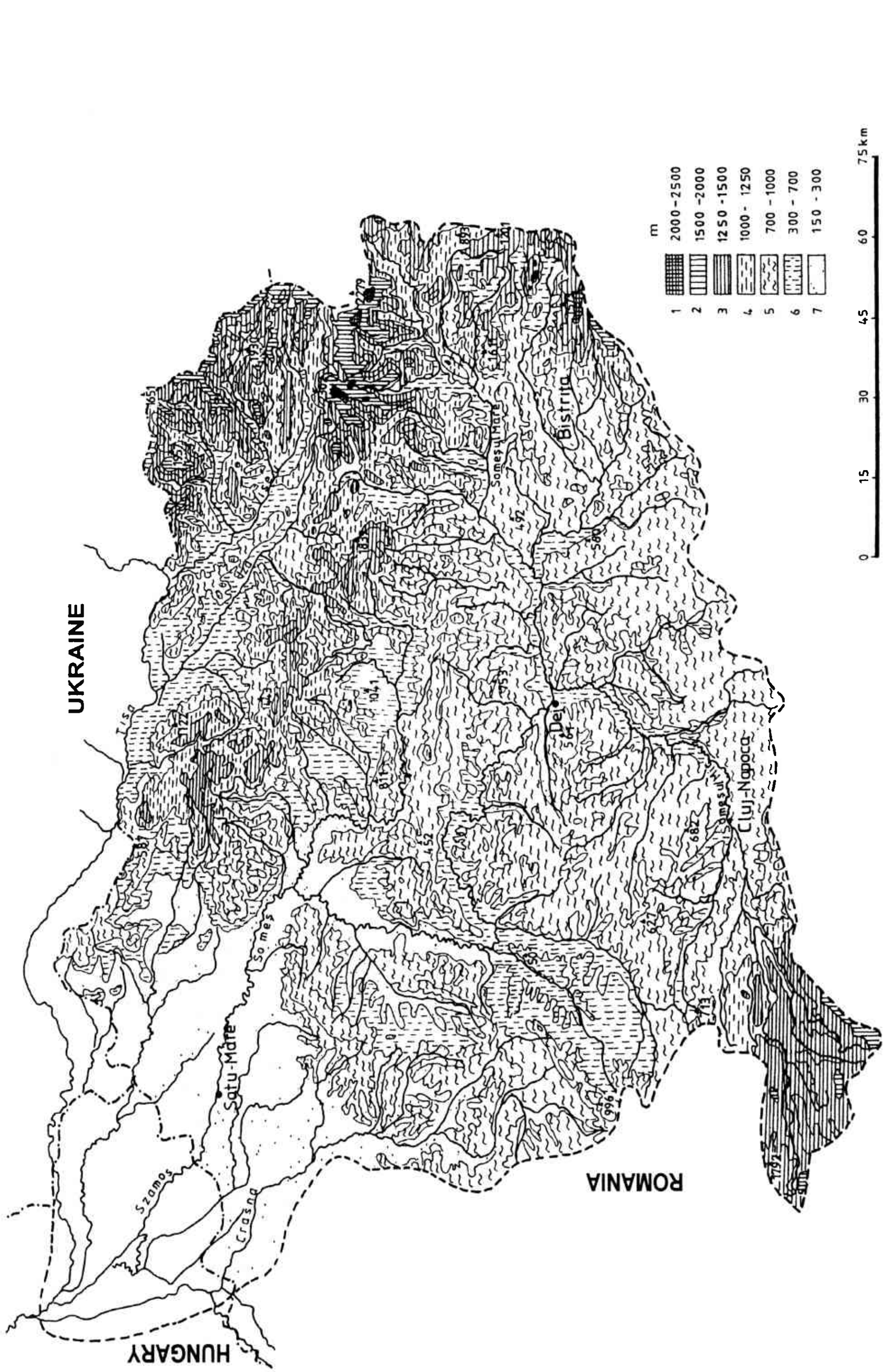

Figure 13. Location above sea level and hydrographic features of the catchment areas of the Szamos/Someş and the Kraszna/Crasna

Air currents arriving from the northwest can penetrate this area most easily. Because most of the catchment area is a low-lying or medium-height mountainous region and at the same time the watershed mountains lying at its southwestern edge are not very high either, air masses bringing precipitation mainly feed the Maros/Mureş valley after passing over this watershed. As a result of all these, in the river-head areas the annual average of precipitation is 800-1000 mm, whereas in the heart of the Transylvanian Basin it is only about 600 mm, which is not increased remarkably by the areas of the Gutin/Gutâi, the Lápos/Lăpuş and the Radna/Rodna Mountains, though rich in precipitation (Nagybánya/Baia-Mare 953 mm, Kapnikbánya/Cavnic 1263 mm).

Distribution of the annual amount of precipitation can be explained by the orographical structure of the region. This part of the Carpathian Mountains runs approximately in a NW-SE direction. Arriving in the Carpathian Basin mainly from the southwest or the west, however, air masses carrying precipitation change their course northeastward because the frontier mountains bounding Transylvania in the west constitute an obstacle. As a result, these air masses are forced to bank up, and ascended they precipitate some of their humidity because of dynamic cooling. Precipitation is also enhanced by the channel effect: the area tends to narrow northeastward. Here we deal with the wettest region of not only the Tisza/Tisa Valley but the whole Carpathian Basin. Increase in precipitation can already be detected in our country 60-80 km from the foot of the mountains. Obviously, the southeastern slopes of the mountain ranges get the most precipitation, so there is a great deal of precipitation even on the southwestern slopes of the Avas/Oaş and the Kőhát/Igniş.

The surface conditions of the catchment area of the Szamos/Someş are complicated and the conditions of precipitation are varied. The Szamos/Someş is formed by two large branches, the Nagy- and the Kis-Szamos/Someşul Mare and Mic. Of the two it is the Nagy-Szamos/Someşul Mare that rises in a wetter region, and, as its name suggests, this is the main river. The source of the Nagy-Szamos/Someşul Mare is on the southern slope of the Radna/Rodna Mts. This huge range runs E-W, but because its southern slope can only receive air currents from the dry Transylvanian Basin, precipitation is much lower here than on the slopes of the Maramuresh Mts. facing southwest.

The terraced valley of the Nagy-Szamos/Someşul Mare below the Radna/Rodna Saddle opens into the Transylvanian Basin below Naszód/Năsăud. At Bethlen it receives the Beszterce/Bistriţa expanded by the Sajó/Sieu and unites with the Kis-Szamos/Someşul Mic at Dés/Dej. Two source rivers of the latter, the Hideg- and the Meleg-Szamos/Someşul Rece and Cald rise in the Gyalu/Gilău Mts. and Bihar/Bihor, respectively. They unite beyond Gyalu/Gilău. The united Szamos/Someş after receiving the Almás/Almaş and the Egregy/Agrij enters the Zsibó/Jibou Basin, and then through the Cikó/Ţicău Pass enters the enclosed Kővár/Ighniş Basin. It receives the Lápos/Lăpuş flowing from the Gutai, and it enters the Great Plain below Szinérváralja/Seini. Its tributary, the Kraszna/Crasna collects the waters of Szilágyság, in the same way as the Berettyó/Barcău does running into the Körös/Crişul. The running of both the Szamos/Someş and the Maros/Mureş is mainly balanced, characteristic of valley-tract rivers.

The upper section of the Szamos/Someş is situated in the Transylvanian Basin, more precisely in the mountain frame bounding the basin in the inside, so this part of its catchment area is characterized by Transylvanian precipitation conditions, a great drought in winter and a comparative abundance in precipitation in summer, whereas annual distribution of precipitation is more even at the lower section of the river. Nevertheless, the influence of the mountains on the conditions of precipitation can be observed in the Transylvanian section as well.

The catchment area of the Szamos/Someş is much bigger than that of the Tisza/Tisa, it is 15,461.3 sq. km together with the drainage basins of the Homoród and Balkány streams (Figure 14.).

In the east the river-head areas of the Nagy-Szamos/Someşul Mare and the Sajó/Sieu in Transylvania are surrounded by the 2000-2300 m high mountain chain. In the west, in the Bihar/Bihor Mountains the individual peaks rise up to 1800 m at the sources of the Meleg- and the Hideg-Szamos/Someş (together the Kis-Szamos/Someşul Mic). The base rock of the mountain range is shale, which is broken through by trachyte rocks in the Kelemen/Căliman Mountains and by granite rocks in the Bihar/Bihor Mountains. Further trachyte rocks are found from Kapnikbánya/Cavnic to Huszt/Hust between the Tisza/Tisa and the Szamos/Someş. Most of the drainage basin is, however, low and medium-height mountainous area covered by the argillaceous, marly deposits formed later in the Tertiary. At quite a number of locations the sediments of the evaporated Neogene sea, thick layers of gypsum and salt emerge to the surface. On the whole, the relief is lower than in the catchment area of the Tisza/Tisa, and the mountain slopes are not so steep.

The Kis-Szamos/Someşul Mic rises on the western slope of the Gyalu/Gilău Mts., an area sheltered from rain. Because of the great height above sea level the amount of precipitation slightly exceeds 1000 mm, but towards the east, around Kolozsvár/Cluj it decreases under 600 mm. The Kis-Szamos/Someşul Mic bending north toward the edge of the Transylvanian Basin enters an area a little richer in precipitation, so the amount of precipitation down the river do not decrease, but increase. The two branches of the Szamos/Someş unite at Dés/Dej, then meandering greatly it arrives in the Great Plain. At this river section it receives a considerable amount of water from the right, because it gains more than 1000 mm from the southwestern slopes of the Cibles/Ţibleş and the Kőhát/Igniş, and 1200 mm from the same part of the Gutin/Gutâi (Kapnikbánya/Cavnic 1263 mm); these figures being similar to those of the Máramaros/Maramuresh Mts.. At this section of the Kis-Szamos/Someşul Mic the higher parts of the surrounding mountains do not receive much less precipitation than the mountainous area around the River Tarac.

Between the confluence of the Szamos/Someşes and the Meszes/Meseş Mountains, indicating the boundary of the Transylvanian Basin, conditions of precipitation are the same, only the difference between the amount in summer and winter is slightly smaller and, though feeble, the secondary maximum of October presents itself again.

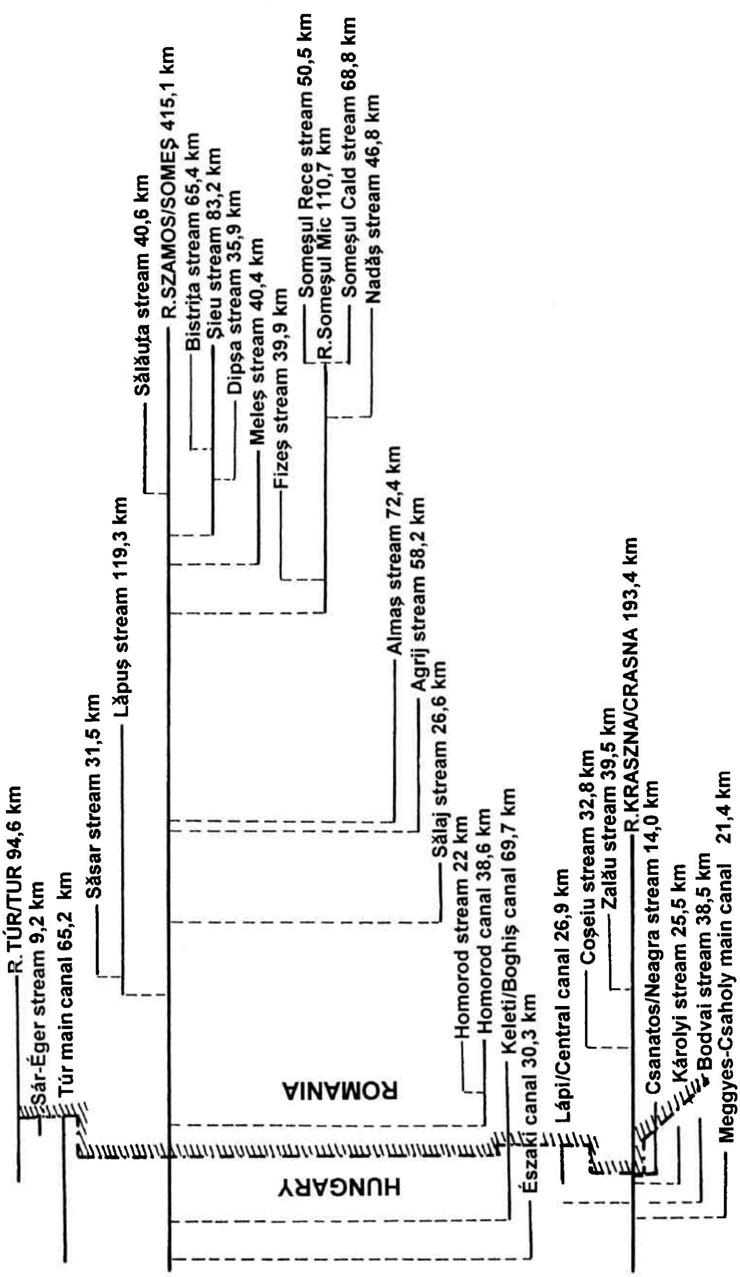

Figure 14. Schematic picture of the drainage network of the Szamos/Someş-Kraszna/Crasna

In the Lápos/Lăpuş valley joining the Szamos/Someş valley from the right the effect of the mountains towering in the north can already be detected, so the rains gliding upwards come to the foreground and the distribution resembles the conditions of the right bank of the Nagy-Szamos/Someşul Mare. This distribution of precipitation is more remarkable at the foot of the Gutin/Gutâi, where the difference of the driest and the wettest months is only 4% of the annual figure.

Around the river-section of the Szamos/Someş on the Câmpia Tisei/Great Plain precipitation gradually decreases, and because the entire catchment area of the Szamos/Someş receives less precipitation, with the exception of the Gutin/Gutâi area, than the drainage basin of the Upper Tisza/Tisa, its mean water output is lower than that of the Tisza/Tisa, despite its larger catchment area.

The section of the Tisza/Tisa between the Szamos/Someş and the Bodrog is a drier area, where annual precipitation is at places lower than 600 mm. It is only the Kraszna/Crasna that flows from a region with more precipitation, from the south, but even its river-head area has a maximum of 7-800 mm of annual average precipitation. The figure is only about 600 mm at most sections of its course.

The water of the Kraszna/Crasna used to sprawl over the Ecsedi swamp, and here it encountered waters flowing over the left bank of the Szamos/Someş. The Kraszna/Crasna enters the plain at Ákos/Acâş; from Nagymajtény/Moftinu Mare a newly dug canal on the western side of the swamp drain its waters straight into the Tisza/Tisa. The soil of the drainage basin in the mountainous area is semi-permeable. The river-head area of the Kraszna/Crasna is much lower than that of the Szamos/Someş. The waters of the Kraszna/Crasna flood at the same time as those of the Szamos/Someş. The flood wave passes the plain section slowly, so it comes later compared to not only that of the Tisza/Tisa, but to the Szamos/Someş too. It stretches along the watershed mountain ridges from the Szamos/Someş, and flows down on the land intersected by brooks between the Berettyó/Barcău and the watershed in the same direction between Ákos and Nagymajtény. It takes place in a way that at large floods, because of the dams of certain mills, the water flows over its bed, and does not return again to the river. It breaks into the Érmellék/Câmpia Ierului and from there flows into the Berettyó/Barcău. The tributaries Homorod/Homorod and Sóspatak/Păriul Sărat of the Kraszna/Crasna were drained into the Szamos/Someş beyond Szatmárnémet/Satu-Mare.

The drainage basin of the Szamos/Someş generally receives less precipitation than that of the Tisza/Tisa. Annual average precipitation is 600-700 mm. The precipitation maximum in the Transylvanian Basin falls on the summer months. The winter, spring and summer floods of the Szamos/Someş usually occur together with those of the Tisza/Tisa. In autumn, however, major rainfall is rare in the Transylvanian Basin, and the high water levels of the Szamos/Someş do not usually increase the flood waves of the Tisza/Tisa in autumn, in October.

The flood waves resulting from rainfall on the Szamos/Someş reach the confluence with a one or two day delay. But on its catchment area, situated further south, snow usually melts earlier, so the flood waves of the Szamos/Someş resulting from thaw arrive at Vásárosnamény earlier than those of the Tisza/Tisa. Dip of the Szamos/Someş is quite high all along.

The Szamos/Someş valley is long, from its spring to its confluence with the Tisza/Tisa the waters travel 439.2 km. On the long journey the flood waves of the Szamos/Someş even up, all the more so because the Szamos/Someş is not fed by considerable watercourses at the lower section.

The Szamos/Someş deposits its gravel below Szatmárnémedi, at Vetés/Vetiş, from there on it transports significant amounts of sharp sand.

Finally, at the plain section of the Szamos/Someş conditions of precipitation are the same as at the plain section of the Upper Tisza/Tisa, only the amounts of precipitation are smaller, because this region lies farther from the mountain frame increasing precipitation. If we compare the conditions of precipitation in the catchment areas of the Szamos/Someş and the Upper Tisza/Tisa, we will find that the annual distribution of precipitation is more continental in the region of the Szamos/Someş, because the winter is drier and the summer is wetter. This allows us to conclude that the role of a front moving upwards is less prominent in the creation of precipitation.

The rivers are well-supplied by water. They have two highs: the early spring high at the time of thaw and the early summer one connected to continental rainfall. In accordance with the extreme climatic conditions of Transylvania the summer floods are larger and more violent. The floods run down rapidly, the flood wave culminates quickly, because the surface rock composition is primarily impervious both in the mountainous area and the Transylvanian Basin. Let the hydrological account of the creation of orographic precipitation serve as evidence.

Meteorological and hydrological conditions in 1970 in the Transylvanian Basin and in the catchment areas of the Szamos/Someş and the Maros/Mureş

The catastrophic flood originated from the flowage of the precipitation falling from the early summer pseudo-monsoon-like cyclone. The northeastern and eastern regions of the drainage basin of the Tisza/Tisa were especially affected by the intense precipitation activity of May 12 and 13. It caused lasting high water levels in the tributaries.

The weather

As a result of the precipitation falling in the first months of 1970 the soil was completely saturated by water. For example until the end of April there were ten significant flood waves running down the Szamos/Someş, all of which exceeded the average height of the river. Precipitation activity in January and April was higher by 93% at Beszterce/Bistriţa, 53% at Dés/Dej, 62% at Etéd/Atid, 58% at Székelyudvarhely/Odorheiu Secuiesc, 57% at Balázsfalva/Blaj and 42% at Maramarossziget/Sighetu Marmaţiei than the annual average.

In areas sheltered from westerly winds precipitation activity was close to the average: 12% at Kolozsvár/Cluj, 13% at Szatmárnémet/Satu Mare and 16% at Nagybánya/Baia Mare. Precipitation activity on 12 and 13 May, directly exploding the catastrophic flood centred over the northwestern parts of the country. In the middle of the rain zone precipitation fell continuously for 26-27 hours, whereas at the edges there were some interruptions. Precipitation activity commenced with an intensity of 10 mm/hour (12

May, 1970, 14 to 15 hours) and intensifying and abating periods followed each other rhythmically according to when the westerly wind reached the western slopes of the Carpathians. In most parts of the country precipitation of these days was between 10 and 50 mm. It reached 50-120 mm on the western slopes of the Eastern Carpathians, especially in the Avas/Oaş-Gutăi unit and in the Kelemen/Căliman Mts.

The degree of this natural phenomenon was determined by the great spatial dimension (about 25,000 sq. km on Romanian territory) and the intensity of the precipitation activity (over 50 mm).

Aerological measuring confirmed the presence of a permanent wind from the northwest (300°) on a front formed along tropical air masses and beside polar cold air masses. Concentration of humidity of the tropical air mass was 15-20 gr/m^3, and 6-12 gr/m^3 of the cold air masses. The synoptic condition took up the form of an orographic cyclogenesis-like situation over the area of the Upper Tisza/Tisa and its tributaries.

This condition and the position of the slopes provide an explanation of the extremely high amount of precipitation of certain regions. While in the mountainous area of the Avas/Oaş-Gutăi and the parts of the Radna/Rodna Mts. facing west even 100-120 mm of precipitation fell, on the slopes facing southeast and east, even in the higher mountainous area there was scant precipitation. Eg: on Ráró/Rarău peak (1650 m) only 31 mm, on Csalhó/Ceahlău peak (1907 m) only 11 mm.

At the same time, at the foot of the Kelemen/Căliman Mts. the situation was as follows: Teke 126.8 mm, Ragla/Ragla 179.5 mm, Beszterce/Bistriţa 110.4 mm.

At the river-head area of the Maros/Mureş, in the Gyergyó/Giurgeu Basin only 30-50 mm fell on average. Eg: Maroshévíz/Topliţa 45.9 mm, Gyergyóalfalu/Joseni 25.1 mm.

Air masses forced southeastward caused precipitation of 100-120 mm at the foot of the volcanic mountain chain, to the south, in Székelyudvarhely/Odorheiu-Secuiesc only 65.8 mm, in Brassó 30 mm and in Kézdivásárhely/Târgu-Secuiesc only 29 mm. Of the 25,000 sq. km bounded by the 50 mm isohyet 37% had 50-80 mm, 38% had 80-100 mm, 15% had 100-120 mm, 8% had 120-150 mm and 2% had more than 150 mm.

The greatest intensity of precipitation was in Beszterce/Bistriţa at 15 hours on 12 May, 1970, when it reached 3 mm/min.(Exactly 6 mm was measured between 15 hours and 15.10.)

At the time the flood came into existence temperature of the air was between 4-12 °C in low-lying areas, and 0 °C at the height of 1800-2000 m.

Flowage of surface waters

The most powerful rise formed between 14 and 19 hours on 12 May on the western slopes of the Eastern Carpathians. The highest water level occurred between 5 and 9 hours on 13 May in the rivers of the mountainous areas. These rises happening at the same time on the upper sections of the Nagy-Szamos/Someşul Mare, the Visó/Vişeu, the Maros/Mureş and the Küküllő/Târnave arrived at (ran on) the high water levels of spring together.

An example that describes its degree: the Nagy-Szamos/Someşul Mare yielded 40 m^3/sec at Óradna/Rodna Veche, which is 8 times higher than the average water output.

Surface flowage in the areas affected by the flood exceeded 20 mm everywhere, in the Fernezey/Firiza Basin and at the upper section of the Túr/Tur it reached even 100-150 mm.

In the whole area the percentage of permeation taking place was extremely low, a very great proportion of the precipitation that fell got to the rivers as surface flowage. It reached quite a high figure primarily on the slopes facing northwest. It was much lower (20-30 mm) in the inner Carpathian Basin, the flood wave did not form here. It is noteworthy that the flood wave of the Maros/Mureş formed only below Maroshévíz/Topliţa, and was created from the flood waves of the tributaries flowing down from the Kelemen/Căliman and Görgény/Gurghiu Mts. To the water of these streams the amount of water from thaw was added.

At the same time, parts of the upper section of the Szamos/Someş sheltered from westerly winds had only a flowage of a mere 27 mm.

The following rivers provided the great amount of flowage: Rebra/Rebra 71 mm, Szálva/Salva 95 mm, Beszterce/Bistriţa 88 mm, Bodok/Bodoc 61 mm and the Sajó/Şieu 51 mm.

The same situation took shape in the Maramuresh Basin, too. There in the comparatively protected Iza Basin flowage barely reached 45 mm, in the Visó/Vişeu Basin 64 mm, whereas in the Túr/Tur Basin with a western exposure it reached 84 mm. In the Fernezey/Firiza drainage area of 95 sq. km flowage was 153 mm.

The flowage coefficient counted on the basis of the amount of total flowage, came close to 1.00, which points out the extremely huge water resources of the time period and areas concerned.

That is precisely the reason why we must deduct the amount of water already in the river-bed when counting surface flowage (masses of water before 12 and 13 May).

On the ensuing days (14-16 of May) there were minor local rains (10-14 mm). These to some extent affected the flood-waves already formed with small secondary flood-waves, which got flattened entering the major rivers. Figures of both precipitation and flowage (both as a mean figure counted on the catchment area) are in a quite close relationship with the mean height of the respective catchment area. It follows that, although the flowage obey the same laws, the regional generalization is quite difficult without knowing the local distribution precisely. In the outer regions, especially in the orographically sheltered ones distribution of height is as follows: both precipitation and flowage show a declining trend above 600-1000 m, whereas the increasing figures of flowage refer to the soil's greater saturation with water.

We emphasize again the orographic influence exerted on the dynamics of the air masses and at the same time on the regional and quantitative distribution of precipitation. That is exactly the reason for all the further geographical factors remaining under the dominance of this influence. The high water content of the soil was an additional factor that provided the great flowage in the Transylvanian forests.

A characteristic feature of the formation of the floods in 1970 is the extraordinary influence of the Carpathians on the atmospheric conditions, by which quite a broad area was affected concerning precipitation. The large rain zone coming into being on the northwestern slopes of the Eastern Carpathians together with the great water content of the soil led to the formation of synchronous flood waves and large rivers even in the mountains.

The freshwaters of Transylvania: lakes and swamps

The individual lakes occupy a small area; concerning their formation they are partly mounded, partly dammed up and partly deepened lakes. The are situated at two major levels: in the Transylvanian Basin and in the rock realm of the high mountains glaciated in the ice age.

The several hundred tiny lakes of the north of the Transylvanian Basin, of the Mezőség/Câmpia Transilvaniei, are predominantly of natural origin. Human modifying activity (obstruction, deepening, damming and fishpond culture) was confined to mostly exploiting the natural conditions. Various factors played a role in the formation of the lakes in the Mezőség/Câmpia. On the uneven surface of the clay slopes of the Mezőség/Câmpia Transilvaniei lakes were often created in the depressions. But the landslides themselves may narrow the stream valleys so much that the water of the stream easily swells into a lake, or it is easy to swell by human intervention. In certain valleys the lakes are distributed in a line resembling a string of beads. What is responsible for the frequent alternation of low and high dip in certain valleys is the structure and composition of the basin. The stagnant stream of low dip once again easily swells into a lake or it can easily be swollen by some effort. We may mention that dams built by beavers perhaps played a part in creating some lakes.

The present geographical and geological literature provides an accurate account of these quite unique surface conditions and hydromorphological features of the Mezőség/Câmpia Transilvaniei.

As long as the Mediterranean-stage strata and the members of the Sarmatian deposits are detectable in one of the border areas of the Mezőség/Câmpia Transilvaniei we can confidently allege that the region is of the Mezőség/Câmpia Transilvaniei -type, even if it does not seem supported by a physical geographical point of view. The series of strata above are accompanied by characteristic morphological formations: slipped lands, lakes, valleys showing senile qualities, coffins, etc., firm proofs of the geological findings (Figure 15.).

In the Palaeogene the Mezőség/Câmpia Transilvaniei was a sea bay, where a distinctive series of red clay strata was created, especially at the edges. After that, in the second part of the Tertiary, fundamental changes occurred in the formation of its relief features. These profoundly influenced the shaping of the Mezőség/Câmpia Transilvaniei, too. In the Mediterranean stage the Mezőség/Câmpia Transilvaniei, more accurately the Transylvanian sea bay communicated with the Hungarian inland sea through two gates: the present Szamos/Someş and Maros/Mureş gates.

In the Helvetian stage fault lines intersected the Mezőség/Câmpia Transilvaniei area, and intense volcanic activity began at the edges.

It is the movements of the Mediterranean stage that directed the formation of the present drainage network of the Mezőség/Câmpia Transilvaniei.

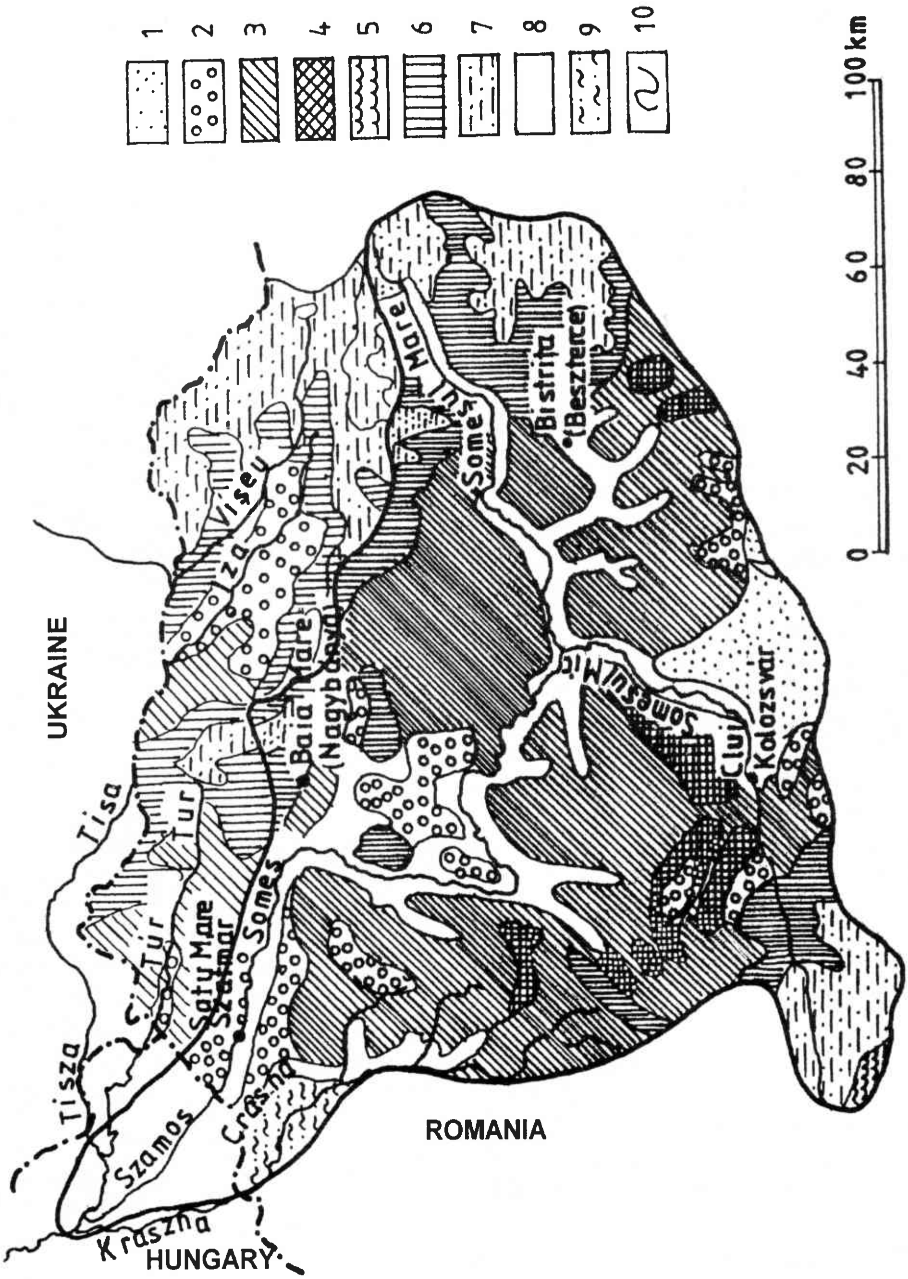

Figure 15. Soils of the catchment area of the Szamos/Someş-Kraszna/Crasna

1. chernozem, 2. brown forest soil, 3. podsolic brown forest soil, 4. pseudorendzina, rendzina soil, 5 red rendzina formed on limestone rocks, 6. brown forest soil of the mountains, 7. brown acid mountain podsol, 8. alluvial soil, 9. marsh and gley soil, 10. boundary of the catchment area

The main role in the formation of the drainage network must be attributed to the fault lines which, after Helvetian-stage tectonic disturbances, interfered with the hydrographical formation of the northern half of the Mezőség/Câmpia Transilvaniei by tiltings of an approximately N-S direction in the Pliocene. The general western slopingness of the basin forced the drainage network to find a western direction within the frames of the fault lines. So the direction of the streams in the northern part of the Mezőség/Câmpia Transilvaniei is roughly NW-SE. A fault line system at right angles to this direction can also be detected, which has created a chessboard-like morphological fault system.

Examining the morphological features of the Mezőség/Câmpia Transilvaniei we must, in any case, point out the causes that either facilitated or hindered the formation or construction of lakes in the nature.

The first, fairly conspicuous morphological feature is the frequency of landslips and creeps. The Sarmatian sandstones sliding down on the slippery surface of the Mediterranean clays or the collapsed fragments of emerging bassets undoubtedly play a great role in the blockage of the valleys and thus the creation of lake surfaces. We need not, however, assume that the measures beginning to slide shall move down to the bottom of a valley. In the hollows of the landslides water will accumulate anyway, and will create the small water surfaces that we may call landslip lakes.

Another morphological feature is the shape and slopingness of the valleys, which, together with a geological factor, the presence of Mediterranean substances, explain the circumstances of the creation of not only the individual lakes, but of entire series, strings of them.

The valleys of the Mezőség/Câmpia Transilvaniei are long, and although they show senile forms at places, they are narrow, or at least they narrow at certain locations so much that either their natural or artificial blockage almost offers itself. These gate-like necks induced the bronze-age man to construct artificial fishponds. The impermeability of the clay deposits in the valley bottoms only helped the formation or construction of lakes.

The slopingness of the valleys in the Mezőség/Câmpia Transilvaniei is also a matter of interest. At first it seems obvious that a low slopingness explains the creation of the lake series. These valleys dip very much in absolute figures, but they have a stepped structure so they have comparatively long stretches of low dip, and therefore sections of low and high dip alternate. Every section of low dip abound in lakes, unless the creation of lakes is disturbed by local factors.

Gullies also belong to the typical scenic units of the Mezőség/Câmpia Transilvaniei, which literally shave the arable soil off the deforested lands. Detrital cones of sometimes huge size of these torrents block the valleys or break the surface of the lakes, and by that contribute to the creation and sedimentation of the lakes. In the case of Lake Hodos/Ţaga we can see a prominent detrital cone, which divides the lake into two basins.

The wide and flat hilltops, which are called „goatbacks" by the people in the Mezőség/Câmpia Transilvaniei, bassets of the tuff shelves and the frequent salt efflorescence belong to the scenic units of the Mezőség/Câmpia Transilvaniei as much as the gleaming lake surfaces, which have made the region practically the country of a thousand lakes.

Natural plant cover

Transylvania is part of the Carpathian flora region concerning the Eastern Carpathians, the Mezőség/Câmpia Transilvaniei, the Southern Carpathians and the Eastern Hungarian Island Mountains. It is only the Lower Danube region that belongs to the flora region of the Eastern Balkan. In its flora the Central European components are dominant with 43%, but thanks to the high degree of continentality of our region their share is lower than, for example, in the Western Carpathians or in Transdanubia. Alpine species are represented by 10.7%, and East Balkan species by 7%. The unique character of Transylvania is also manifested by the numerous indigenous species. Their proportion is the highest (7%) here, of the whole Carpathian Basin (Figure 16.).

The geographical picture of the vegetation of our region is a scaled-down picture of the natural plant cover of the whole large Carpathian Basin, divided into altitudinal zones. The natural plant cover of the low, enclosed, dry Transylvanian Basin is, just as that of the Great Plain, the wooded steppe on the „coffins" of the sliding land with needle grass, Volga pheasant's eye and Siberian milkwort. The offsets are covered by oak, beech and fir forests. In accordance with the strong continentality of Transylvania the lower and upper boundaries of each zone have settled higher than in the western parts of the Carpathian Basin. At the edges of the Transylvanian Basin and in the plain foreground of the Eastern Island Mountains, on the Tertiary hilly areas the oak zone ranges wide up to a height of 850-950 m.

In their rich undergrowth a number of Balkan and indigenous shrubby and weedy plants can be found. Lilac and maybe walnut are also indigenous in this zone.

The beech zone surrounds Bihar/Bihor and the Transylvanian Basin. Its upper boundary is at about 1300 m. In the north the endemic hawkweed, Transylvanian liverleaf and Josika syringa (Syringa Josikaea) are characteristic in its undergrowth.

The spruce forests crown the Eastern and Southern Carpathians in an uninterrupted zone. Formerly they covered the surface of even the Gyergyó/Giurgeu and Csík/Ciuc basins, too. The spruce zone is situated at a height of 1000-1500 m in the Eastern Carpathians, 1040-1680 m in the Southern Carpathians and the isolated spruce forests are at 1090-1530 m in Bihar/Bihor. Northern Carpathians, present themselves emerging from the spruce zone in island-like patches between 1540-2000, 2100 m. Its typical species are mugho pine (Pinus mugo), rhododendron, cranberry and juniper.

The region of the Lower Danube is a gate area concerning plant geography, too, through which a number of eastern and southern plants entered the Carpathian Basin and a great many of them stopped in front of the gate for ever. The beech zone descends the lowest here within the area of the Carpathian Basin. At lower levels semitropical trees and shrubs appear (eastern hornbeam, nettle-tree, Turkish hazel, holm oak, white linden). The slopes are covered by syringa and fustet shrubs. On the eroded cavernous limestone plateaus and rocks Austrian pines of the Bánság/Banat spread the branches of their crowns like those of stone pines do.

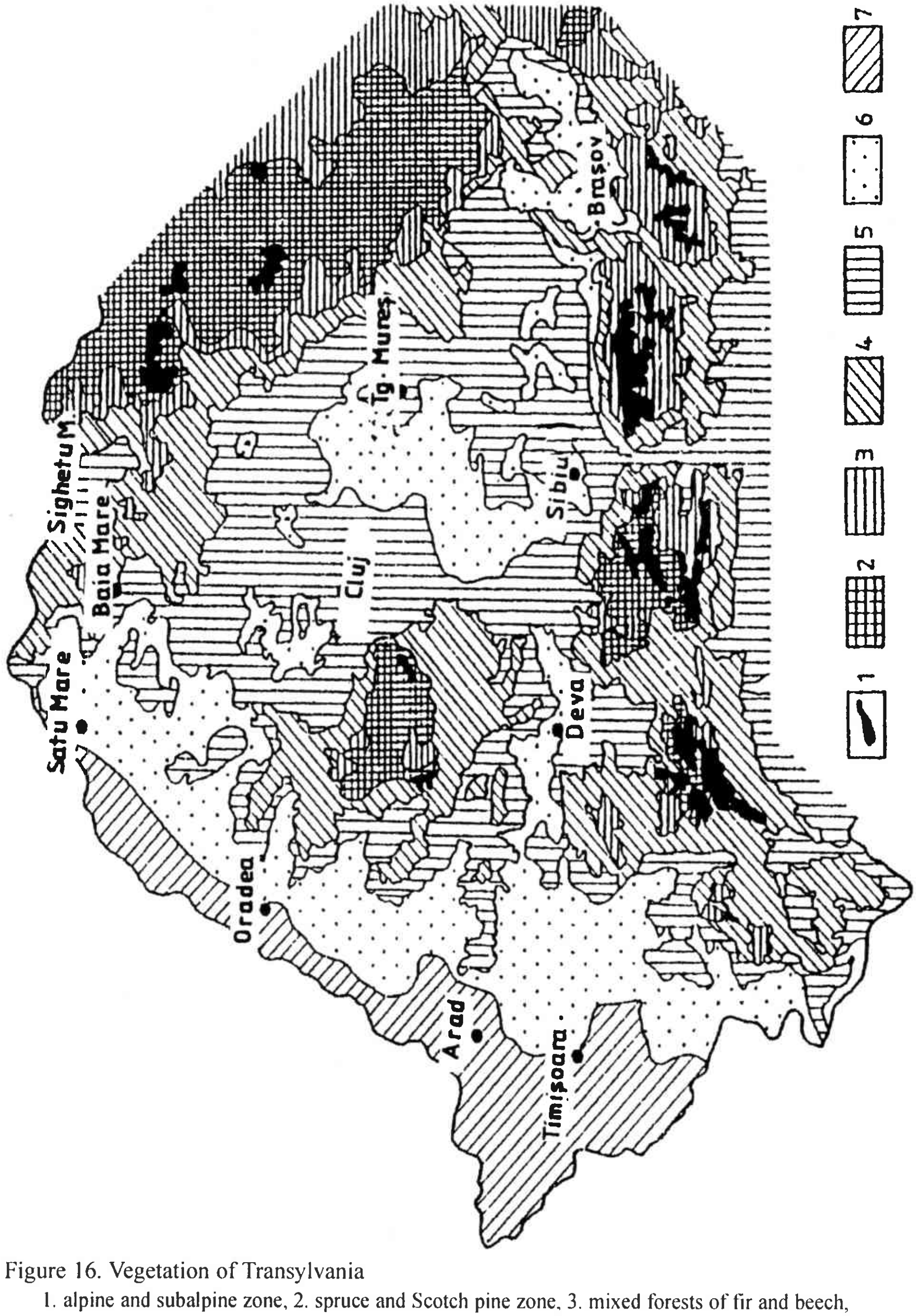

Figure 16. Vegetation of Transylvania

1. alpine and subalpine zone, 2. spruce and Scotch pine zone, 3. mixed forests of fir and beech, 4. beech zone, 5. mixed forests of oak and beech, 6. durmast and turkey oak forests 7. wooded steppe zone, (after the study book Geografia României for form XII)

The picture of the original, compact wooded land gradually changed in the course of the appearance, settlement, life and struggle of man. First, down on the plain, in the low hilly areas, in the low mountains and at the foot of them the forests were replaced by meadows dominated by herbs, especially grass. This process was accelerated at the rate of the growth of agriculture and animal rearing.

But the forests, though in patches or decreasing in extent, have survived. Therefore every scenic unit of Transylvania can be classified as a biogeographical region, or zone ranging from the wooded steppe, determined by the relief of the heath (Heide) region, to the high-mountain coniferous woods.

The varied relief of the mountains, the hilly areas and the plains cause local climatic variations in Transylvania.

Accordingly, increase in the height of the relief bring along gradual decrease in temperature and increase in the amount of precipitation. As a result, vertical levels characterized by ecosystems of different features take shape.

From a height of approximately 300-400 m, where the local climatic and bioecological influence of the relief is apparent, to a height of 900-1300 m the vegetation of the forests is dominated by durmast (up to 800 m) and beech (up to 1300 m). Above this, from 1200 to 1550 m spruce forests are most common, the areas covered by juniper and the shrubby dwarf pine form above 1600 m, and between 1900 and 2200 m the dwarf shrubs of the Transylvanian rhododendron can be found. Above that level up to the highest peaks only alpine meadows and dwarf shrubs are present.

Because of the geographical location and the bioclimatological and ecological factors determined by this location the whole Transylvanian flora region belongs to the nemoral zone of the temperate-climate forests. The forests are present from the Bánsági Plain (Temesköz)/Câmpia Banatului (Timişului) to the high, snowy alpine zone of the mountains. The boundary between two levels is not a rigid line. Local penetrations occur at several places, the reason for which is nothing else than the relief laid out in depth, the exposure of the slopes and the existence of differences in light, shade and temperature in Transylvania.

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Soils of the flood plain of the River Someş/Szamos[1]

Sámuel Jakab

Introduction

Along its way the River Someş crosses several relief units of various lithological structure, which leave their marks on the soil cover of the flood plain, including the active flood plain. Its catchment area of 15.217 km^2 covers the south and west sides of the northern group of the East Carpathians, built up of metamorphic, igneous and heterogeneous sedimentary rocks; the northern slopes of the Bihor and Gilău Mountains, constructed of metamorphic rocks, granite, and partly of limestone; and the north-west half of the Transylvanian Tableland, consisting mostly of pellitic-psephitic and, subordinately, of psammitic deposits (marly clay, sandy clay, loam, sand and sandstone). Finally, the hydrographic basin of the river Someş includes the north-eastern corner of the Great Pannonian or Hungarian Plain.

Upstream the town Dej/Dés, the river has two branches, namely the Someşul Mare and the Someşul Mic. The origin of the whole Someş system is considered to be the source of the Someşul Mare, in the Rodna Mountains.

In its upper reaches the valley of the Someşul Mare has not flood plain. Between the source and Sanţ/Újradna it follows a fault line, running in a tight bed full of block boulders accompanied by bluffs and steep rocky slopes covered with a shallow soil.

From Sanţ to its emergence from the mountainous region a few kilometres below Năsăud/Naszód, the Someşul Mare cuts first into crystalline formations and andesites, then hard sedimentary rocks composed of sandstone and conglomerate. The valley broadens a little, forming a narrow flood plain stripe covered with a shallow alluvial protosoil on gravely crystalline and andesitic substratum that originated from the surrounding mountains. The soil covering the latters, although shallow, is generally well protected by forest and mountain pastures.

After its emergence from the mountainous area, the river crosses a relatively high hilly country built up of looser sedimentary rocks (marly clay, sandy clay, loam, benches of sand and volcanic tuffs). Below Beclean - Bethlen - the valley widens continually, the flood plain reaching a breadth of 3-4 km and covered by an alluvial skeletal protosoil near the river bed, and skeletal alluvial soils farther from the river. On this section the alluvial deposits consist of a mixture of coarse crystalline and andesitic gravels, sand and fine particles, the latters originating from the nearby piemontane region. The dominance of bare plough-land in this area accelerates soil erosion on the sloping areas, frequently causing turbidity in the river.

[1] The first name is Romanian, and the second Hungarian

The River Someşul Mic is formed by two branches beyond Gilău/Gyalu: the Someşul Cald river and the Someşul Rece river. Both flow entirely through a mountainous area, cutting their way through crystalline schists, granites, and the Someşul Cald, at its riverhead, through limestones. They have no real flood plain, running in more or less narrow valleys. The valleys occasionally broaden, however, the slopes become gentle and the gradient of the river bed decreases to some extent. In these broadenings peat soils and even high moor have been developed, as near Blajoaia, Runcu Ars and Smida is. In the headwaters of the Someşul Rece, as a consequence of extensive deforestation in 1968 and inadequate silviculture in the last decades, a wide-ranging poses of swamp formation has arised. In certain cases storage lakes have been established, such as Fantanele-Belis, Tarniţa on the Someşul Cald, Someşul Rece on the and Gilăuat the junction of the river branches beyond Gilău .

On leaving the mountainous area near Gilău, the Someşul Mic enters into the hilly country of Someş Tableland, being a highly deforested agricultural region, strongly exposed to soil erosion.

Between Gilăuand Cluj the flood plain is narrow (1-1,5 km). The soil consists mostly of skeletal alluvial protosoil on calcareous gravely substratum. Below Cluj the valley broadens out and the soil cover deepens, consisting of loamy alluvial soils and sandy loam and silty stratified substratum. The risk of soil erosion on the surrounding hilly area, predominately on arable and strongly eroded pastures is considerable.

After the confluence of the Great and Someşul Mic near the town of Dej, the river Someş, penetrates at first into Oligocene sandstones and conglomerates of Someş Tableland, then into Eocene formations composed of limestones, sandstones, marls and striped clays. The flood plain narrows in this sector between Câţcău/Kackó and Jibou/Zsibó, the alluvial deposits are coarser, containing less fine fractions, than in the sector between Cluj and Câţcău.

After its emergence from the Surduc-Jibou narrows the Someş flows in a small trough-like depression between Jibou and Benesat/Benedekfalva, covered with reddish loamy alluvia, originating from the surrounding Paleocene continental red clays.

On breaking through the short (about 3 km) narrows of Ţicău/Szamoscikó the river steps into the wide Depression of Baia Mare/Nagybánya, and then flows over a large selfbuilt succession of paleodeltas, situated between the foot of the Gutâi Mountains and the confluence with the river Tisza, belonging to a large area of subsidence of the north-east Great Hungarian Plain. All this area of subsidence is filled by a thick porous sedimentary sequence that originated from the neighbouring mountains.

Prior to river regulation and the erection of flood-control levees, in this deep alluvial area the running waters wandered freely, virtually without beds, as the countless backwaters prove.

Keywords: flood plain soil, River Someş

Materials and methods

In this paper we present shortly the soil cover of the flood plain of the river Someş, at a scale of 1:200.000. Within the limits of the flood plain, the active flood plain represents frequently a relatively narrow strip, difficult to delineate at the scale we used.

For a convertible manipulation we present the soil map of the flood plain on eight sheets. On each of them we sketched the profile of the significant soils to be found in the presented area.

The materials used consist of soils maps and geological maps published by the Romanian Research Institute of Pedology and Agrochemistry, and by the Institute of Geology, as well as several other published and unpublished soil surveys and studies and our own survey and soil analyses. In all chemical procedures air-dry samples were crushed, than the nonsoil material fragments were carefully avoided by a 2-mm roundhole sieve. The material retained by sieve is reported as greater than 2 mm fraction, and the results are reported on this basis.

The soils of the flood plain, in particular those of the active flood plain, are of great importance for aquatic plant communities. The soil cover is an important natural filter, which retains waste products in large quantities. Its efficiency depends considerably on certain soil characteristics that affect permeability, cation mobility (such as clay, humus, pH) and their integration as cation exchange capacity. Secondly, as a component of riverine biotopes, the food plain soils determine to a great extent the nature, the structure of communities.

The soil cover is, at the same time, a mediator between climatic factors, runoff and underground water supply of rivers, considering that it represents the upper layer of medium in which the runoff is formed. So, in the case of high permeable soils the abundant rainfalls do not cause the appearance of high runoff values in every case because of rapid infiltration. In the deeper levels the rapidly infiltrated water is protected against evaporation, consequently higher fluctuations of ground water arise and hereby that of underground supply. An opposite effect occurs with the soils of a high water-holding capacity (loamy and clayey soils with high humus content).

In regions of previous soils the values of runoff are higher, and those of evapotranspiration are reduced, as compared to regions of clayey soils.

The soils of mountainous regions are less permeable during the whole year, as compared to those of pericarpathian areas. The excessive moisture of the mountain soils assure, at the same time, almost a continuous infiltration of the ground water toward the rivers, and consequently a rich underground supply, which maintains the clearness of water in mountain rivers.

Short description of soils

The characteristics of soils described in this paper are shown in Table 1. Three groups of soils have been found in the flood plain of the river Someş, as follows : alluvial protosoils, alluvial soils and gley soils.

Alluvial Protosoils

The recent formations of the flood plain are represented by alluvia or alluvial protosoils. In most of the cases the soil-forming processes are incipient or absent, due to more or less frequent flooding that hinders pedogenesis. The spreading of alluvial protosoils is limited to the active flood plain, or flood control stripe.

Generally the alluvial protosoils are stratified, having in most cases a loose consistency and coarse texture (gravels, sands, loamy sands), but occasionally, they also can be moderately coarse textured (sandy loam) and medium-textured (loam and silt). This group of soils has a low content of organic matter and clay, consequently a weak cation-exchange capacity and low retaining power (mostly in the coarse-textured soils). The lime content, and in connection with this the pH-value vary along of the river. But they never become a limiting factor for plant growth.

Due to their particle-size distribution and lack of an impervious layer, even in the deeper levels, most of the alluvial protosoils are excessively permeable to water, therefore they cannot retain a great part of the substances which pollute the running water. In this respect the storage of various wastes on active flood plains, near the riverbed, can be harmful for the river. In countless cases waste matter of different origin and mostly sawdust are deposited close by the riverbed, polluting the water.

When the alluvial protosoils are covered with vegetation, their retaining and filtering power becomes more efficient. Consequently, in order to enhance the retaining and filtering power of these soils, their deforestation with poplar is desirable.

Alluvial soils

Alluvial soils occupy most of the floodwater free, or rarely flooded, higher level of the river plain, being in various stages of development and fertility. Contrary to alluvial protosoils, their upper - Ao or Am - horizon is deep, with a humus content exceeding 2-2,5 %. The clay content is also higher, compared with alluvial protosoils, and vary from 22 to 33 %. As a result of this higher clay content the water that penetrated through their profile is well filtered.

Excepting those of the mountainous region, showing acid reaction, in most cases all alluvial protosoils and alluvial soils of the flood plain show slightly and moderately alkaline reaction, and only seldom neutral or slightly acid.

Due to their high fertility, the alluvial soils of the river Someş are used almost totally as plough-land, in same cases employing irrigation.

The groundwater level fluctuates seasonally between 1-5 m, in close connection with the water level of the river.

No chemical pollution of the alluvial soils could be proved as a consequence of fertilisers, but near the towns and cities large amounts of waste are deposited on the flood plain. A lot of fertile alluvial soils being withdrawn from agricultural use, harming at the same time not only the neighbouring soil stripe, but also the groundwater and running water.

The wastewater purification plants can be important sources of soil- and groundwater pollution. Because their dry beds are frequently filled, large amount of sewage sludges are deposited directly on the soils, not far from the river.

Gley soils

Three types of gley soils have been distinguished : low humic gley soil, humic gley soil and gley solonchak. Each is hydrogenic soil with high groundwater levels during a long period of the year. Most of these soils have high clay contents, and are thus bad water conductors. They appear mostly at the contact of the flood plain with the slope foot, or in deep-lying areas of the flood plain. The important river regulation- and floodwater prevention works performed, especially in the lower reaches of the river Someş, led to many changes in position of the riverbed. As a result , the present flood plain is full of cut-off branches and oxbows, filled with poor water conductor silt and clayey materials, favourable for hydrogenic soil-forming processes. Where the substratum contains soluble salts, or salty underground springs occur, salt-affected soils and solonchaks are developed, as in the case below the city of Cluj.

On the gley soils generally a luxuriant herbaceous vegetation grows which represents not only an important fodder source for cattle but a favourite transitional place for many migratory birds. Transformation of these soils into agricultural land is not advisable.

Conclusion

On the flood plain of the river Someş (Szamos), three groups of soils were distinguished: alluvial protosoils, alluvial soils and gley soils. The alluvial protosoils appear on the active flood plain having a low retaining and filtering power. The alluvial soils are spread on the greatest part of the floodwater-free higher level of the river plain, while the gley soils occur mostly on the marginal deep lying areas of the flood plain.

No harmful chemical pollution of the soil cover could be proved along the entire course of the river. However some exceptions exist, mainly around of wastewater purification plants of the towns and cities, as well as in the places where different waste materials are deposited, mostly in the neighbourhood of settlements. In order to enhance the retaining and filtering power of the alluvial protosoils on the active flood plain, their deforestation with poplar is desirable.

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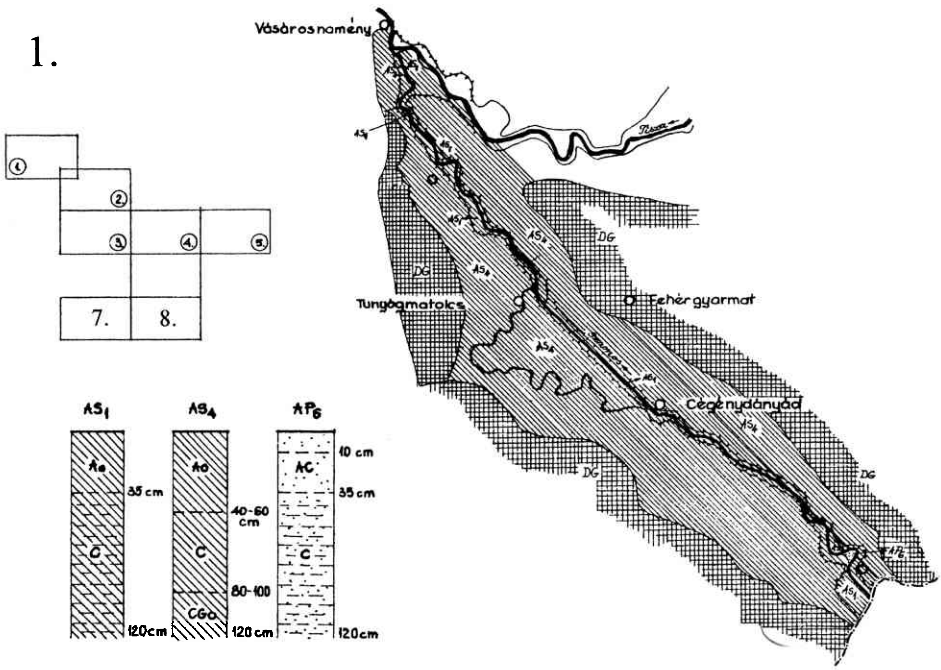
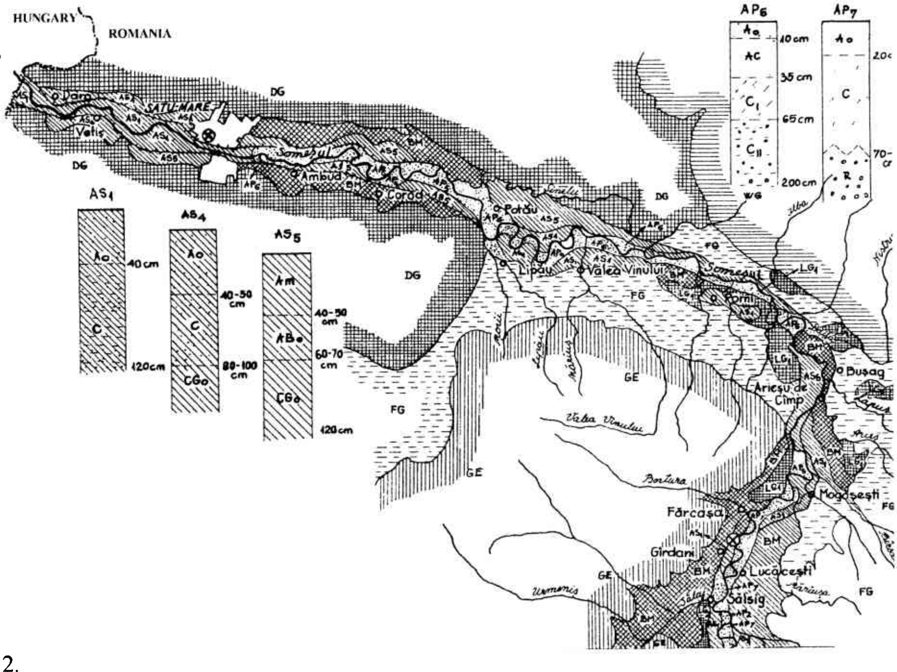
1.



Map 1.

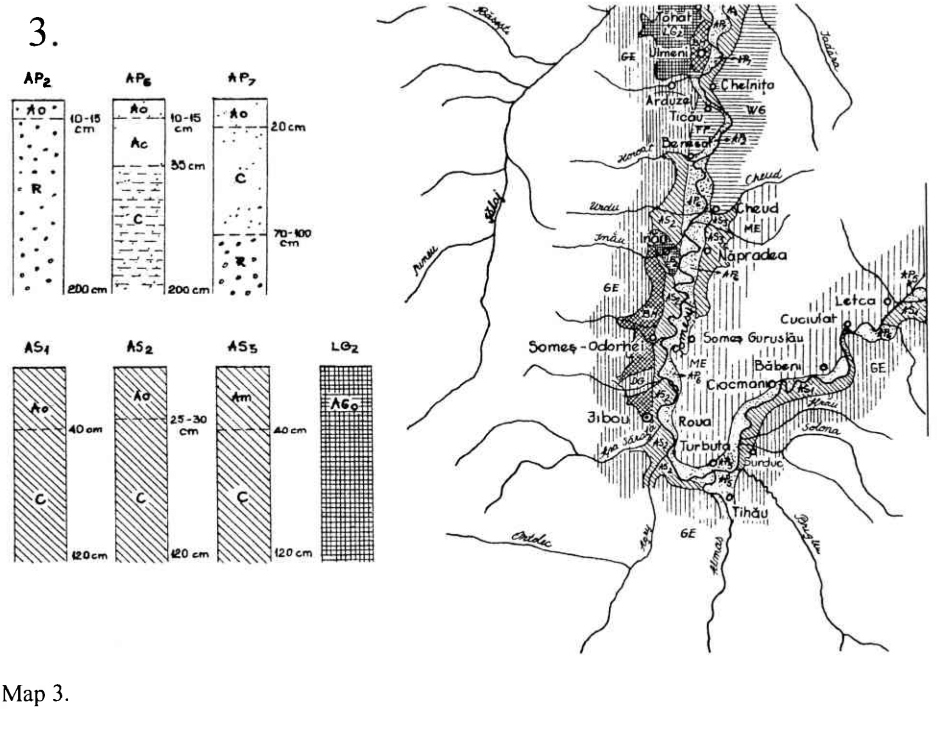
2.



HUNGARY
ROMANIA
SATU-MARE
Someşul
Ambud
Corod
Potău
Lipău
Valea Vinului
Pomi
Buşag
Ariceşu de Cîmp
Mogoşeşti
Fărcaşa
Gîrdani
Lucăceşti
Sălsig
Vetiş
DG
FG
GE
BH
LG1
AS1
AS4
AS5
AP6
AP7

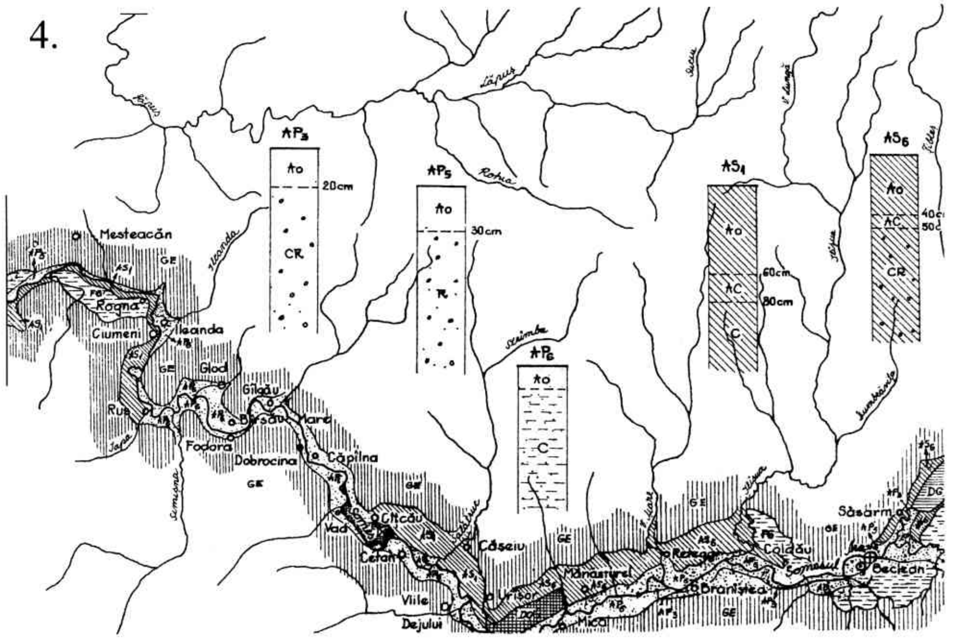
Map 2.

3.

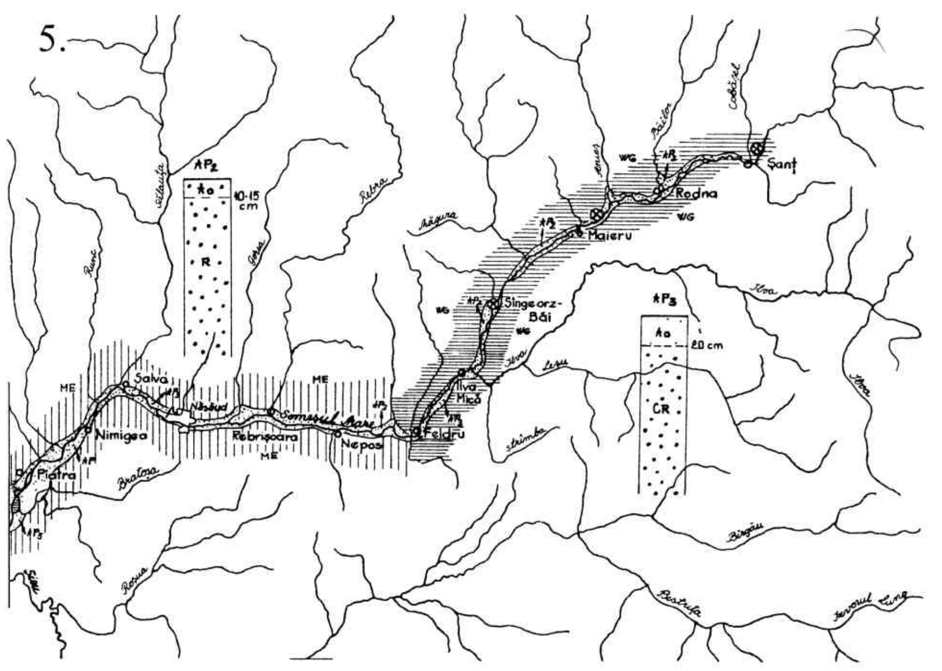


AP2
AP6
AP7
AS1
AS2
AS5
LG2
Chelniţa
Ulmeni
Arduzel
Ticău
Cheud
Năpradea
Letca
Cuciulat
Someş-Odorhei
Someş Guruslău
Băbeni
Ciocmani
Jibou
Rona
Turbuţa
Surduc
Tihău
Someşul
GE
ME
DG
WG

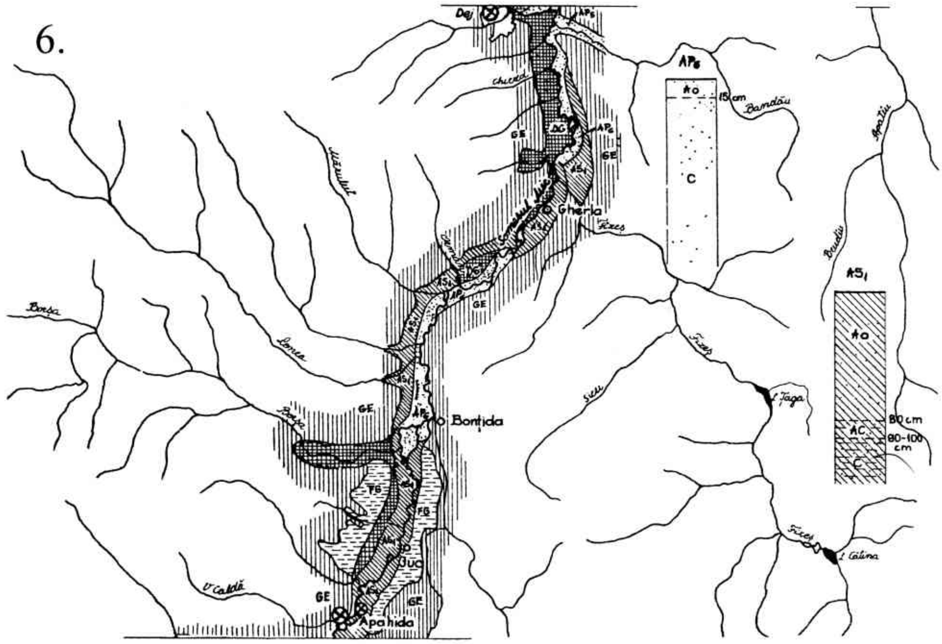
Map 3.


4.
Mesteacăn
Rogna
Ciumeni
Ileanda
Glod
Gilgău
Rus
Bîrsău
Mare
Fodora
Dobrocina
Căpîlna
Vad
Cîțcău
Cetan
Căşeiu
Viile
Dejului
Urişor
Mănăstirel
Mica
Reteag
Coldău
Braniştea
Someşul
Săsarm
Beclean
Lăpuş
Rotua
Ileanda
Someş

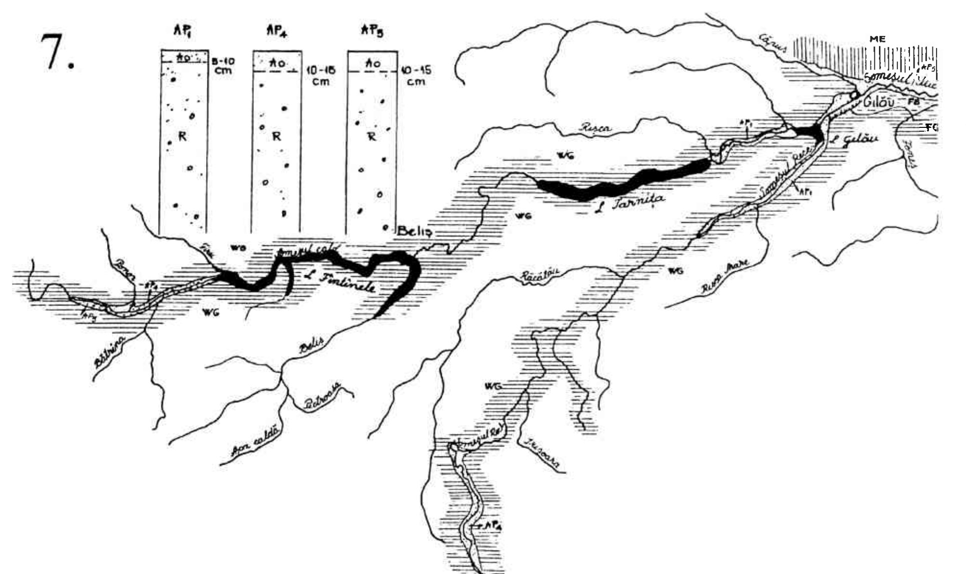
Map 4.


5.
Şanț
Rodna
Maieru
Singeorz-Băi
Ilva
Mică
Feldru
Salva
Năsăud
Nimigea
Piatra
Rebrişoara
Nepos
Someşul Mare
Ilva

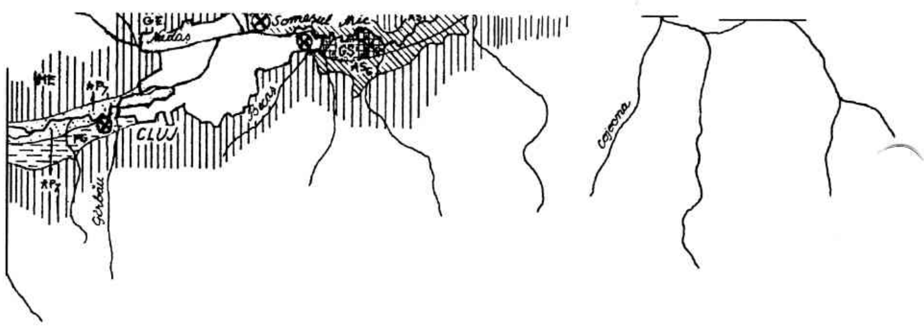
Map 5.


6.
Dej
AP5
AP6
15 cm
C
AS1
80 cm
AC
80-100 cm
Gherla
Bonțida
Apahida
GE
DG
FG
L. Țaga
L. Cătina

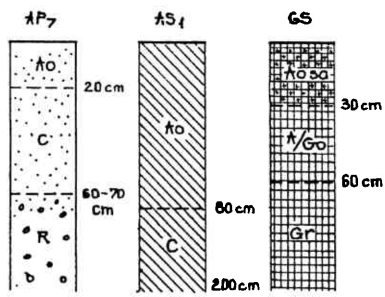
Map 6.


7.
AP1
AP4
AP5
5-10 cm
10-15 cm
10-15 cm
R
Beliș
Gilău
L. Gilău
L. Tarnița
L. Fîntînele
WG
ME
FG

Map 7.


Somesul Mic
CLUJ
Cojocna
GS
AP7

8.


AP7
AS1
GS
Ao
20 cm
C
60-70 cm
R
Ao
80 cm
C
200cm
Aosa
30 cm
A/Go
60 cm
Gr

Map 8.

LEGEND OF SOILS

1. ALLUVIAL PROTOSOILS

AP_1	Skeletal alluvial protosoils on metamorphic rocky substratum
AP_2	Skeletal alluvial protosoils on gravelly crystallin substratum
AP_3	Loamy sandy skeletal alluvial protosoil on gravelly andesitic and crystallin substratum
AP_4	Gley loamy sandy alluvial protosoils and peaty soil on gravelly granitic substratum
AP_5	Skeletal alluvial protosoils on gravelly calcarous substratum
AP_6	Sandy loam and loamy stratified alluvial protosoils on sandy substratum
AP_7	Sandy loam and loamy alluvial protosoils on gravelly substratum

2. ALLUVIAL SOILS

AS_1	Loamy alluvial soil on stratified loamy sandy and silty substratum
AS_2	Red loamy alluvial soil on red loam
AS_3	Clayey loam alluvial soil on silt
AS_4	Deep gley sandy loam alluvial soil on sandy loam and silt
AS_5	Deep gley loamy alluvial soil and brown earth on silt
AS_6	Skeletal alluvial soil on gravelly substratum

3. GLEY SOILS

LG_1	Low humic gley soil on silt and clayey substratum
LG_2	Low humic amphygley soil clayey substratum
GS	Gley solonchak on salty clayey substratum
DG	Drained humic gley soil on silty and clayey substratum

OTHER SIGNS

BM — Brown earth on loamy substratum outlying of flood plain

Water covered area

Floodcontrol levee

WG — Wooded and grazing land with well protected soil cover of the mountainous regions; no pollutants

ME — Steep slopes covered mostly with pasture and partly with plough-land,moderatly submited to soil erosion

GE — Gently to moderate slopes used mostly as plough-land,submited to a great extent to soil erosion

FG — Flat or gently undulating surfaces;no soil erosion risk

⊗ Source of pollutants

Soil and Location	pH H_2O	Org. mat %	$CaCO_3$ %	N total %	P ppm	K ppm	Coar-se Sand %	Fine Sand %	Silt %	Clay %
AP_1 - Şanţ										
Ao 0 - 10 cm	7,15	4,33	-	0,212	39	142	24,8	29,6	32,5	13,2
R 10 - 30 cm							83,7	2,2	10,1	4,0
AP_2 - Sângeorz-Băi										
Ao 0 - 6 cm	7,42	1,97		0,100	126	266	68,7	22,3	5,0	4,0
R 10 - 30 cm	7,47									
AP_3 - Salva										
Ap 0 - 20 cm	7,75	2,41	3,2	0,118	33	176	45,3	42,7	8,0	4,0
C 20 - 40 cm	8,12		4,5				17,6	66,3	8,0	8,1
AP_4 - Blăjoaia										
AoGr 0 - 15 cm	3,70	12,2	-	0,668	9	166	25,6	48,8	11,2	18,8
C 15 - 35 cm	5,55	0	-	0,110			76,0	12,0	8,0	6,0
Gr 65 - 85 cm	5,60	1,93	-				12,5	21,4	33,6	31,5
AP_5 - Floreşti										
Ao 0 - 10 cm	7,90	1,93	4,9	0,096	43	109	52,2	28,6	15,0	4,2
C 10 - 20 cm	8,05	0,40	5,2				57,0	30,4	8,2	4,4
AP_6 - Păuleşti										
Ao 0 - 8 cm	8,00	2,00	1,5	0,110	29	183	1,9	65,2	14,5	18,4
AC 10 - 30 cm	7,95	1,53	2,3				1,5	64,0	17,0	17,5
C_I 40 - 60 cm	8,15	0,20	3,0				0,5	57,3	21,0	21,2
C_{II} 80 - 120 cm	8,15	0,63	1,1				1,7	76,0	10,3	12,0
AP_7 - Gârdani										
Ao 0 - 20 cm	7,70	1,85	2,1	0,111	23	133	8,4	59,6	16,6	15,5
C 40 - 60 cm	8,10	0.92	2,3				0,7	30,7	38,0	30,6
R 100 - 120 cm	8,0									
AS_1 - Vásárosnamény										
Ao 0 - 20 cm	7,85	2,12	0,8	0,115	63	274	2,7	45,8	29,9	21,6
CI 40 - 60 cm	8,14	1,13	0,6				2,3	67,8	15,3	14,6
CII 80 - 120 cm	8,15	1,38	1,3				0,5	64,0	26,6	9,0

Table 1.

Table 1. continue

Soil and Location	pH H_2O	Org. mat %	$CaCO_3$ %	N total %	P ppm	K ppm	Coar-se Sand %	Fine Sand %	Silt %	Clay %
AS_2 - Someş-Odorhei										
Ao 0 - 20 cm	8,08	2,09	1,5	0,111	95	199	2,9	63,0	10,6	23,5
C 20 - 40 cm	8,21		1,7				2,6	72,5	6,6	18,3
AS_3 - Vetiş										
Ap 0 - 20 cm	7,55	2,61		0,133	83	175	0,8	38,2	27,8	33,2
Ao 20 - 40 cm	7,80	2,69		0,127			0,9	48,0	25,6	25,5
C 50 -120 cm	7,80	0,70					0,4	67,0	10,2	22,4
AS_4 - Satu Mare										
Ap 0 - 20 cm	6,30	2,03	-	0,109	78	211	11,2	45,4	17,4	26,0
Am 20 - 37 cm	6,30	1,91	-	0,117	59	232	12,5	43,8	16,2	27,5
CGor 70 - 120 cm	6,30	0,59	-	0,060	37		7,4	42,7	15,9	34,0
AS_5 - Culciu Mare										
Ap 0 - 20 cm	6,50	2,44	-	0,138	84	232	22,0	26,7	19,2	32,1
Am 20 - 45 cm	6,62	1,97	-	0,097	96	245	28,7	23,1	17,2	31,0
CGo 80 - 120 cm	7,00	1,20	-	0,070	29	193	23,6	25,3	17,6	33,5
AS_6 - Reteag										
Ap 0 - 20 cm	7,90	1,72	1,3	0,090	96	266	21,7	44,9	8,1	25,3
Ao 20 - 36 cm	7,92	1,53	1,5	0,073	99	258	22,3	47,0	7,4	23,3
C 50 - 120 cm	7,90	0,70	0,7	0,037	63	199	29,5	54,9	2,0	13,6
LG_1 - Valea Vinului										
Ao 0 - 20 cm	7,1	4,48	-	0,233	46	234	2,3	18,7	29,5	49,5
A/Go 20 - 40 cm	7,2	1,70	-	0,112	43	210	1,9	19,9	29,7	48,5
Gr 60 -120 cm	7,5	0,90	-	0,056	36	189	0,7	16,8	22,4	60,1
LG_2 - Sălsig										
Aow 0 - 20 cm	7,95	3,01	2,2	0,172	89	180	5,1	20,9	34,0	40,0
A/Go 30 - 45 cm	8,32	1,30	3,2	0,090	76	166	3,2	18,6	32,0	56,2
Gr 50 - 120 cm	8,30	0,70	4,1	0,042	49	156	2,0	25,5	9,0	63,5
				SO_4 %	Cl %	Total res%				
GS - Dezmir										
Aosa 0 - 20 cm	7,6	4,30	8,83	0,12	1,76	6,40	0,9	20,5	36,3	42,3
A/Gosa 40 - 60 cm	7,8	1,65	10,42	0,07	1,19	4,28	0,8	24,3	35,2	39,7
Grsa 65 -120 cm	7,8	0,87	6,92	0,05	1,30	4,59	1,0	18,1	28,0	52,9

The aquatic and paludal flora and vegetation from the River Someş/Szamos[1] Valleys

Constantin Drăgulescu and Kunigunda Macalik

Abstract

In this study we present the aquatic and paludal flora and vegetation of the Someşul Mare, Someşul Cald, Someşul Rece, Someşul Mic and „united“ Someş rivers. The Someş River's Basin was divided in seven sectors, respectively „A“, „B“, „C1“, „C2“, „D“, „E“ and „F“ sectors. After a short presentation of the botanical researches in this area, we present the aquatic and paludal flora, based on our own researches and on data from literature, too. A list of hydro- and hygrophytes is given, with the place of appearance of every species in the different sectors. After every species we listed in brackets the authors from references the data of whom we used or we put „(!)“ to denote our own data. This list contains a number of 352 species from 52 families, and subspecific taxons are also given. Besides the flora, The Someş Valleys' vegetation is also characterized. From the total of 200 vegetal associations, a number of 91 are aquatic or paludal ones.

Keywords: aquatic and paludal flora and vegetation, River Someş

Introduction

Before our investigations the botanic researches along the Someş/Szamos were unequally distributed and they were disproportionate, too. Thus, the Someşul Mic, Someşul Cald and Someşul Rece (respectively „D“, „C1“ and „C2“ sectors) were relatively well studied, from floristic and even phytocenological point of view. Someşul Mare („A“ and „B“ sectors) was investigated summarily from floristic point of view, and some phytocenological research was also done. As for the „united“ Someş („F“ and especially „E“ sectors) it was, practically uninvestigated, especially from phytocenological point of view.

Naturally, the first data from the Valley of Someş/Szamos were floristic and were given by J. Chr. G. Baumgarten (1816), later supplimented by F. Schur (1866) and M. Fuss (1866). They referred to the flora of Someşul Mic, and to a lesser degree, to that of Someşul Mare. The last was better analysed by Fl. Porcius (1878). F. Fodor (1909), I. Fintha (1994) and K. Karácsonyi (1995) made the most important contribution to the cognition of the flora of the inferior course of Someş/Szamos („F“ sector), while E. I.

[1] The first name is Romanian, and the second Hungarian

Nyárády (1941-1944), Z. Hargitai (1942, 1943) and R. Soó (1949) focused their attention on the course of Someşul Mic („D“ sector). A. Margittai (1933), I. Todor (1955) and I. Resmeriţă (1970) published lists of plants from the courses of Someşul Cald and Someşul Rece (respectively „C1“ and „C2“ sectors). „Flora R.P.R.“ (1952-1976) synthetized all those data and supplemented them with new ones, increasing the number of plants known in the whole Valley of Someş/Szamos to almost 1200 species. As for the vegetation, the first phytocenological informations were provided by R. Soó (1927, 1947), and Şt. Csűrös (1944, 1947, 1970) about Someşul Mic, and by I. Prodan (1948) about Someşul Mic and Someşul Mare. This was supplemented with data belonging to the authors I. Pop and I. Hodişan (1962, 1981), I. Pop (1969, 1974), I. Hodişan and I. Pop (1970), I. Pop and colab. (1983, 1984, 1986), D. Mititelu and colab. (1988) and K. Karácsonyi (1995). For the superior course of Someşul Mare and for the united Someş, respectively „A“, „E“ and „F“ sectors, the phytocenological data are lacking or are just accidental and summary. In 1994 we published conspectus of the Someş vegetation which includes 190 associations.

Materials and methods

In order to provide a more correct and precise botanic characterization of the course of Someş/Szamos rivers, they were divided into seven sectors differing from one another not only floristic-phytocenologically, but also geomorphologically, pedologically, from a climatic point of view, in landscape degradation and in the level of water pollution. The seven sectors are noted by „A“, „B“, „C1“, „C2“, „D“, „E“ and „F“ (Figure 1.). In the list of the cormophytes, and the index of vegetal associations, after every item we have indicated the sector the respective item was found in.

The nomenclature of the phytotaxons and the philogenetical system according to which the families were arranged, follow that of the „Flora R.P.R.“, vol. I-XIII. The bioforms and floristic elements are presented according to V. Sanda and colab. (1983) and R. Soó (1964-1980). In the following list, for each phytotaxon we have mentioned the sectors of the river where the plant grows (letters from „A“ to „E“), pointing out in brackets - by arabic numerals - the work which quote the plant. The bioform and the floristic element are also given. Our own data are indicated by the exclamation mark (!).

The nomenclature of the associations (as well as, to a great extent, their classification) were given on the basis of the following works: E. Oberdorfer (1970, 1977), V. Sanda and colab. (1980) and R. Soó (1964-1980).In the enumeration of the species we used the following abbreviations of the names of bioforms and floristic elements: Ph - phanerophyte (MPh - megaphanerophyte, mPh - mezophanerophyte, nPh - nanophanerophyte), Ch - chamaephyte, H - hemicryptophyte, G - geophyte, T - therophyte (Th - annual therophyte, TH - biannual therophyte),Hh - helohydatophye; Cp - circumpolar, Eua - Eurasian,E - European, Ec - Central European, Atl-M-Atlantic - Mediterranean, M -Mediterranean, MP - Mediterranean-Pontic, P - Pontic, Pn - Pannonic, B - Balcanic, D - Dacic, Carp - Carpathic, Alp - Alpin, Bor - Boreal, C - continental, Cosm - cosmopolitan, Adv - adventive.

The exclamation mark (!) indicates our own data.

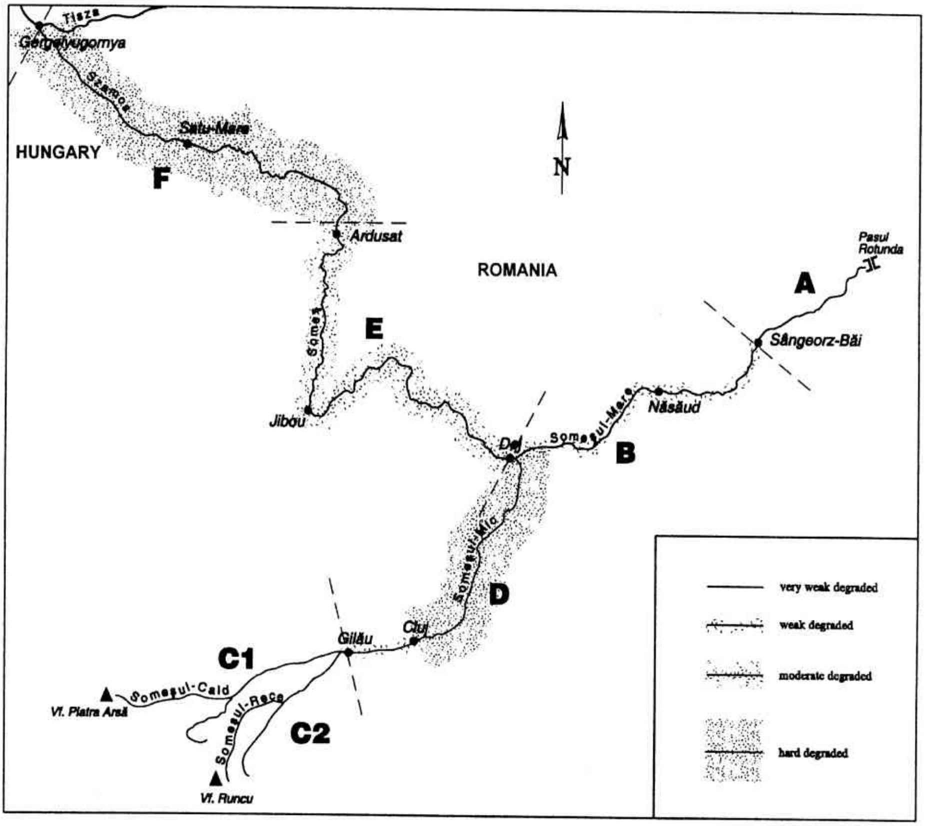


Figure 1. The sectors of the Someş rivers and the landscape degradation in Someş valleys

Results and discussion

Ecologic and floristic-phytocenologic characterization of the Valley of Someş/Szamos

In order to better characterize the Valley of Someş/Szamos from these points of view, we shall summarise each of the seven sectors of the river.

Sector „A" is the superior course of Someşul Mare, between its springs and Sângeorz-Băi (Figure 1.). The vegetation is represented by woods of *Picea abies*, *Picea abies-Fagus* and *Fagus silvatica*, alternating, here and there with lawns of *Festuca rubra* and *Agrostis tenuis*. The characteristic plant associations, which occur only in this sector of the Someş are *Hypno-Polypodietum vulgaris* and *Petasito-Telekietum speciosae*. Among the species which occur only in this sector, we mention: *Salix eleagnos, Saxifraga stellaris, Polemonium coeruleum, Ligularia sibirica* and *Eriophorum gracile.*

The water of the river is little polluted, the landsape is almost unaltered, the woods are of a good vitality and the secondary natural lawns are dominant.

Sector „B“ is the segment of Someşul Mare between Sângeorz-Băi and Dej , where it confluences with Someşul Mic (Figure 1.). The vegetation is represented by tipical water meadow associations, by woods of *Fagus silvatica, Quercus petraea* and *Carpinus betulus*, here and there replaced by lawns of *Agrostis tenuis* and *Festuca rubra.* We note, among the associations which occur only in this sector: *Carici-Menyanthetum* and *Peplido-Limoselletum aqauticae.* Hygrophilous species present only in this sector are: *Cnidium dubium, Carex melanostachya.* Among the aquatic macrophytes we mention *Ranunculus peltatus* and *R. aquatilis*.

In this sector the water has a slightly higher level of pollution than in the previous one, mainly caused by domestic remains and animal dejections. The landsacpe is practically degraded, in the sense that almost 50% of the woods from the immediate proximity of the river were felled, their place being taken by secondary lawns and agricultural crops. This sector hosts the botanical reserve „Fâneţele de la Mogoşeni-Floreşti“, on an area of 10 ha (D. Mititelu and colab., 1988).

Sector „C1“ is the course of Someşul Cald from its springs to Gilău (Figure 1.), that is to its confluence with Someşul Rece. The woods of *Picea abies, Picea abies-Fagus, Fagus-Carpinus* and *Quercus petraea-Carpinus* - here and there broken by lawns of *Festuca rubra, Agrostis tenuis* and *Nardus stricta* - are dominant. Species which occur only in this sector are *Salix pentandra, Swertia punctata, Juncus alpinus* and *Carex paniculata.*

Because of the altitude Someşul Cald is exposed to the anthropic pressure to a smaller extent. The woods have a medium vitality, and the landscape - which is generally agreable - is more or less altered by the dams of three accumulation lakes. The river and the lakes are not very polluted. On the upper level, Someşul Cald runs through Cetatea Rădesei and Cheile Someşului Cald, both of them very spectacular and home to many rare species.

Sector „C2“ encompasses the course of Someşul Rece from its springs to Gilău, where it confluences with Someşul Cald (Figure 1.). The woods and lawns are similar to those in the previous sector, but we must point out that here, on the upper course of the Someşul Rece, the peat bogs with their characteristic range of species occur on a large area. Among the plant associations which is to be found only in this sector we mention *Equisetetum fluviatilis, Carici stellulatae-Sphagnetum*, among the cormophyte species *Epilobium nutans, Rumex aquaticus, Drosera intermedia* and *Juncus filiformis.*

The landscape is sufficiently well preserved, but the woods (especially those of *Picea abies*) have a more reduced vitality than those of the „A“ and „C1“ sectors. The river contains clean water. In this sector what should be laid under protection, are the peat bogs situated upstream the chalet Blăjoaia, on the upper course of Someşul Rece and its affluents. E. Pop's (1947, 1960), I. Pop and colab.'s (1986, 1987) and our research has pointed out a series of rare species of plants and vegetal associations typical for the peat bogs. Among these we mention: *Drosera rotundifolia, Drosera intermedia, Andromeda polyphpolia, Vaccinium oxycoccos, Empetrum nigrum, Carici rostratae-Sphagnetum, Eriophoro vaginato-Sphagnetum recurvi-magellanici.*

Sector „D" is the sector of Someşul Mic between Gilău and Dej where the confluence of Someşul Mic with Someşul Mare takes place (Figure 1.). Unlike the other sectors, the agricultural crops are predominant here. The mesophilous, meso-xerophilous and meso-hygrophilous lawns took the place of the broken up woods, remants of which are still to be found, especially that of *Quercus petraea-Carpinus* and *Quercus petraea-Quercus robur*. Isolated groups of halophilous phytocenoses evolved too. From the vegetal associations distributed only in this sector we mention: *Ranunculo trichophyllii-Callitrichetum cophocarpae, Myriophyllo-Potametum, Potametum crispi, Parvopotameto-Zannichellietum, Ruppietum rostellatae* and *Puccinellietum limosae*. It is this sector of the river where the *Myriophyllum spicatum* and *Potamogeton crispus* species appear.

Apart from „F", the „D" sector is the most degraded segment of the Someş. The woody vegetation (including the meadow one) is mostly destroyed, and the river has an extraordinarily high degree of pollution (mainly due to the industry of Cluj). Particular attention must be paid to the preservation of the remaining woods. Of areas which should be protected we mention the salt marshes from Ocna-Dej.

Sector „E" includes the course of the united Someş between Dej and Ardusat (Figure 1.). In this sector a greater wood-covered area could be observed than in the previous one. The meadow riverside coppices in this region are, too, altered by the felling of the trees of *Salix alba* and *Populus alba*. The largest portion of sector E belongs to the agricultural crops and the lawns of *Agrostis stolonifera, A. tenuis, Festuca rubra* and *Arrhenatherum elatius*. Not many specific vegetal associations and plants are listed because the sector was less studied. However we mention the: *Bolboxshcoenetum maritimi, Glycerietum plicatae, Polygonetum cuspidati.*

The landscape is moderately degraded, especially because of the substitution of large woody areas by agricultural crops, and the water of the river is intensely polluted. We suggest that the meso-hygrophilous vegetation between Benesat and Ardusat be laid under protection.

Sector „F" is the lowland course of the Someş, between Ardusat and its confluence with Tisza (Figure 1.). As a consequence of the anthropization of the landscape, the absence of woods may be noticed. The agricultural crops, the meso-xerophilous lawns and the riverside coppices of *Salix-Populus* are predominant. Among the associations noticed only in this sector we mention *Bidentetum cernui*. Among the cormophytes, the *Ranunculus lateriflorus, Elatine triandra, E. alsinastrum, Trapa natans.*

This sector is intensely degraged, the vegetation being mostly artificial or anthropized. The water is also intensely polluted by the polluting agents from the towns situated in the pervious sectors joining those from the cities Baia Mare and Satu Mare.

The hydrophilous and hygrophilous flora

The Someş is characterized by a rich flora, incorporating 2412 phytotaxons, consisting of 1700 species, 90 subspecies, 336 varieties and 286 forms. A total of 352 species are hydro- or hygrophilous, and they belong to 59 families (Table 1.). The most abundantly represented families are the CYPERACEAE (54 species), ASTERACEAE (31 species), POACEAE (26 species), SALICACEAE (23 species), RANUNCULACEAE (16 species), POLYGONACEAE (14 species), APIACEAE (14 species), LAMIACEAE (12 species), JUNCACEAE (11 species), and ONAGRACEAE (10 species).

LYCOPODIACEAE
1. Lycopodium innundatum L.: C2 (44); Ch; Cp
EQUISETACEAE
2. Equisetum telmateja Ehrh.: A (16), B (23,49,!), C1 (37),D (16,61,!); G; Cp
- var. legitimum: F. Wirtig B, D (16)
- f. frondescens (A.Br.) Aschers.: B (16)
- var. minus J. Lange: B, D (16)
- var. densum F. Wirtig: B (16)
- var. conforme (Schm. et Rgl.) F. Wirtig: B, D (16)
- f. intermedium (Luerss.) F. Wirtig: B (16)
- f. monostachyum (Milde) F. Wirtig: B, D (16)
- f. polystachyum (Schm. et Rgl.) F. Wirtig: B (16)
- f. brevisimile (Dorfl.) F. Wirtig: B (16)
3. E. palustre L.: A-F; G; Cp
- var. simplicissimum: A. Br. A (16)
- f. arcuatum Milde: A (16)
- f. racemosum Milde: A (16)
- f. corymbosum :A (16)
4. E. fluviatile L. em. Ehrh.: A (16), C1 (16, 37, 68), C2 (!), D (9), F (17, 26); Hh; Cp
5. E. hyemale L.: C1 (51, !); G; Cp
POLYPODIACEAE
6. Matteuccia struthiopteris (L.) Todaro: A (16, !), C1 (38, 41, !), C2 (16, 68, !), D (12, 16, 61); H; Cp
7. Dryopteris thelipteris (L.) A. Gray: A (16), B (29), D (16, 61); Hh; Cp
SALVINIACEAE
8. Salvinia natans (L.) All.: F (16, 17, 26, 62); Hh; Eua
MARSILEACEAE
9. Marsilea quadrifolia L.: F (17, 59); Hh; Eua (M)
BETULACEAE
10. Alnus glutinosa (L.) Gaertn.: B (5, 29, 61, !), C1 (41), C2 (68), D (12, 48, 64, !), E (!), F (18, 26); MPh-mPh; Eua
11. A. incana (L.) Mnch.: A (!), B (23, 29, !), C1 (41, !), C2 (6), D (12, 64); MPh-mPh; Eua

SALICACEAE
12. Populus alba L.: B (16, 49), D (16, 61), E (!), F (18, !); MPh-mPh; Eua
- var. nivea (Willd.) Handb.: E (!)
13. P. nigra L.: B (16, 23, 49, !), D (16, 48, 61), E (32), F (26, 32, !); MPh; Eua
14. P. x canescens Sm. (alba x tremula): D (64), F (!)
- f. apahidensis Nyár.: D (64)
15. Salix fragilis L.: B (23), C1 (36), C2 (6, 68), D (48, 64, !), E (32, !), F (!); MPh-mPh; Eua
- f. latifolia Anders.: C1 (36,37), C2 (68)
16. S. triandra L.: B (5), C1 (41), D (12, 32, 61, !), E, F (17, 32, !); mPh; Eua
17. S. pentandra L.: C1 (36); MPh; Eua
18. S. alba L.: B (23), D (48, 61, !), E, F (17,32, !); MPh-mPh; Eua
19. S. purpurea L.: A-F; mPh; Eua
- f. eriantha Wimm.: D (64)
- f. parviflora Pázm.: E (34)
20. S. eleagnos Scop.: A (16, !); mPh; Ec
21. S. viminalis L.: A, B (16, !), D (16, 32, 48, 64, !), E (32, !), F (17,18, 32, !); mPh; Eua
22. S cinerea L.: B (29, 61, !), C1 (37, 68), D (49, 64), E, F (!); mPh; Eua
23. S. aurita L.: A (16), B (29), C1 (16, 36, 37); mPh; E
24. S. rosmarinifolia L.: B (16, 29, !), C1 (36, 37, 53), D (16, 61); mPh; Eua
25. S. x alopecuroides Tausch (fragilis x triandra): D (64)
- f. latifolia: Nyár. D (16)
26. S. x rubens Schrk. (alba x fragilis): C1 (68), D (49, 61, 64)
- var. excelsior (Host.) A. et G.: C1 (68)
- var. palustris (Host.) Seem.: C1 (68)
27. S. x undulata Ehrh. (alba x triandra): D (49)
- f. erythroclados (Simk.) Beldie: D (16)
28. S. x leiophylla A. et G. (purpurea x triandra): D (16)
29. S. x multinervis Döll (aurita x cinerea): B (16, 29), C1 (16, 37, 68)
30. S. x parviflora Host. (purpurea x rosmarinifolia): B, D (16)
31. S. x subcinerea Anders. (silesiaca x cinerea): C1 (37)
32. S. x cuspidata Schultz. (fragilis x pentandra): C1 (68)
33. S. x trevirani Spreng. (triandra x viminalis): D (49)
34. S. x rubra Huds. (purpurea x viminalis): D (49)
POLYGONACEAE
35. Rumex hydrolapathum Huds.: D (16); H (G); E
36. R. aquaticus L.: C2 (!); Hh; Cp
37. R. stenophyllus Ldb.: D (16, 42, 61), F (17); H; Eua
- var. microvalvis Bih.: D (16)
38. R. maritimus L.: B (16, 29), D (16, 61); Th; Eua
39. R. palustris Sm.: D (16, 42, 48, 49), F (26); Th-TH; Eua
40. R. x stenophylloides Simk. (maritimus x stenophyllus): D (16)

41. Polygonum hydropiper L.: A (16), B (16, 29,!), C2 (68), D (16, 48, !); Th; Eua
- var. acutifolium A. Br.: B, D (16)
42. P. mite Schrank: A (16), B (16, 29), D (16,39, 48, 61), E (32), F (26); Th; Eua
43. P. minus Huds.: A, B (16), D (16, 61), F (17); Th; Eua
44. P. persicaria L.: A (16), B (16, 29), D (16, 48, 61, !), E (!), F (17, 18, !); Th; Eua
- ssp. verum Schuster: B (!), D (16)
- var. nodosum (Pers.) Weinm.: B, D (16)
- var. tomentosum (Schrank.) Beck: A (16), C1 (68), C2 (16, 68), D (16, 48, 63)
- var. normale Schuster: B (16)
45. P. amphibium L.: B (!), D (42, !), F (18, 28); G-Hh; Cosm
- f. aquaticum (Leyss) I. Grinț:. B (16), D (16, 48, 61), F (!)
- f. terrestre (Leyss) I. Grinț.: B (16), D (16, 48), E, F (32)
46. P. bistorta L.: A (16, !), B (29, !), C1 (37, 68, !); H; Eua
47. P. cuspidatum Sieb. et Zucc.: B, C2 (!), D (16, !), E, F, (!); Th; Adv
48. P. x condensatum F. Schultz. (mite x persicaria): D (16)
PORTULACACEAE
49. Montia fontana L.: A, C2 (16); Th; Cp
CARYOPHYLLACEAE
50. Myosoton aquaticum (L.) Mnch.: A (16, 54), B (16, 29, 49, 54), C2 (68), D (16, 61, !), E (32, !); Th-Th; Eua
51. Stellaria alsine Grimm: C1 (36, 51, 68), C2 (68, !); H; Cp
52. S. palustris Ehrh.: C2 (44, 68); H; Eua
53. Lychnis flos-cuculi L.: A-F; H; Eua
EUPHORBIACEAE
54. Euphorbia stricta L.: C1 (50, 53), F (17, !); Th; E
55. E. palustris L.: D (49); H-Hh; E
56. E. lucida W. et K.: D (16, 61), F (17); H; E
CALLITRICHACEAE
57. Callitriche stagnalis Scop.: C2, D (16); Hh; Eua
58. C. cophocarpa Sendtn.: B (16), D (16, 61, 62), F (17); Hh; Eua
59. C. palustris L. em. Druce: C1 (68), C2 (68, !), D (16, 61, 62), F (16, 17, 18, 26); Hh; Cp
RANUNCULACEAE
60. Trollius europaeus L.: A (54), C1 (37, 50), C2 (16); H; E
61. Caltha palustris L.:
- ssp. palustris: C1 (45), C2 (44), E (34); H; Cp
- ssp. cornuta (Schott, Nyman et Kotschy): Hegi F (17, 18); H; Eua
- ssp. laeta Schott, Nyman et Kotschy: A-F; H; E
- var. pseudocornuta Zap.: D (16)
- var. alpina (Schur) Graebn.: A (16, !), C2 (!), D (16)
62. Myosurus minimus L.: D (16), F (18, 26); Th; Cp
63. Ranunculus peltatus Schrank: B (16); Hh; E
64. R. aquatilis L.: B (16); Hh; Cosm

65. R. trichophyllus Chaix: A, B (16), D (16, 61), F (18); Hh; E
- var. pedicellatum Glück: D (16)
- var. penicillatum Glück: D (16)
66. R. rionii Lagg.: C2, D (16); Hh; Eua
67. R. polyphyllus W. et K.: F (16, 26); Hh-H; Eua
68. R. lingua L.: D (16, 61), F (17); Hh; Eua
69. R. flammula L.: A (16), B (16, 29, !), E (!), F (18); H; Eua
70. R. ophioglossifolius Vill.: F (16); H; Atl-M
71. R. sceleratus L.: B (16), D (16, 39, 42, !), E (!), F (18, !); Th; Cp
72. R. repens L.: A-F; H; Eua
- f. prostratus (Gaud.) Nyár.: C2 (68)
- f. degeneratus (Schur) A. Nyár.: A (16)
73. R. lateriflorus D.C.: F (18); Th; Eua
74. Thalictrum flavum L.: B (16), F (18, 26); H; Eua
75. T. lucidum L.: D (20, 61), F (17); H; Ec
NYMPHAEACEAE
76. Nuphar lutea (L.) Sm.: F (16, 17, 18, 26); Hh; Eua
- var. sericea (Láng) Kitt.: F (17)
CERATOPHYLLACEAE
77. Ceratophyllum demersum L.: D (62); Hh; Cosm
78. Ceratophyllum submersum L.: D (62); Hh; Eua
BRASSICACEAE
79. Rorippa sylvestris (L.) Bess.: A-F; H-G; E
- ssp. sylvestris f. pseudopalustris (Schur) Nyár.: D (16)
- f. acutissima Nyár.: D (16)
- f. densiflora Borb.: F (16)
- f. dentata (Koch) Borb.: A, D (16)
- f. rivularis (Rchb.) Nyár.: D (16)
- f. tenuifolia (Tsch.) Beck: A, D (16)
- ssp. kerneri (Menyh.) Soó: B (29), D (16, 39), F (16, 26)
80. R. islandica (Oed.) Borb.: B (16), C1 (51), D (16, 39, 61), F (17); Th-TH; Cosm
81. R. austriaca (Cr.) Bess.: D (16, 39, 61, !), E (!), F (!18, !); H-G; Ec
- var. microcarpa (Kitt.) Borb.: D (16)
82. R. amphibia (L.) Bess.: D (16, 42, !), E (32), F (16, 17, 18); Hh; Eua
- f. aquatica (L.) Fritsch: D (16)
83. R. x barbaraeoides (Tsch.) Cel. (islandica x sylvestris): B (16), C2 (16, 68), D (16, 61)
- var. reichenbachii Knaf: D (16), F (17)
- f. astylis (Rchb.) Nyár.: D (16), F (17)
- f. macrostylis (Tsch.) Nyár.: D (16)
84. R. x neogradensis Borb. (austriaca x islandica) var. dejensis Nyár.: D (16)
85. R. x repens Borb. (amphibia x sylvestris) var. subglubosa (Borb.) Nyár.: D (16)
86. Cardamine amara L.:
- ssp. amara: A (!), C1 (50, 68, !), C2 (22, 44, 68); H; Eua
- ssp. opizii (Presl.) Cel.: A (!), C2 (68); H; Ec

87. C. pratensis L.:
- ssp. pratensis: A (16), C1 (50, 53, 68, !), C2 (22, 68), D (16); H; Cp
- ssp. pratensis var. dentata (Schult.) Neibr.: F (17)
- ssp. matthioli (Moretti) Soó var. matthioli: B (16), D (16, 61), F (18); H; Ec
DROSERACEAE
88. Drosera rotundifolia L.: A (16), C1 (36, 45, 53, 68), C2 (68, !); H; Cp
89. D. intermedia Hayne: C2 (37, 44); H; Cp
ELATINACEAE
90. Elatine triandra Schkuhr: F (17); Hh; Cp
91. E. alsinastrum L.: F (18, 26); Hh; Eua (M)
VIOLACEAE
92. Viola biflora L.: C1 (38, 51, 68, !), C2 (68); H; Cp
HYPERICACEAE
93. Hypericum humifusum l.: A (16); Th; Eua
94. H. tetrapterum Fries.: A (16), B (29), C1, C2 (6), D (16, 61); H; E
95. H. x laschii Fröhl (tetrapterum x maculatum): B (16)
SAXIFRAGACEAE
96. Saxifraga stellaris L.: A (!); Ch (H); Eua
97. Chrysosplenium alternifolium L.: C1 (41, 68, !), C2 (68), D (61, 63), F (17); H; Cp
98. Parnassia palustris L.: B (49), C1 (37, 68, !), C2 (!); H; Cp
ROSACEAE
99. Potentilla palustris (L.) Scop.: B (10, 29), C1 (37); Hh; Cp
100. P. supina L.: D (39, 63, !), F (17, !); Th-H; M
- f. elatior (Lehm.): Th. Wolf D (48)
- var. limosa Boenn.: D (16, 48)
101. P. anserina L.: A-F; H; Cosm
102. Geum rivale L.: A (!), C1 (36, !), C2 (68, !); H; Cp
103. Filipendula ulmaria (L.) Maxim: A (!), C1 (36, 41, 51, !), C2 (44, !), D (61); H; Eua
- f. denudata (J.et C. Presl.) Beck.: A (16), C1, C2 (68)
FABACEAE
104. Trifolium hybridum L.: B (16), D (16, 42, !), E (!); H; E
105. Lathyrus paluster L.: C2, D (16); H; Cp
LYTHRACEAE
106. Peplis portula L.: B (29), C1 (36, 37), D (16), F (17); Th; Atl-M
107. Lythrum hyssopifolia L.: B (16, 29), D (16, 48), F (17, 18); Th; Cosm
108. L. virgatum L.: B (29, 49), D (16), F (17, 18); H-Hh; Eua
109. L. salicaria L.: A-F; H-Hh; Cosm
- var. salicaria f. glabrescens (Neilr.) Todor: C1, C2 (68)
- var. tomentosum D. C.: B (16)
ONAGRACEAE
110. Epilobium hirsutum L.: C1 (50, 68), C2 (68), D (16, 61, !), F (17, !); H (Hh); Eua
111. E. adenocaulon Hausskn.: A, D (16); H; Adv
112. E. parviflorum (Schreb.) Wither.: C2 (68), D (16, 48, 61), F (17); H; Eua
- f. umbrosum Hausskn.: A, D (16)

113. E. roseum (Schreb.) Pers.: B (16), C1 (!), C2 (68), D (16, 48, 61); H; Eua
- f. apricum Hausskn.: D (16)
- f. umbrosum Hausskn.: C1 (68)
114. E. tetragonum L.:
- ssp. tetragonum: A (16), D (16, 61), F (17); H; Eua
- ssp. lamyi (F. Schultz) Nym.: C2 (44), F (17); H; E
115. E. palustre L.: B (29), C1 (36, 37, 53, !), C2 (44), F (17); H; Cp
- f. longifolium Hausskn.: A (16)
- f. major Fires: A (16)
- var. fontanum Hausskn.: A (16)
- var. pilosum Hausskn.: A, B (16)
- f. subdenticulatum K. Rubner: B (16)
116. E. alsinifolium Vill.: C1 (53); H; Eua
117. E. obscurum (Schreb.) Roth: A, B (16), D (16, 61), F (17); H; Atl-M
118. E. nutans Schmidt: C2 (!); H; E
119. E. dodonaei Vill.: A (16), D (16, 61); H; Ec
TRAPACEAE
120. Trapa natans L.: F (16, 17, 26, !); Hh; Eua
- var. hungarica (Opiz) Borb.: F (62)
HALORAGACEAE
121. Myriophyllum verticillatum L.: D (16, 61, 62), F (17, 26, 62); Hh; Cp
122. M. spicatum L.: D (16, 61, 62), F (26); Hh; Cp
HIPPURIDACEAE
123. Hippuris vulgaris L.: F (18); Hh; Cp
GERANIACEAE
124. Geranium palustre Torner: A (16), B (29), C1 (36, 37, 68), C2 (68), D (48, 610; H; Eua
APIACEAE
125. Cicuta virosa L.: B (29), F (18, 59); Hh; Eua
126. Berula erecta (Huds.) Coville: B (29), C2 (22); Hh; Cp
127. Sium sisaroideum D. C.: D (16, 20, 61); Hh; Eua
128. S. latifolium L.: F (17); Hh; Eua
129. Oenanthe aquatica (L.) Poir.: B (29, 49), C2 (68), D (42, 61, !), F (17, 18); Hh; Eua
130. O. silaifolia M. B.: F (17, 180; H; M
131. O. banatica Heuff.: C1 (36, 37), C2 (16), D (16, 49), F (17); H; D-B-Pn
132. Cnidium dubium (Schkuhr) Thell.: B (29); TH (H); Eua
133. Selinum carviflora L.: B (29), E (!); H; Eua
134. Angelica sylvestris L.: B (29, 49, !), C1 (53, 68), C2 (68), D (61), E (!), F (17, !); H; Eua
- var. vulgaris Frisch: C2 (16)
- var. elatior Whlbg.: A (16), D (16, 20, 61)
135. A. archangelica L.: C1 (68, !), C2 (16, 68, !); TH-H; Eua
136. Peucedanum palustre (L.) Mnch.: B (16, 29), D (16), F (17); H; Eua
- f. angustifolium (Rchb.) Thell.: B (16)
137. P. latifolium (M.B.) D.C.: D (10, 16, 61); H; P-B
138. Heracleum palmatum Baumg.: A (16), C1, C2 (!); H; End (Carp)

PRIMULACEAE
139. Lysimachia nummularia L.: A-F; Ch; E
- f. parviflora (Peterm.) Morariu: B, D (16)
140. L. vulgaris L.: C1 (36, 41, 68), C2 (68), D (39, 61, !), E (!), F (18); H-Hh; Eua
141. Glaux maritima L.: D (16, 49); H; Cp
142. Hottonia palustris L.: B (47, 62), E (16), F (17, 28); Hh; E
ERICACEAE
143. Andromeda polifolia L.: C1 (37, 45), C2 (16, 44, 68, !); Ch (nPh); Cp
144. Vaccinium oxycoccos L.: C1 (16, 36, 37), C2 (16, !); Ch; Cp
- ssp. microcarpum (Turcz.) M.N. Blytt.: C1 (16, 36, 45, 68), C2 (37, 44)
145. Empetrum nigrum L.: C1 (37, 45, 68), C2 (37, 44, 68, !); nPh; Cp
CONVOLVULACEAE
146. Calystegia sepium (L.) R. Br.: B (5, 49), D (16, !), E (!), F (16, !); H; Eua
POLEMONIACEAE
147. Polemonium coeruleum L.: A (16); H; Cp
BORAGINACEAE
148. Myosotis scorpioides L.: A-F; H-Hh; Eua
- var. elatior Opiz: A (!)
- var. memor Kitt.: F (16, 26)
149. M. caespitosa K. F. Schultz: A (16), D (61); Th-TH (H); Cp
150. Symphytum officinale L.: A (!), B (29, !), D (12, 39, 48, !), E (!), F (18); H; Eua
- ssp. bohemicum Schmidt: F (17)
- ssp. uliginosum (Kern.) Nym.: F (17)
- f. inundatum Menyhárt: D (16)
SCROPHULARIACEAE
151. Scrophularia umbrosa Dum.: C1 (41), D (49, 61), E (32), F (17); H; Eua
152. Gratiola officinalis L.: D (49), F (18); H; Eua
153. Limosella aquatica L.: B (29), D (16, 48, 49), F (17); Th; Cosm
154. Veronica anagallis-aquatica L.: B (29), C1, C2 (68), D (39, 48, 49), F (18); H-Hh; Cp
- f. limosa Krösche: D (16)
- f. tenerrima (Schm.) Vahl.: D (16, 61)
155. V. anagallidioides Guss.: F (17); H-Hh; Eua
156. V. beccabunga L.: B (29, !), C1 (36, !), C2 (22, !), D (39, 42, 48, 61), F (17, 59, !); Hh-H; Eua
157. Pedicularis limnogena A. Kern.: C1 (16, 37, 45, !); H; Carp-B
158. P. palustris L.: D (61); H; Eua
LENTIBULARIACEAE
159. Utricularia vulgaris L.: C2 (16), D (16, 61), F (16, 26); Hh; Cp
160. U. bremii Heer: D (62); Hh; Ec
161. U. australis R. Br.: F (17); Hh; Atl-M
LAMIACEAE
162. Teucrium scordium L.: D (16); H; Eua
163. Scutellaria galericulata L.: B (29), C1 (36), D (48, 61, !), E (!), F (18, !); H; Cp
164. S. hastifolia L.: B (16, 54), D (61), F (18); H; Ec

165. Stachys palustris L.: B (29), C1 (68), D (48, 61), F (18); H (G); Cp
166. Lycopus europaeus L.: B (23, 29, !), C1 (41), D (42, 48, !), E (!), F (18, !); Hh; Eua
167. L. exaltatus L.: A (16, !), D (49, 61), F (17); Hh; Eua
168. Mentha pulegium L.: D (61, !), F (18); H; Eua
169. M. arvensis L.: B (29), C1, C2 (68), D (48, !); H-G; Cp
- ssp. arvensis var. pascuorum Top.: B (16)
- var. foliicoma (Opiz) Top.: B, D (16)
- ssp. austriaca (Jacq.) Briq. var. austriaca: A, B, C2, D (16)
- var. fontana (Weihe) Top.: D (16)
170. M. verticillata L.: B (!), D (48, 49, 61, !); H; E
- var. ovatifolia Top.: B, D (16)
- var. tortuosa (Host) Top.: A, B, D (16)
- var. serotina (Host) Top.: A, B, D (16)
- var. montana (Host) Top.: A (16)
171. M. aquatica L.: B (290, D (16, 32, 49), E (32), F (17, 18, 32); Hh-H; Eua
- var. stagnalis Top.: D (16)
172. M. longifolia (L.)Nathh.: A-F; H (G); Eua
- ssp. longifolia var. ensidens Briq.: B (16)
- var. favrati (Des. et Dur.) Briq.: A (16)
- var. recta (Des. et Dur.) Top.: A (16)
- var. huguenini (Des. et Dur.) Briq.: B, D (16)
- var. vallesiaca (Briq.) Trantm.: A (16)
- var. szamosiana Top.: D (16)
- ssp. mollisima (Borkh.) Dom.: D (16)
- ssp. incana (Willd.) Guşul.: D (16)
173. M. x hirta Willd. (longifolia x aqautica):
- f. grintzescui (Prod.) Guşul.: D (16)
PLANTAGINACEAE
174. Plantago maritima L.: B (49), D (10, 16, 61); H; Eua
- ssp. maritima f. leptophylla Mert. et Koch: D (16)
- ssp. serpentina (All.) Arc.: D (16)
- f. angustissima (Schur) Paucă et Nyár.: D (16)
175. P. cornuti Gouan: B (49), D (10, 16, 20, 61); H; E
GENTIANACEAE
176. Menyanthes trifoliata L.: A (16), B (16, 29), C1 (37), D (16, 61); Hh; Cp
177. Centaurium littorale (D. Turner) Gilmour.:
- ssp. ulilginosum (W. et K.) Rothm.: D (16); Th-TH; Eua
178. Swertia punctata Baumg.: C1 (37, 38, 51, 68, !); H; Carp-B
RUBIACEAE
179. Asperula rivalis Sibth. et Sm.: A (16), B (29), D (16, 61), F (17); H; Eua
180. Galium uliginosum L.: A (16), C1 (36, 37), C2 (68), D (16); H; Eua
181. Galium palustre l.: C1 (37, 53, 68), C2 (22, 68, !), D (42, 48), F (17, 18, !); H; Cp
- ssp. elongatum (Presl.) Lange: F (17)
- ssp. transsilvanicum Pázm.: E (34)

VALERIANACEAE
182. Valeriana officinalis L.: A (24, !), B (29), C1 (11, 38, 41, 68, !), C2 (22, 68), D (61); H; Eua
- var. latifolia Vahl.: D (16)
- f. altissima (Hornem.) Koch: D (16)
- var. media Koch: D (16)
183. V. sambucifolia Mikan: C1 (68), D (16); H; Ec
184. V. simplicifolia (Rchb.) Kabath.: C1 (16, 36, 37, 51, 53, 68), C2 (44, 68, !); H; Ec
DIPSACACEAE
185. Succisa pratensis Mnch.: A (160, B (29, !), C1 (36, 51, 68), C2 (68), D (16), E (!), F (18); H; Eua
- f. glabrata (Schott) Jáv.: C1 (36), D (16)
186. S. inflexa (Kluk) Yundz.: F (18); H; Ec
CUCURBITACEAE
187. Echinocystis lobata (Mchx.) Torr. et Gray: B (16), D (!), E (32, !), F (17, 26, 59, !); Th; Adv
188. Sicyos angulata L.: B (16), D (16, 49, 61), F (17); Th; Adv
ASTERACEAE
189. Eupatorium cannabinum L.: A-F; H; Eua
190. Solidago canadensis L.: D (16, 48), F (26); H; Adv
191. S. gigantea Ait.: D (160, F (17, !); H; Adv
192. Aster punctatus W. et K.:
- ssp. punctatus: D (16, 49), F (17, 26, 59); H; Eua
193. A.tripolium L.: D (10, 42, 61, !); H; Eua
194. A. salignus Willd.: B, D (16); H; Adv
195. Gnaphalium uliginosum L.: B (29), D (16, 48), F (17); Th; Eua
196. Inula helenium L.: B (29), D (16, 61); H; Adv
197. Pulicaria dysenterica (L.) Gaertn.: D (16, 48); H; E
198. P. vulgaris Gaertn.: B (160, D (61), F (18, !); Th; Eua
199. Telekia speciosa (Schreb.) Baumg.: A (!), B (49), C1 (51, 68), C2 (68, !), D (12, 61); H; Carp-B-Cauc
200. Helianthus decapetalus L.: A (!), B (30, !). D, E, F (17, 26, !); H; Adv
201. Rudbeckia laciniata L.: D (16, 48, 49, 61), F (17); H; Adv
202. Bidens tripartita L.: B (23, !), C1, C2 (68), D (40, 42, 48, !), E, F (!); Th; Eua
- f. pumila (Roth) Nyár.: D (16)
203. Bidens cernua L.: C2 (68), D (48, 61), F (17, 18, !); Th; Eua
- f. minima (Huds.) Nyár.: D (16, 48)
204. Petasites hybridus (L.) G.˙M. Sch.: B (23), C1 (41, !), C2 (68), D (12, 61), F (17, 18); G (H); Eua
205. P. kablikianus Tausch: A (16), C2 (68); G (H); Carp-B
206. Senecio paludosus L.: C1 (37), D (49); H; Eua
207. S. fluviatilis Wallr.: D (16, 48, !); H; Eua
208. Ligularia sibirica (L.) Cass.: A (16); H; Eua (Bor)

209. Carduus personata (L.) Jacq.: A, C1, C2 (!); H; Ec
- var. simplicifolius Sanguin: C1 (68), D (16)
- var. agrestis (Kern.) Hay.: C1 (68)
210. Cirsium palustre (L.) Scop.: C1 (37); TH; Eua
211. C. brachycephalum Jur.: A (16); TH-H; Pn
212. C. canum (L.) All.: B (29), C2 (!), D (10, 12, 61), E (!), F (18); G (H); Eua
213. C. rivulare (Jacq.) Link.: A (24), B (29), C1 (37, !), C2 (68), D (12,61); H; Ec
214. C. oleraceum (L.) Scop.: B (29), C1 (68), C2 (6, 68, !), D (61); H; Eua
215. C. heterophyllum (L.) Hill.: C1 (16, 36, 37, 51), C2 (68); G (H); Eua
216. Taraxacum bessarabicum (Hornem.) Hand.-Mazz.: D (16, 42); H; Eua
217. T. palustre (Lyons) Symons: A (16), D (16, 61); H; E
- f. scorzonera (Gaud.) Hay.: D (16)
218. Sonchus paluster L.: C1 (68), D (16); H; Eua
- f. hungaricus Kárp.: D (16)
219. Crepis paludosa (L.) Mnch.: C1 (36, 38, 68), C2 (44); H; E
ALISMATACEAE
220. Alisma plantago-aquatica L.: B (29), D (32, 42, 48), F (17, 18, !); Hh; Cosm
221. A. lanceolatum With.: A (!), B (29), C2 (68), D (10, 61, 66), F (17); Hh; Eua
222. Sagittaria sagittifolia L.: F (16, 17, 26); Hh; Eua
BUTOMACEAE
223. Butomus umbellatus L.: B (29), D (61), F (17, 18, !); Hh; Eua
HYDROCHARITACEAE
224. Stratiotes aloides L.: D (16), F (17, 18, 62); Hh; Eua
225. Hydrocharis morsus-ranae L.: F (16, 17, 26, 62); Hh; Eua
JUNCAGINACEAE
226. Scheuchzeria palustris L.: C1 (37, 45), C2 (16, 44, 68, !); G; Cp
227. Triglochin maritima L.: A (16, 54), B (16, 49, 54), D (10, 16, 42, 65); H; Cosm
228. T. palustris L.: D (16, 20, 65, 66); H; Cp
POTAMOGETONACEAE
229. Potamogeton pectinatus L.: D (16, 61, 62, 66); Hh; Cosm
- var. interruptus (Kit.): Aschers. D (61)
230. P. crispus L.: D (61, 62, 66, !), F (17); Hh; Cosm
- f. serrulatus (Schrad.) Ţopa: D (16)
231. P. pusillus L.: A, B (16, 62), C2 (62), D (16, 62, 66); Hh; Cosm
232. P. nodosus Poir.: F (17, 59, !); Hh; Cp
233. P. natans L.: B (16, 62), C1 (68), C2 (16, !), D (12, 42, 61, 66), F (17, 18, 26); Hh; Cosm
- var. prolixum Koch: D (16, 62)
- f. ovalifolius Fieb.: D (16)
- f. pygmaeus Gaud.: D (16)
234. P. lucens L.: D (16, 62, 66), F (26); Hh; Eua
235. P. gramineus L.: F (17); Hh; Cp
236. Ruppia rostellata Koch: D (62); Hh; Cosm
- var. obliqua (Schur) Ţopa: C2 (16), D (16, 66)

237. Zannichellia palustris L.: D (16); Hh; Cosm
- ssp. pedicellata Wahlbg.: D (10, 62)
- var. aculeata (Schur) Țopa: D (16, 42, 61, 66)
NAJADACEAE
238. Najas minor All.: F (16, 26); Hh; Eua
TYPHACEAE
239. Typha latifolia L.: A-F; Hh; Cosm
240. T. minima Funk.: F (!); Hh; Eua
241. T. angustifolia L.: B (29), D (42, 61), F (18, !); Hh; Cosm
SPARGANIACEAE
242. Sparganium minimum Hill.: A, B (16, 54, 62), C1 (37); Hh; Cp
243. S. emersum Rehmann: A, D (16) F (26); Hh; Eua
244. S. erectum L.:
- ssp. erectum: C1, C2 (68), D (49, 61, !), F (18); Hh; Eua
- ssp. microcarpum (Neum.) Dom.: D (16)
- ssp. neglectum (Beeby) Sch. et Thell.: B (29), D (16)
IRIDACEAE
245. Gladiolus imbricatus L.: B (29), C1 (37, 50), D (61), F (17); G; Eua
246. Iris pseudacorus L.: B (16, 29, 49, 54), D (16, 49, 61), E (!). F (16, 18, !); G-Hh; E
247. Iris spuria L.: D (16); G; Pn-D
248. Iris sibirica L.: D (16, 61), F (16, 18, 26); G; Eua
JUNCACEAE
249. Juncus bufonius L.: A-F; Th; Cosm
250. J. compressus Jacq.: B (29, 49), D (16, 39, 42, 48), F (18); G; Eua
251. J. gerardi Lois.: B (29), D (16, 42, 61), F (26); G; Cp
252. J. filiformis L.: C2 (44, 68, !); H; Cp
- var. transsilvanicus (Schur) A. et G.: C1 (37)
253. J. alpinus Vill.: C1 (37); H; Cp
- var. fuscoater (Schreb.) I. Grinț.: C1 (36)
254. J. effusus L.: A-F; H; Cosm
- var. compactus Lej. et Court.: C1 (36), D (49)
255. J. conglomeratus L.: C1 (45, !), C2 (44), D (61, !), E (!); H; Eua
256. J. inflexus L.: C2 (68), D (16, 39, 42, 48); H; Eua
257. J. articulatus L.: B (29), C1 (36, 53, 68), C2 (68), D (16, 20, 48, 61) F (17); H; Cp
258. J. atratus Krock.: A (16), B (16, 29), D (61), F (17); H; Eua
259. J. thomassii Ten.: A (16), C2 (16, 68), D (61); H; D-B
CYPERACEAE
260. Scirpus sylvaticus L.: A (16, 24, 54, !), B (29, !), C1 (36, 53, !), C2 (22, 68, !), D (12, !), E (!); Hh-G; Cp
261. S. radicans Schuhr: B (16); G; Eua
262. Eriophorum vaginatum L.: C1 (36, 37, 45, 53, 68), C2 (44, 68, !); H; Cp
263. E. angustifolium Honckeny: C1 (37, 45, 68), D (61); G; Cp
264. E. gracile Koch: A (16); G; Cp

265. E. latifolium Hoppe: A (24), C1 (36, 37, 68), C2 (68); H; Eua
266. Bolboschoenus maritimus (L.) Palla: B (!), D (10, 42, 48, !), E (!), F (17, 26, !); Hh; Cosm
- var. compactus (Hoffm.) Hay.: D (16)
267. Isolepis supina (L.) R. Br.: F (17); Th (Hh); Cosm
268. Schoenoplectus triqueter (L.) Palla: D (16); Hh-G; Eua
269. S. lacustris (L.) Palla: B (29, 49, !), D (42, 61, !), E (!), F (18, 28, !); Hh-G; Cosm
270. S. tabernaemontani (Gmel.) Palla: D (16, 20, 61, 65); Hh-G; Eua
271. Eleocharis quinqeflora (Hartm.) O. Schwarz: D (16); H; Cp
272. E.acicularis (L.) R. Br.: B (16), F (17, 18); Th; Cp
273. E. carniolica Koch: C1 (37), F (26); Th; Alp-Carp-B
274. E. ovata (Roth) Roem. et Shulz.: A (16), F (17); Th; Cp
275. E. uniglumis (Link.) Schult.: B (29), D (16, 49); G (Hh); Cp
276. E. palustris (L.) R. Br.: A (24), B (29, !), C1 (68), C2 (68, !), D (42, 48, 61, !); G (Hh); Cosm
- var. casparyi (Abromeit.) Borza: D (16)
- f. salina Schur: D (61)
- ssp. mamillata (Lindb.) Blauverd.: F (17)
277. Cyperus fuscus L.: A, B (16), D (16, 48, 61), F (17, 26); Th; Eua
- var. virescens (Hoffm.) Vahl.: A, D (16);;
278. Blysmus compressus (L.) Panzer: A (16), C2 (68), D (16); G; Eua
279. Chlorocyperus glomeratus (Torn.) Palla: D (48), F (17); Hh; Eua
280. Pycreus flavescens (L.) Rchb.: A, B, D (16), F (17); Th; Cosm
281. Dichostylis micheliana (L.) Nees.: F (17); Th; Eua
282. Rhynchospora alba (L.) Vahl.: C1 (37, 45), C2 (44); H; Eua
283. Cladium mariscus (L.) Pohl.: D (16); Hh; Cosm
284. Carex pauciflora Lightf.: C1 (16, 36, 37, 45, 68), C2 (16, 37, 44, 68, !); H; Cp
285. C. vulpina L.: B (29, 49), C1 (50), D (10, 16, 42, 61), F (17, 18); Hh-H; Eua
- f. crassinervis (Schur) Kük.: D (61)
286. C. divisa Huds.: D (16);;
287. C. diandra Schrank.: A (16), D (61); G; Cp
288. C. paniculata Jusl.: C1 (16, 36); Hh; Ec
289. C. leporina L.: A (24), B (29), C1 (36, 45, 50, 53, !), C2 (44); H; Eua
290. C. bohemica Schreb.: F (59); H; Eua
291. C. canescens L.: B (29), C1 (36, 37, 45, !), C2 (44, 68); H; Cp
292. C. elongata L.: B (29); H; Eua
293. C. stellulata Good.: C1 (36, 50, 53, !), C2 (44, 68, !), D (61); H; Cp
294. C. remota Grufb.: D (61), F (17); H; E
295. C. limosa L.: A (16), C1 (16, 37, 45, !), C2 (68); H; Cp
296. C. paupercula Michx.: C1 (45), C2 (37, 44); H; Cp
297. C. pendula Huds.: A (16), C1 (68), D (61); H; Atl-M
298. C. nigra (L.) Reichard.: B (29), C1 (36, 45, 68, !), C2 (44); G; Cp
299. C. gracilis Curtis: A (16), B (29, 49), C1 (53, 68, !), D (12, 16, 61), E (!); Hh-G; Eua
300. C. elata All.: B (29); Hh; E

301. C. buekii Wimm.: B (16), D (7, 16, 61); Hh; P-Pn
302. C. distans L.: B (29, 49), D (10, 39, 42, !); H; E
303. C. flava L.: A (!), C1 (53), C2 (44, !), D (61); H; Cp
304. C. lepidocarpa Tausch.: C1 (36, 68); H; E
305. C. acutiformis Ehrh.: B (29), D (61), E (!), F (18); Hh; Eua
306. C. melanostachya Willd.: B (29); Hh; Eua
307. C. riparia Curt.: B (29, 49), D (32, 42, 61), E (!), F (18); Hh; Eua
308. C. rostrata Stokes: A (16), B (29), C1 (37, 45, 68, !), C2 (44, 68, !), D (16); Hh; Cp
309. C. vesicaria l.: A (16), B (29), C1 (36), C2 (44), D (16, 63); Hh; Cp
310. C. pseudocyperus L.: A (16), B (29), D (16, 42); Hh; Cp
311. C. x tetrastachya Trauntst. (canescens x stellulata): C1 (16, 36, 68);;
312. C. x corcontica Domin (limosa x paupercula): C2 (16);;
313. C. x pannewitziana Figert (rostrata x vesicaria): D (16);;
POACEAE
314. Echinochloa crus-galli (L.) P. Beauv.: C1 (68), D (16, 25, 48, !), E, F (!); Th; Cosm
315. Typhoides arundinacea (L.) Mnch.: B (49, !), C1 (68), D (20, 49, 61), E (!), F (18); Hh-H; Cp
316. Leersia oryzoides (L.) Sw.: D (49), F (18, 26); Hh; Cp
- f. patens Wiesbg.: D (16)
317. Alopecurus ventricosus Pers.: B (29); H; Eua
318. A. pratensis L.: A-F; H; Eua
319. A. geniculatus L.: B (29), C1 (37), C2 (68), D (16, 39), F (16, 18); H; E
320. A. aequalis Sobol.: C1 (36, 37), D (39, 48), F (17); H; Cp
321. Heleochloa alopecuroides (Piller) Host.: F (17, 18); Eh; Eua
322. H. schoenoides (L.) Host.: D (16, 48, 61); Th; Eua
323. Agrostis stolonifera L.: A-F; H; Cp
324. Calamagrostis canescens (Web.) Druce: D (16); H; Eua
325. C. neglecta (Ehrh.) Gaertn.: A (16); H; Cp
326. C. pseudophragmites (Haller) Koeler: B (!), C1 (68), D (63), E, F (!); H; Eua
327. Phragmites australis (Cav.) Trin. et Steud.: A-F; Hh; Cosm
- var. flavescens Custer: A, B, D (16)
328. Deschampsia caespitosa (L.) P. Beauv.: A-F; H; Cosm
329. Molinia coerulea (L.) Mnch.: B (29), C1 (36, 45, 51, !), D (61), F (26); H; Eua
- ssp. coerulea var. robusta Prahl.: A (16)
- ssp. arundinacea (Schrank) Paul.: B (16), C1 (37)
- ssp. litoralis (Host.) Paul.: A (16)
330. Poa palustris L.: B (29, !), D (42, 49), F (17, 26); H; Cp
331. P. remota Forselles: A (16); H; Eua
332. P. trivialis L.: B (29, 49), C1 (36, 68), C2 (22, 68, !), D (16, 39, !), E, F (!); H; Eua
- f. glabra (Döll) Nyár.: C1 (37), D (16)
333. Catabrosa aquatica (L.) P. Beauv.: B (49), D (39, 48, 61), F (4, 26); H; Cp
- f. salina (Schur) Nyár.: D (16)
334. Glyceria maxima (Hartm.) Holmberg: B (49, !), D (12, 49, !), F (18); Hh-H; Cp
- var. arundinacea (M. B.) Hay.: D (16)

335. G. fluitans (L.) R. Br.: C1, C2 (68), D (16); Hh-H; Cosm
336. G. plicata Fries: B (29, !), C1, C2 (68), D (61), E (!), F (18); Hh; Eua
337. G. nemoralis (Uechtr.) Uechtr. et Koern.: D (39, 42, 61); Hh; Ec-Sarm
338. Festuca pratensis Huds.: A-F; H; Eua
- ssp. pratensis var. subspicata (G.F.W.Meyer) A. et G.: B, D (16)
- ssp. appenina (De Not) Hegyi: F (26)
339. F. arundinacea Schreb.: B (29), C1 (68), C2 (44), D (10, 49, 61), F (26); H; Ec
ORCHIDACEAE
340. Orchis laxiflora Lam.: F (18, 26); G; Eua
- ssp. elegans (Heuff.) Soó: B (29, 49), D (16), E (!)
341. O. incarnata L.: A (16), B (16, 29), C1 (68), D (16, 61); G; Eua
- var. haematodes (Rchb.) Pauců et Beldie: B, D (16)
342. O. latifolia L.: A (16, !); G; Ec
343. O. cordigera Fries: A (16, 54), C2 (68); G; Alp-Carp-B
344. O. x maculatiformis Rouy (incarnata x maculata): A, D (16)
345. Epipactis palustris (L.) Cr.: A (16), B (16, 29), D (16, 61); G; Eua
ARACEAE
346. Acorus calamus L.: D (16), F (18, 26); Hh (G); Adv
347. Calla palustris L.: C1 (16, 37); Hh; Cp
LEMNACEAE
348. Lemna trisulca L.: B (29), D (61, 62), F (17, 18, 26, 28); Hh; Cosm
349. L. minor L.: B (29), D (10, 61, !), E (!), F (17, 18, 26, !); Hh; Cosm
350. L. gibba L.: A (16), B (16, 29), D (62), F (17); Hh; Cosm
351. Spirodela polyrrhiza (L.) Schleiden: E (!), F (17); Hh; Cosm
352. Wolffia arrhiza (L.) Harkel: F (17); Hh; Atl-M

The aquatic and paludal vegetation

Generally speaking, the vegetation of the Valley of Someş has a vertical distribution: typical mountainous associations on the superior courses of Someşul Mare, Someşul Cald and Someşul Rece (respectively „A", C1" and „C2" sectors), hilly and plateau vegetaion on the inferior course of Someşul Mare, on the course of Someşul Mic, and on the first segment of the „united" Someş („B", „D" and „E" sectors), and lowland vegetation on the inferior course of the „united" Someş („F" sector). In the previous chapter we have already pointed out some characteristics of the vegetation of the Someş sectors. From the 200 identified vegetal associations a number of 91 are aquatic or paludal ones (Table 1.). These belong to 34 alliances, 23 orders and 19 classses.

Rivers	No. of species	No. of associations	No. of aquatic and paludial sp.	No. of aquatic and paludial associations
Someşul Mare	909	84	254	39
Someşul Cald	734	61	132	36
Someşul Rece	583	36	115	27
Someşul Mic	1049	108	233	56
Someşul "Unit"	759	75	235	36
Total	**1670**	**200**	**352**	**91**

Table 1. The distribution of the macrophyte species and associations in the Someş Valleys

The conspect of the vegetal associations

LEMNETEA W. Koch et Tx. 1954
LEMNETALIA W. Koch et Tx. 1954
Lemnion minoris W. Koch et Tx. 1954
1. Lemnetum minoris (Oberd. 1957) Müller et Görs 1960: B (29), D (61, 62, !), E (!), F (26, 28, !)
Utricularion vulgaris Pass. 1964
2. Lemno-Utricularietum vulgaris Soó 1928: D (62, 65)
POTAMETEA Tx. et Prsg. 1942
POTAMETALIA W. Koch 1926
Ranunculion aquatilis Pass. 1964
3. Ranunculo trichophylli-Callitrichetum cophocarpae Soó (1927) 1960: D (61, 62)
4. Callitrichetum cophocarpae-palustris (Rațiu 1966) Drg. 1989: C1 (!)
Potamion W. Koch 1926 emend. Oberd. 1957
5. Myriophyllo-Potametum Soó 1934: D (61, 62), F (26)
- *myriophylletosum verticillati* Soó 1957: D (61)
- *myriophylletosum spicati* Soó 1957: D (12, 61)
6. Potametum crispi Soó 1927: D (61, 62, !), F (26)
7. Parvopotameto-Zannichellietum (Baumann 1921) W. Koch 1926: D (65)
- *potametosum pusilli* Soó (1927) 1973: D (62)
Nymphaeion Oberd. 1957 emend. Neuhausl 1959
8. Potametum natantis Soó 1927, Eggler 1933: B (!), D (12, 42, 61, !)
9. Polygonetum natantis Soó 1927: D (61)
- *potametosum natantis* Soó 1964: D (61)
10. Potametum lucentis Hueck 1931: F (26)
RUPPIETALIA J. Tx. 1960
Ruppion maritimae Br.-Bl. 1931
11. Ruppietum rostellatae (Todor 1948) Pop et all. 1988: D (61)
PHRAGMITETEA Tx. et Prsg. 1942
PHRAGMITETALIA W. Koch 1926 emend. Pign. 1953
Phragmition australis W. Koch 1926 emend. Soó 1947
12. Scirpo-Phragmitetum W. Koch 1926: B (29, !), D (7, 12, 32, 42, 53, !), E (!)
- *phragmitetosum* Soó 1957: B (!), D (10, !), E, F (!)
- *glycerietosum maximae* Pázmány 1966: D, E (32)
13. Typhaetum angustifoliae (All. 1922) Pign. 1943: F (!)
- *typhaetosum latifoliae* Pop et all. 1988: B (29), F (28)
14. Typhaetum latifoliae Soó 1927: C2 (!), D (42, !), F (!)
15. Schoenoplectetum lacutris Eggler 1933: B (49, !), D (42, !), F (1)
16. Glycerietum maximae Hueck 1931: B (!), D (12, 49, !), F (1, 55)
Bolboschoenion maritimi Soó (1945) 1947
17. Bolboschoenetum maritimi Soó (1927) 1957: B (!), D (10, 42, 61, !), E (!)
18. Schoenoplectetum tabaernemontani Soó (1927) 1949: D (61, 65)

19. Eleocharietum palustris Schennikov 1919, Soó 1933: B, C2 (!), D (42, !)
NASTURTIO-GLYCERIETALIA Pign. 1953
Glycerio-Sparganion Br.-Bl. Et Siss. Ex Boer 1942
20. Equiseto-telmateji-Glycerietum nemoralis Szabo 1971: D (61)
21. Sparganio-Glycerietum fluitantis Br.-Bl. 1925: D (65)
22. Glycerietum plicatae Oberd. (1952) 1957: B (29, !), D, E (!)
Phalarido-Glycerion Pass. 1964
23. Equisetetum fluviatilis Soó (1927) 1947: C2 (!)
24. Phalaridetum arundinaceae Libb. 1931: D, E (!)
25. Calamagrostietum pseudophragmitis Beldie 1967, Kopecky 1968: B, D, E (!)
MAGNOCARICETALIA Pign. 1953
Magnocaricion elatae W. Koch 1926
26. Caricetum rostratae Rübel 1912: B (29), C2 (!)
27. Carici-Menyanthetum Soó (1938) 1955: B (29)
28. Caricetum gracilis Almquist 1929, Grabner et Hueck 1931, Tx. 1937: B (29, 49), C1 (!), D (12, 49), E (!), F (28)
29. Caricetum acutiformis Sauer 1937: D (12, 61), F (!)
- caricetosum ripariae Soó 1957: B (29), F (1, 55)
30. Caricetum ripariae Soó 1928: B, D (49)
31. Caricetum vulpinae Soó1927: B (29, 49), D (61)
ISOETO-NANOJUNCETEA Br.-Bl. Et Tx. 1943
NANOCYPERETALIA Klika 1935
Nanocyperion flavescentis W. Koch 1926
32. Pycreo-Juncetum Soó et Csűrös 1944: D (48, 61)
33. Juncetum bufonii Morariu 1956, Philippi 1968: C1 (!)
34. Peplido-Limoselletum aquaticae Philippi 1968: B (29)
35. Dichostyli-Gnaphalietum uliginosi (Horvatic 1931) Soó et Tímár 1947: F (17)
MONTIO-CARDAMINETEA Br.-Bl. Et Tx. 1943
MONTIO-CARDAMINETALIA Pawl. 1928
Cardamini-Montion Br.-Bl. 1925
36. Cardaminetum amarae (Rübel 1912) Br.-Bl. 1926: C1 (!)
- chrysosplenietosum (Lungu 1971) Drg. Hoc loco: C2 (!)
SCHEUCHZERIO-CARICETEA NIGRAE Nordh. 1936
SCHEUCHZERIO-CARICETALIA NIGRAE (W. Koch 1926) Görs et Müller ex. Oberd. 1967
Rhyncosporion albae W. Koch 1926
37. Rhyncosporetum albae W. Koch 1926: C1 (45, 56)
38. Caricetum limosae Br.-Bl. 1921: C1 (45)
Caricion canescenti-nigrae (W. Koch 1926) Nordh. 1936
39. Carici stellulatae-Sphagnetum Soó (1934) 1954: C1 (45), C2 (44, !)
- nardetosum strictae Lupşa 1971: C2 (!)
40. Carici rostratae-Sphagnetum Zólyomi 1931: C1 (45, !), C2 (44, !)
TOFIELDIETALIA Prsg. apud Oberd. 1949
Eriophorion latifolii Br.-Bl. Et Tx. 1943

41. Carici flavae-Eriophoretum Soó 1944: A, B (!), D (65)
OXYCOCCO-SPHAGNETEA Vr.-Bl. Et Tx. 1943
SPHAGNETALIA Pawl. 1928
Sphagnion fusci Br.-Bl. 1920
42. Sphagnetum fusci Luq. 1926: C1 (53)
43. Eriophoro vaginato-Sphagnetum recurvi-magellanici (Weber 1902) Soó (1927) 1954: C1 (45, !), C2 (44, !)
- *callunetosum* Lupşa 1971: C2 (!)
- *empetrosum nigrae* Lupşa 1971: C2 (!)
- *empetroso-callunetosum* Lupşa 1971: C2 (!)
- *cardaminosum pratensis* Pop et all. 1988: C1 (!)
-*caricetosum rostratae* Lupşa 1971: C1 (!)
MOLINIO-ARRHENATHERETEA Tx. 1937
MOLINIETALIA w. Koch 1926
Calthion palustris Tx. 1937
44. Calthaetum laetae Krajina 1933: C1 (50, !), C2 (22, 56, !)
- *eriophorosum angustifolii* Resmeriţă 1969: C1 (!)
45. Scirpetum sylvatici Schwick. 1944: B (!), D (61), E (!)
46. Epilobio palustri-Juncetum effusi Oberd. 1957: A (24), B (29)
47. Cirsietum cani Tx. 1951: C1 (!)
48. Cirsietum rivularis Ralski 1931: C1 (!)
49. Cirsio-Polygonetum bistortae Tx. 1951: B (29), C1 (!)
Holco-Juncion Pass. 1964
50. Holcetum lanati Issler 1936: C1 (50)
Filipendulo-Petasition Br.-Bl. 1947
51. Filipenduletum ulmariae W. Koch 1926: C1, C2 (!), D (61)
52. Chaerophylletum hirsuti (Soó 1927) Krajina 1933: C1, C2 (!)
53. Petasitetum hybridi (Dost. 1933) Soó 1940: B (23), C1 (!)
Agrostion stoloniferae Soó (1943) 1971
54. Agrostietum stoloniferae (Újvárosi 1941) Burduja et all. 1956: A-F (!)
- *eleocharetosum* Soó 1964: D (61)
- *poetosum trivialis* Soó 1957: B, D (!)
- *ranunculetosum repentis* Soó 194: D, E (!)
- *narcissetosum stellaris* Mititelu et Dorca 1987: B (29)
55. Poaetum pratensis Răvăruţ et all. 1956: B (29), D (!)
56. Alopecuretum pratensis Regel 1925, Nowinski 1928: A (!), D (10, 12, !), E, F (!)
- *deschampsietum caespitosae* (Soó 1947) Drg. Hoc loco: D (12), E (!)
- *ranunculetosum acris* Juhász apud Soó 1957: E (!)
- *agrostideto-festucetum pratensis* Soó 1947: F (!)
57. Festucetum pratensis Soó 1938: B (49, !), C1 (50), D (7, 12, 42, 49, !), E (!), F (28, !)
- *dactyletosum glomerati* Grigore 1971: D (49, !)
- *caricetosum distantis* Pázmány 1971: E (!)
58. Agrostideto-Festucetum pratensis Soó 1949: D (12, 49), E (!)

59. *Poaetum trivialis* Soó 1940: D (12)
60. *Caricetum distantis-vulpinae* Todor 1947: D (10)
61. *Ranunculo strigulosi-Equisetetum palustris* Gh. Popescu 1975: C2 (!), D (61)
Deschampsion caespitosae (Horvatic 1930) Soó 1971
62. *Agrostio stoloniferae-Deschampsietum caespitosae* Újvárosi 1947: B (29), D (49, 61, !), F (1, 55)
NARDO-CALLUNETEA Preising 1949
NARDETALIA (Oberd. 1949) Preising 1949
Potentillo ternatae-Nardion Simonn 1957
63. *Carici-Nardetum strictae* Resmeriţă et Pop 1986: C1 (!)
PUCCINELLIO-SALICORNIETEA Ţopa 1939
FESTUCO-PUCCINELLIETALIA Soó 1968
Juncion gerardii Wendelbg. 1943
64. *Juncetum gerardii* (Warming 1906) Wenzl. 1934: D (42)
65. *Plantagini cornuti-Agrostietum stoloniferae* Soó et Csűrös 1944: D (42, 65)
66. *Triglochineto maritimae-Asteretum pannonici* (Soó 1927) Ţopa 1939: B (29), D (10, 61, 65)
ARTEMISIETEA Lohm., Prsg. et Tx. 1950
CALYSTEGIETALIA SEPIUM Tx. 1950
Calystegion sepium Tx. 1947 ex Oberd. 1949
67. *Calystegietum sepium* (Tx. 1947) Pass. 1964: D (!)
68. *Stenacti-Solidaginetum* Oberd. 1957: D (49)
69. *Polygonetum cuspidati* Tx. et Raabe 1950 apud Oberd. 1967: D, E, F (!)
70. *Helianthetum decapetali* Morariu 1967 n.n.: B (30), D, F (!)
71. *Eupatorietum cannabini* Tx. 1937: C2, E (!)
BIDENTETEA TRIPARTITI Tx., Lohm. et Prsg. 1950
BIDENTETALIA TRIPARTITI Br.-Bl. Et Tx. 1943
Bidention tripartiti Nordh. 1940
72. *Bidentetum tripartiti* (W. Koch 1926) Libbert 1932: B (!), D (65), E (!)
- *polygonetosum hydropiperi* Tx. 1937: D (!)
73. *Bidentetum cernui* Slavnic 1951: F (!)
PLANTAGINETEA MAJORIS Tx. et Prsg. 1950
PLANTAGINETALIA MAJORIS Tx. (1947) 1950
Agropyro-Rumicion crispi Nordh. 1940
74. *Rumici-Alopecuretum geniculati* Tx. (1937) 1950: D (!), F (28)
75. *Lolio-Potentilletum anserinae* Knapp 1946: A (24), B (!), D (39), E (32, !), F (!)
76. *Rorippo silvestri-Agrostietum stoloniferae* (Moor 1958) Oberd. et Th. Müller 1961: B (!)
77. *Ranunculetum repentis* Knapp 1946 emend. Oberd. 1957: D, E (!)
78. *Juncetum effusi* Soó (1931) 1949: B, C2, F (!)
79. *Junco-Menthetum longifoliae* Lohm. 1953: D (!), F (28)
EPILOBIETEA ANGUSTIFOLII Tx. et Prsg. 1950
PETASITO-CHAEROPHYLLETALIA Morariu 1967
Telekion Morariu 1967 n.n.
80. *Petasito-Telekietum speciosae* (Morariu 1967 n.n.) Beldie 1967: A (!)
- *matteucciosum* Drg. Hoc loco: A (!)

BETULO-ADENOSTYLETEA Br.-Bl. 1948
ADENOSTYLETALIA Br.-Bl. 1931
Adenostylion alliariae Br.-Bl. 1925
81. Carduo personatae-Heracleetum palmati Beldie 1967: C1, C2 (!)
- *angelicosum archangelicae* Drg. 1984: C2 (!)
SALICETEA PURPUREAE Moor 1958
SALICETALIA PURPUREAE Moor 1958
Salicion albae (Soó 1930 n.n.) Müller et Görs 1958
82. Salici-Populetum (Tx. 1931) Mejer Drees 1936: D (7, 61), E, F (!)
83. Salicetum albae-fragilis Issler 1926 emend. Soó 1957: B (!), D (12, 61, !), F (17, 26, !)
- *amorphosum fruticosae* Morariu et Danciu 1970: F (!)
- *cornetosum sanguineae* (Wendelbg. Zelinka 1952) Kárpáti 1958: D (32)
- *rubosum* Pázmány 1966: E, F (32)
- *echinocystosum* Drg. 1991: D, E (!)
84. Salicetosum purpureae (Soó 1934 n.n.) Wendelbg.-Zelinka 1952: B, C1 (!), D (12), E, F (26, !)
- *agrostetosum* Pázmány 1971: E, F (32)
85. Salicetum triandrae Malcuit 1929: B (32), D (12, 32, 61, !), E (32), F (17, 32)
- *amorphosum fruticosae* Borza 1954 n.n.: D (!)
- *agrostetosum* Pázmány 1966: E, F (32)
- *phragmitetosum* Kárpáti apud Pázmány 1966: D (12, 32)
- *salicetosum viminalis* Soó 1958: E (!)
Salicion eleagni (Aichinger 1933) Moor 1958
86. Salici-Myricarietum germanicae Moor 1958: B (5), C1, C2 (!), D (12, 61)
ALNETEA GLUTINOSAE Br.-Bl. Et Tx. 1943 emend. Müller et Görs 1958
SALICETALIA AURITAE Doing 1962 emend. Westh. 1969
Salicion cinereae Müller et Görs 1958
87. Alno-Salicetum cinereae (Kobendza 1930) Pass. 1956: B (29), E, F (!)
QUERCO-FAGETEA Br.-Bl. Et Vlieger 1937 emend. Soó 1964
FAGETALIA SILVATICAE (Pawl. 1928) Tx. et Diem. 1936
Alno-Padion Knapp 1942 emend. Medwecka-Kornas 1957
88. Aegopodio-Alnetum glutinosae Kárpáti et Jurko 1961: A, B (!), C1 (41), D (61)
- *matteuccetosum* Pócsi 1962: B (!)
- *caricetosum remotae* Zólyomi 1943: D (65)
89. Alnetum glutinosae-incanae Br.-Bl. (1915) 1930: B (23)
90. Alnetum incanae (Brockmann 1907) Aichinger et Siegrist 1930: A, C1, C2 (!)
- *matteuccetosum* Soó 1962, Lungu 1971: C2 (!)
- *salicosum* Lungu 1971: C1 (!)
VACCINIO-PINETEA Pass. Et Hofm. 1968
ERIOPHORO-PINETALIA Pass. Et Hofm. 1968
Eriophoro-Pinion Pass. Et Hofm. 1968
91. Eriophoro-Pinetum silvestris Hueck 1925 emend. Pass. Et Hofm. 1968: C1 (!)

Conclusions and proposals

The flora of the Someş Valleys is rich in species. These are varied as a result of the length of the river course which runs through several different forms of relief with different geological substrata and varied soils, as well as distinct climates.

The natural primary vegetation lacks almost totally, being replaced by a secondary one. Through repeated cutting the primary woods evolved towards the actual ones, with a medium to high degree of vitality or they were replaced by secondary lawns and agricultural crops.

In the last few decades a large number of adventive species (mostly from North-America and Asia) invaded the Someş rivers valley. Most of them formed hygro-mesophilous associations of adventive weeds, frequenlty dominated by a single species, or with a very low biodiversity, associations which modified the „aspect" of the riverside and took the places of the primary vegetation. Among these species we mention: *Polygonum cuspidatum, Echinocystis lobata, Sicyos angulata, Solidago gigantea, S. canadensis, Helianthus decapetalus* and *Rudbeckia laciniata.*

The chorology of many species of plants and vegetal associations as well as their evolution is often (and in many places) disturbed or even halted by the human factor through a series of actions and activities like clearings, mowings, the intensive grazing, drainings and embankings, by the use of pesticides, etc. All these determined the disappearance of some tens of species of plants and vegetal associations from the floristic-phytocenologic inventory of the Someş Valleys - just in this century (e.g. *Marsilea quadrifolia, Hippuris vulgaris, Acorus calamus* etc.).

We have to mention the large peat-bogs from the Someşul Rece and Someşul Cald rivers, with a large number of protected species, like *Drosera rotundifolia, Drosera intermedia, Vaccinium oxycoccos, Empetrum nigrum, Eriophorum vaginatum, Salix pentandra,* etc.

The characteristics of the flora and vegetation, correlated to that of the water, points out the fact that the best preserved sectors, with a certain ecologic equilibrium are, in order, the „A", „C2", „C1" and „B" sectors, the otherd obviously degraded, with a precarious ecologic equilibrium, the destruction and pollution degree being higher in the „D" sector, then in the „F" and finally in the „E" (Figure 1.).

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Water quality of Hungarian reach of the River Szamos

József Császár

Introduction

„In the thought of progress there was as much ignorance as self-confidence. We felt we were so up that we did not even look round to see whether we were really up or actually down."

(László Németh)

Németh László put down the thought chosen as a motto with the purpose of comparing modern and primitive art. We believe his thought can be considered valid in every walk of life where our activities have been motivated by progress at any cost.

The industrial countries of the west woke up earlier than us, they began to mitigate and eliminate the conflict between production and the condition of the environment. But we must add to this that earlier awakening was forced by pollution manifold greater than our problems ...

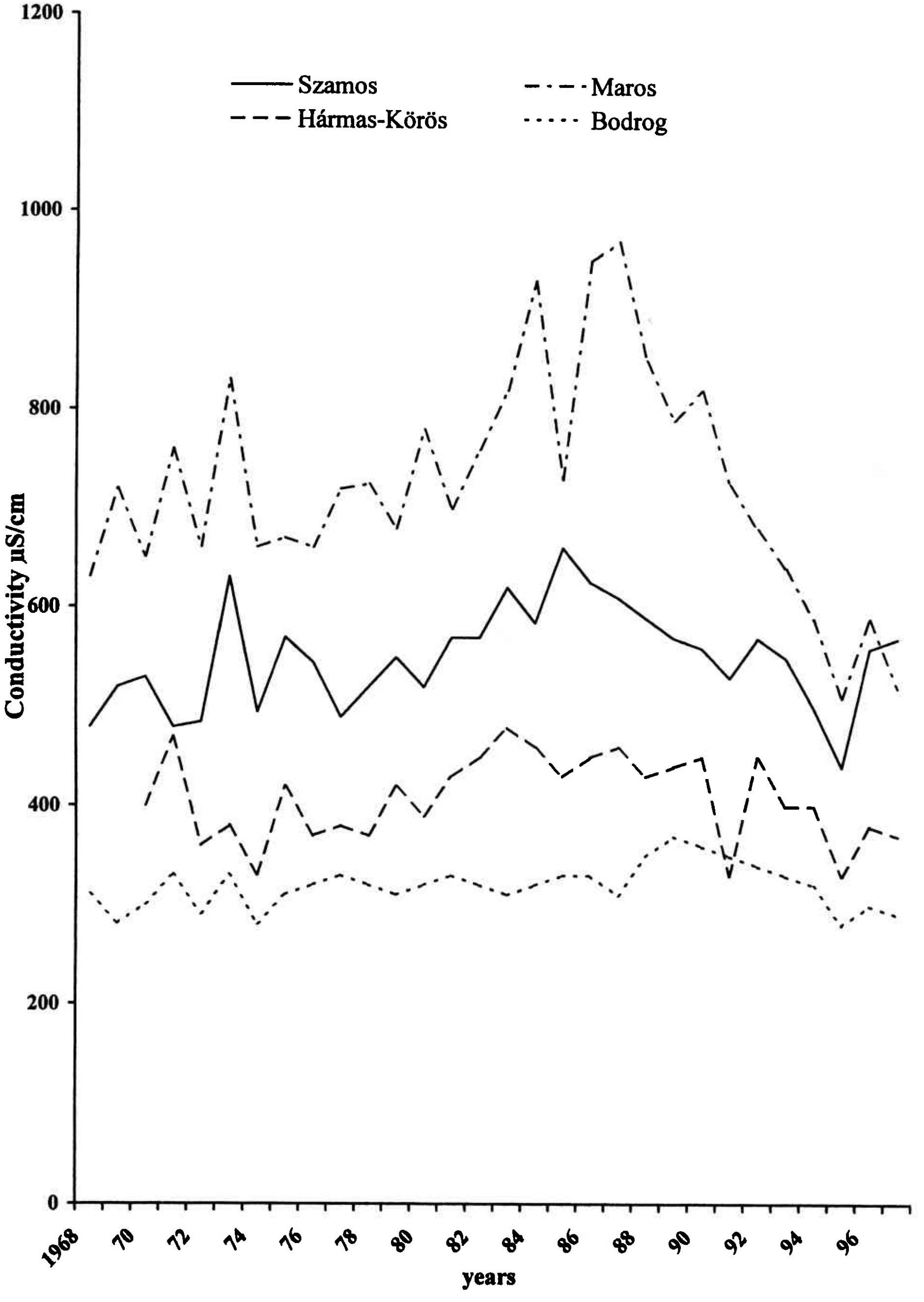
Our domestic results dwarfed beside the rehabilitation of the Thames and the Rhine, the decrease of a few percentage points in pollution hardly improved the quality of our waters.

If we look at the data in Table 1. and compare the pollution of the last column, 1995, and the previous one, 1990, we might as well be proud because the decrease is considerable. The only trouble is that we did not achieve it with activities to protect the water quality, but with the collapse of our agricultural and industrial production. This process is not characteristic of only our country, Figures 1-4. may prove it quite convincingly that the situation is similar to ours with our northern and eastern neighbours. We have selected 4 illustrative components: the annual averages of dichromate Chemical Oxygen Demand (COD_{Cr}) indicating organic pollution, ammonium and nitrate ions (NH_4^+ and NO_3^-) indicating plant nutriments and conductivity showing the pollution with mineral salts, which provide a comprehensive description of the changes in the water quality.

	estimated					measured				
tons/day	**1950**	**1955**	**1960**	**1965**	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**
COD_{Cr}	250	400	600	800	1000	1137	1105	964	835	478
Oil/Fat	15	30	40	55	70	90	60	47	49	27
NH_4^+	15	30	36	58	60	65	77	73	59	32
Mineral salt	1000	1500	1700	2000	2200	2417	2727	3059	3055	1812

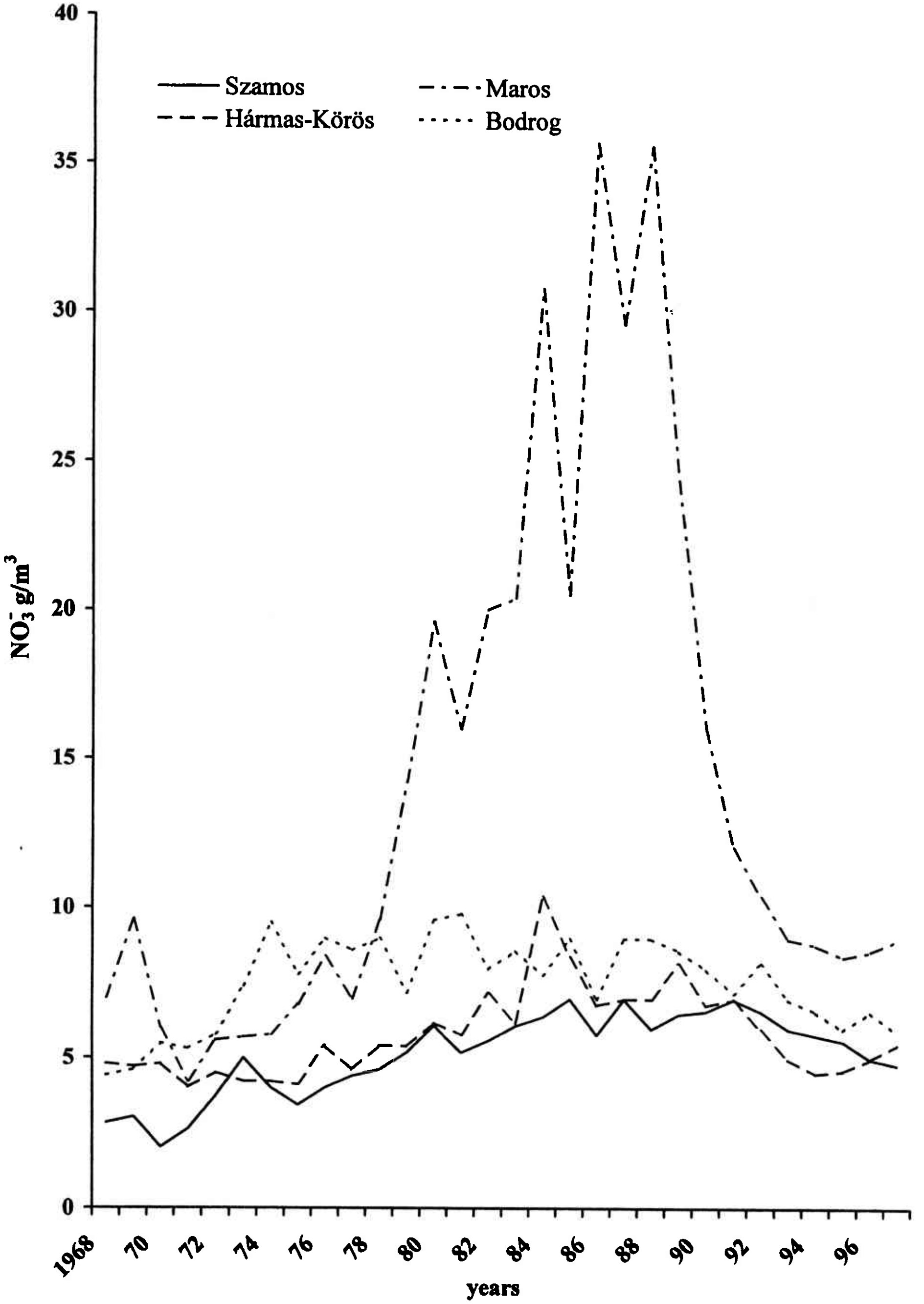
		%		
100	97	85	73	42
100	70	52	54	30
100	118	112	91	49
100	110	126	126	75

Table 1.



1200
1000
800
600
400
200
0
Conductivity µS/cm
Szamos
Hármas-Körös
Maros
Bodrog
1968
70
72
74
76
78
80
82
84
86
88
90
92
94
96
years

Figure 1.


40
35
30
25
20
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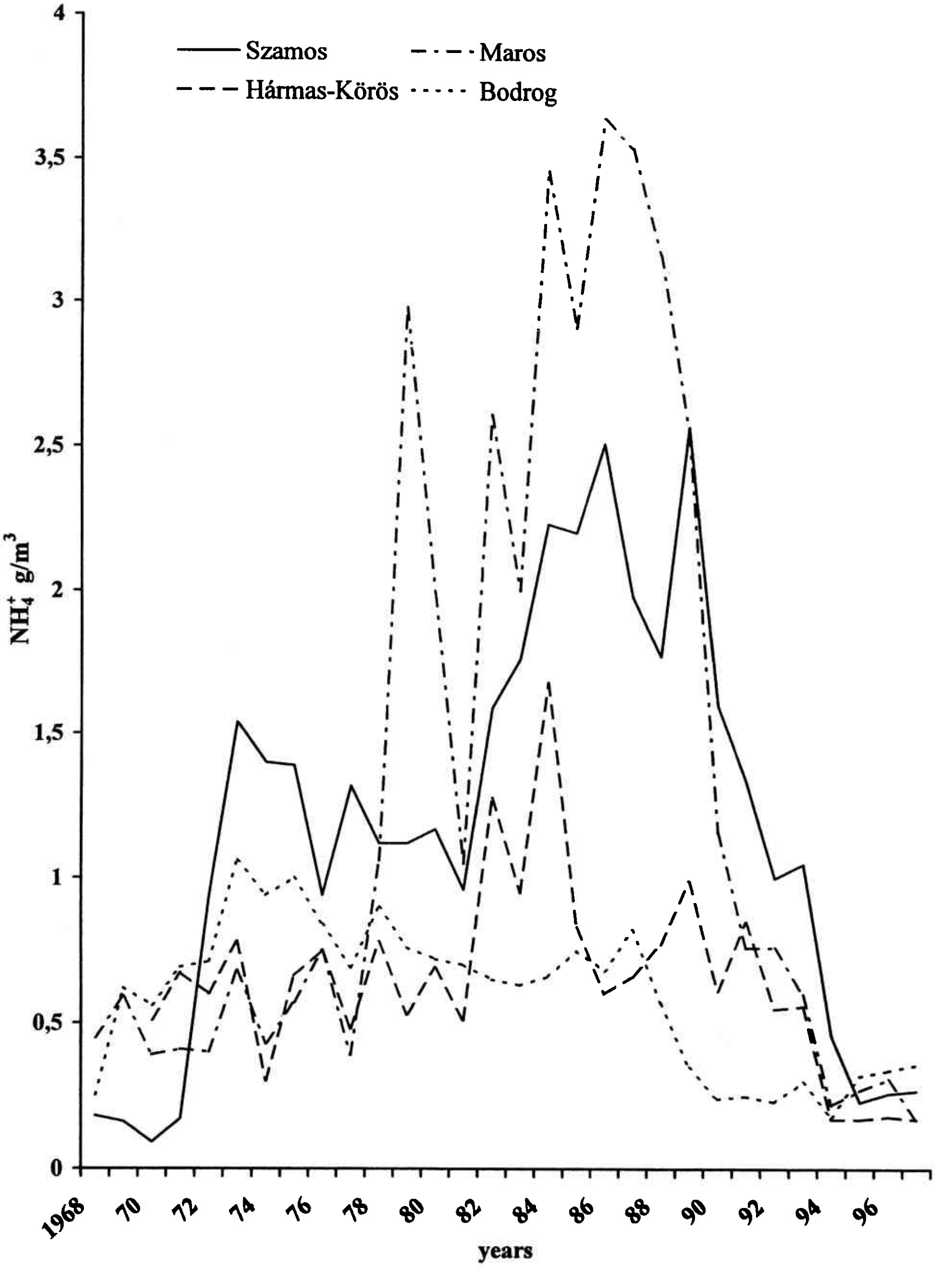
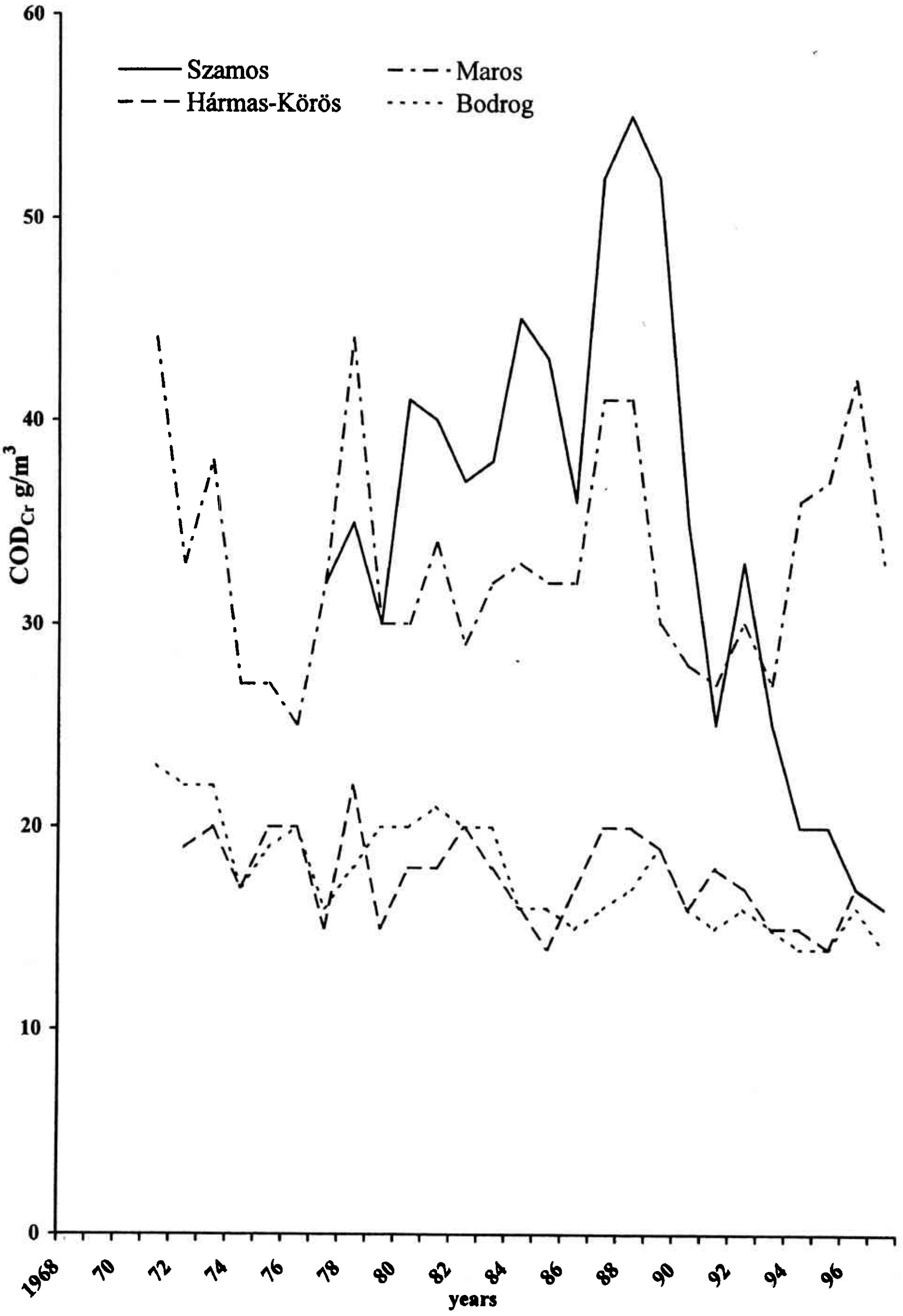
10
5
0
Szamos
Maros
Hármas-Körös
Bodrog
NO_3^- g/m^3
1968
70
72
74
76
78
80
82
84
86
88
90
92
94
96
years

Figure 2.



Szamos
Maros
Hármas-Körös
Bodrog
4
3,5
3
2,5
2
1,5
1
0,5
0
NH_4^+ g/m^3
1968
70
72
74
76
78
80
82
84
86
88
90
92
94
96
years

Figure 3.



Szamos
Hármas-Körös
Maros
Bodrog
60
50
40
30
20
10
0
COD_{Cr} g/m^3
1968
70
72
74
76
78
80
82
84
86
88
90
92
94
96
years

Figure 4.

We think we must review the happenings and problems - everyone in their own field - of the past now, at the time of a standstill, of decline. We should do it not for the sake of historical fidelity but, having drawn the conclusions, for being able to avoid the pitfalls.

We must carry out a thorough and profound analysis, because in our opinion there is quite a great chaos, a great deal of impatience and unfounded expectation of a miracle. Here we suspect we do not know well the natural conditions of the water quality, the conditions which has never experienced human activity. According to our system of evaluation watercourses that have not been polluted by humans often prove to be polluted. This is a problem, because we are unable to determine what we actually want to achieve, or because we will search for solutions in the wrong way.

Hydrographical data in the catchment area of the River Szamos

Meteorological observations in Hungary

Within the catchment area of the Szamos there is a meteorological station at Fehérgyarmat and at Jánkmajtis. We did not consider the data of precipitation accessible in hydrographical almanacs worth processing, because of the 411 rkm of the Szamos only 50 rkm are in Hungary and of the drainage basin of 15,880 sq. km only 306 sq. km. The river regime of the Szamos is determined by the hydrometeorological events across the border, whose data, however, we do not possess.

We have found a sequence of data noteworthy for us in the relevant value of the Hydrographical Almanac: the monthly average precipitation (in millimeter) for the confluence of the Szamos counted on the basis of the period between 1901 and 1940.

01	02	03	04	05	06	07	08	09	10	11	12	M
44	39	44	51	78	99	87	82	559	61	53	51	748

The data shown are averages, in the high mountainous areas of the Nagy-Szamos/Someşul Mare[1] the annual mean is 1000-1300 mm, at the spring of the Kis-Szamos/Someşul Mic it is only 800-1000 mm, whereas in the Transylvanian Basin it is about 600 mm.

1.1% of the drainage basin of the Szamos/Someş is high mountains, 24.9% is a mountainous area between the heights of 600-1600 m, 60.4% is a hilly area above 200 m, whereas 13.6% is plain below the altitude of 200 m.

Flowage from the area is determined by the combination of the relief conditions, precipitation, evaporation and the vegetation. In recent years it has also been influenced by reservoirs built in the catchment area. We should also mention that permeation, in other words the water-retaining capacity is medium in the drainage basin.

A consequence of the enlisted factors is that flood waves of a few days may occur after intense showers at any time of the year.

[1] The first name is Hungarian, and the second Romanian

Hydrometric staffs

On the Hungarian section of the Szamos there are 3 hydrometric staffs, run by the Hydrographical Service:

Cserger	47.6 rkm	catchment area 15 283 sq.km
Nábrád	19.0 rkm	catchment area 15 750 sq.km
Olcsvaapáti	4.7 rkm	catchment area 15 876 sq.km

Data concerning water levels can be obtained from the Hydrographical Almanacs, at the Csenger stretch daily water output is also provided.

The hydrometric staff at Csenger has been in operation since 1875. On the basis of the Water Management Institute (WMI)'s processing of the observations between the years 1921 and 1976 we have completed Figure 5., where we illustrate the monthly mean streamflow at various probability. Dinamism of average monthly streamflow shown in Figure 6.

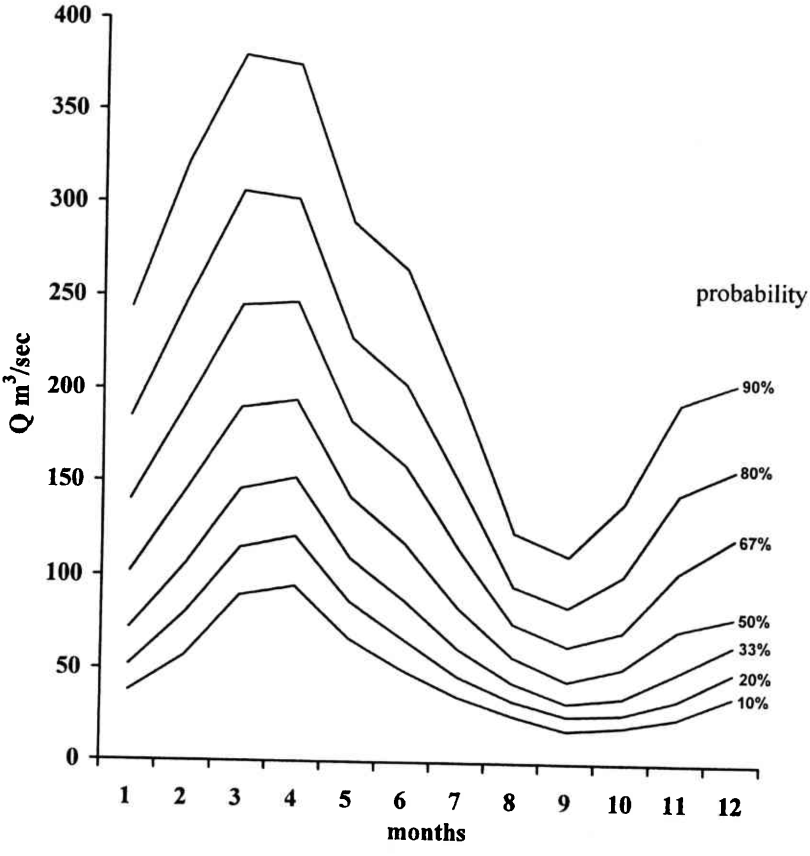


Figure 5.

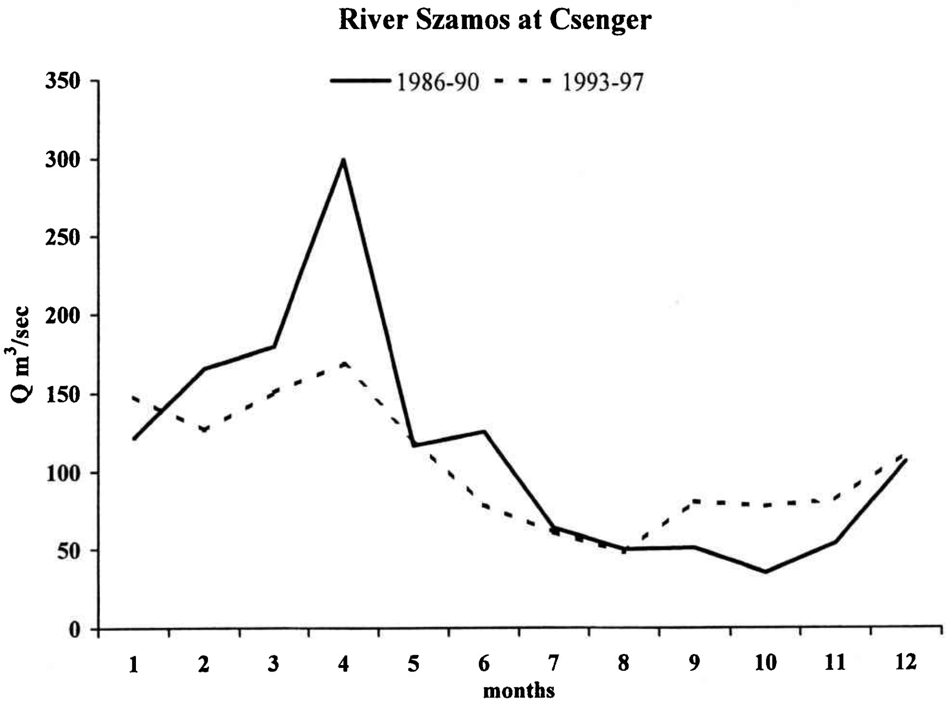


Figure 6.

On counting the stream of mass we noted that the Environment Management Institute (EMI) has recently corrected the data registered at taking the samples; they replace them with the daily average streamflow recorded in the Hydrographical Almanacs. With regards to the insignificant difference this change causes in the stream of mass we have not corrected our former calculations.

Concerning the water quality the accumulation process of the waters flowing down the bed is of vital importance. Water penetrating through impermeable layers is filtered, surface flowage may or does wash pollution of colloidal or coarse disperse phase. Changing water output results in changing speed (stream energy), so settling or stirring occur. Dilution provided by the water mass flowing down is also important here.

The rate of flowage, even the averages counted from data of long periods may vary from day to day. To illustrate the degree of importance of this we show the averages counted from the streamflow measured at the same time as taking the samples, for four 5-year periods: 1. 1976-80, 2. 1981-85, 3. 1986-90, 4. 1993-97.

	Jan.	Febr.	March	April	May	June	July	Aug.	Sept.	Okt.	Nov.	Dec.	average
1	281	277	278	295	242	164	147	103	106	88	105	150	186
2	180	151	261	193	244	142	99	70	41	63	70	207	143
3	122	166	180	300	117	126	63	58	51	35	54	107	114
4	148	127	151	169	121	79	61	48	81	78	82	112	105

Table 2.

So we must remark that our survey of the water quality was conducted while the water output was decreasing, which was seemingly moderated by fluctuation, but was still significant. The trend of the annual Mean Streamflow for the 21-year period between 1976 and '97 is as follows:

$MWD_n=188-4.6n$ $r=0.65$ $M=135\ m^3/sec$

MWD_n is the mean streamflow of the nth year in the time sequence, „n" is the number of years, „r" is the correlation factor, which characterizes the closeness of the relationship determined by the equation.

We would also like to remark that the trend is characteristic only of the time period the calculation included. Extrapolation must not be done, because, for instance, we could easily come to the conviction that the Szamos would completely dry up in about 40 years. With examining long - 40-50-year time sequences of MWD the regression factor usually turns out 0.

Water quality surveys

The first water quality surveys (that we know of) were conducted by VITUKI (Water Research Center for Water Resources Development) in the case of the Szamos in the first half of the 50s, and the results were published in 1957 entitled „Qualitative evaluation of our watercourses".

The condition of the water quality was indicated in 5 sections of the Szamos with 1 sample every season.

The water managament created the network of laboratories examining water quality in the 2nd half of the 60s for every Disctrit Water Authority, and since 1968 the Szamos has been measured at the 46.4 rkm - Csenger - weekly, and at the 19.2 rkm - Tunyogmatolcs - every second week. At the beginning of the 90s the laboratory network was annexed to conservation and examination of the Tunyogmatolcs section ceased on the basis of MSZ (Hungarian Standard) 12749. We should not complain about it because domestic pollution is insignificant, so a fundamental change in the water quality does not occur from Csenger to the confluence of the river with the Tisza at Vásárosnamény.

The watercourse sections to be sampled, frequency sample-taking, the range of components to be examined, methodology to be applied at the evaluation, and the methods of examination were determined by MSZ 10-172/1-83, MI 10-172/2-84 and MI 10-172/3-85 until 1994. Since then the regulations of MSZ 12749 have been compulsory.

Evaluation of the water quality data of the Szamos

At first approach we have reviewed the data sequences of the 1955 measures of VITUKI. We have concluded that concentrations of pollutants of the 4 samples for the 4 sections each - Csenger, Szamossóly, Tunyogmatolcs, Olcsvaapáti - did not reveal significant differences, as it had been expected on the basis of minimal domestic pollution. Here we present mean concentrations for every season:

	Winter	Spring	Summer	Autumn
COD_{Mn} g/m^3	6,60	16,50	14,80	4,60
BOD_5 g/m^3	2,20	2,90	2,70	1,20
O_2 g/m^3	98,00	105,00	99,00	96,00
NH_4^+ g/m^3	157,00	172,00	150,00	288,00
NO_3^- g/m^3	8,20	9,20	4,00	2,60
Conductivity uS/cm	474,00	334,00	420,00	559,00
Na^+ g/m^3	41,00	25,00	-	80,00
Cl^- g/m^3	52,00	272,00	35,00	110,00
Total Hardness g/CaO/m^3	122,00	86,00	91,00	112,00
Total suspended matter g/m^3	127,00	241,00	529,00	54,00
pH	6,38	7,62	8,12	7,62
Q m^3/sec	106,00	326,00	180,00	35,00

Table 3.

Judging from the results the water of the Szamos was being polluted even then. It was probably the communal pollution entering the water without purification at Kolozsvár/Cluj and Szatmárnémeti/Satu Mare, though only a small amount yet, of which the biologically decomposable part the watercourse managed to tackle.

Permanganate Chemical Oxygen Demand (COD_{Mn}) points to an important factor: the amount of most probably dissipative organic debris that though biologically not, but chemically is oxidizable, will grow with increasing streamflow.

The mineral indicators changing with streamflow prove a more powerful dilution, which indicates the input of industrial pollution and/or mine waters containing minerals.

Oxygen concentrations did not show any significant pollution.

Nitrate ion concentrations are already surprisingly high - then they may not have come from artificial fertilizer washed in.

Examination of oxygen budget

Of the components of oxygen budget we have got an unbroken time sequence between 1968-97 and 1976-90 concerning 5-day Biochemical Oxygen Demand (BOD_5) and the oxygen saturation; their descriptive statistics already enlisted are summed up in Figures 7-8.

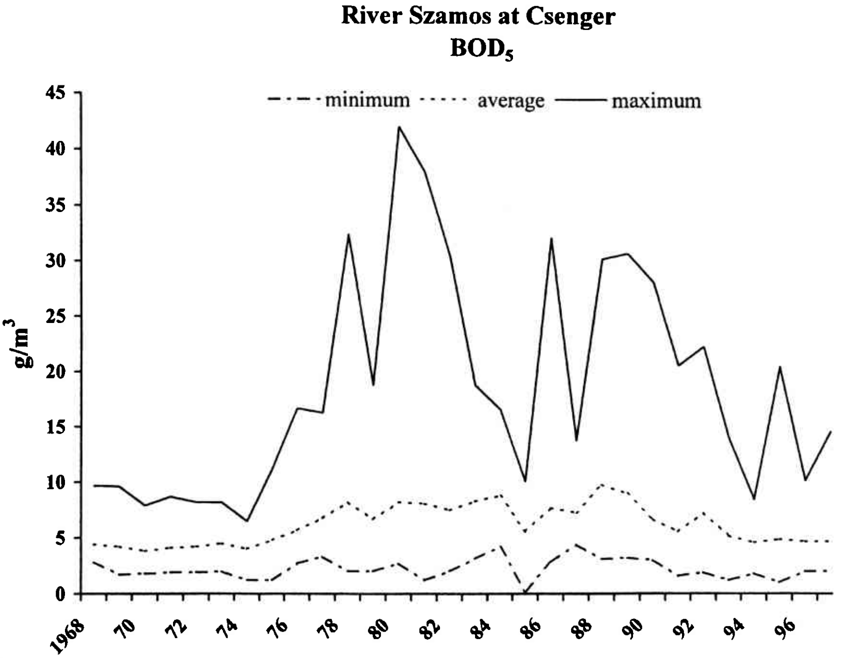


Figure 7.

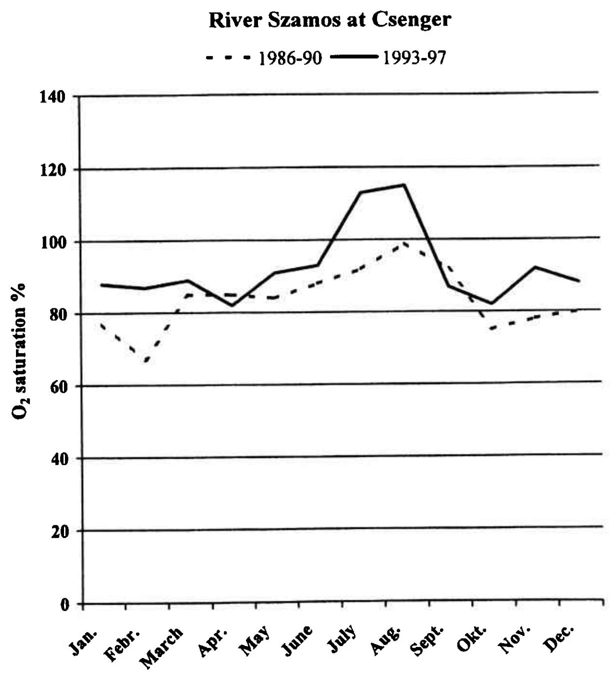


Figure 8.

The 30-year time sequence can be characterized mathematically by the trends below.

BOD_5	Cn= 5.30+0.057n	r=0.28	M=6.88 g/m^3	s=1.76
O_2 Sat. %	Tn=83.6+0.201n	r=0.33	M=86.7%	s=5.22

Where n=number of year, Cn=concentration of nth year, Tn= saturation of nth year, r= correlation coefficiens, M= average value, s=variance

The original (shaken, so containing floating substances, too) BOD_5 have been examined regularly only since 1977 at the Csenger section of the Szamos, so the trends of the four important components between 1977-97 are also determined:

COD_{Cr}	Cn=45.1-0.94n	r=.0.50	M=34.8 g/m^3	s=11.4
COD_{Mn}	Cn=17.1—.39nn	r=0.54	M=12.8 g/m^3	s=4.39
BOD_5	Cn=8.63-0.15n	r=0.60	M=6.93 g/m^3	s=6.15
O_2 Sat. %	Tn=79+0.68n	r=0.67	M=88.5 g/m^3	s=6.15

The characteristic annual statistics of COD_{Cr} in the time sequence between 1977-97 are shown in Figure 9.

River Szamos at Csenger
COD_{Cr}

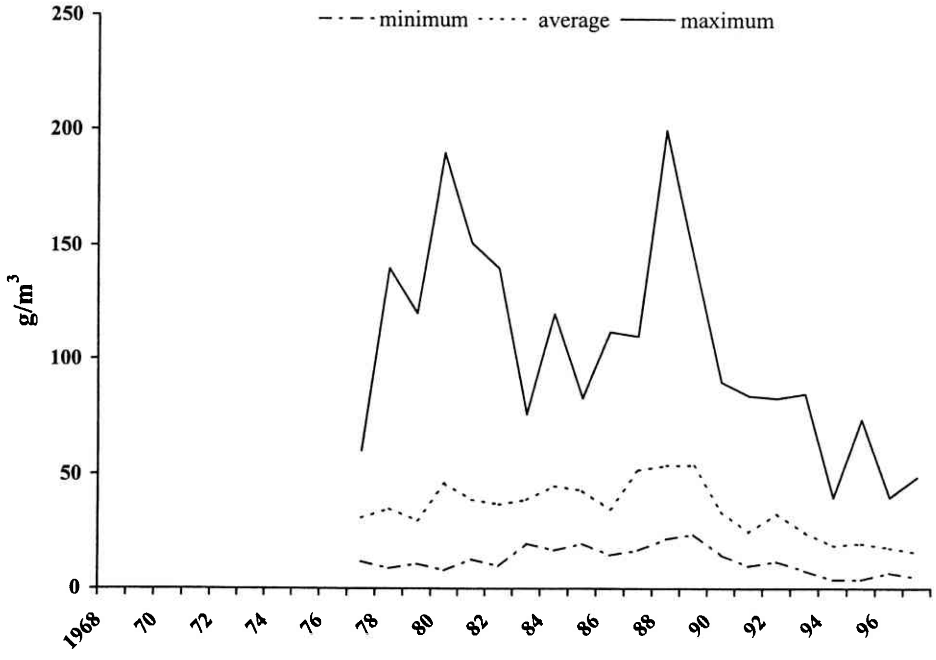


Figure 9.

The picture based on the figure and the four trends are encouraging, but the comparatively low correlation factors of the trends indicate the uncertainly of the change.

Here the problem is the same as the one we mentioned previously, namely that annual fluctuation, ascending and descending trends following each other loosen up the relationship expressed by the equation.

Looking back at the 1955 BOD_5 concentrations we can say that until the commencement of regular measurements in 1968 they nearly doubled. The sequences of the 10-year trends also testify that deterioration was continuous until the period of 1976-85 in a way that the intensity of the increase reached its maximum between 1972-81. At the same time the relationship was closest with a 0.92 correlation factor. After that during four further periods deterioration decreased - and the relationship loosened - and then it began to decrease in an uncertain way, the trend being broken time and again. We found the highest figure of the degree of decrease in the 1988-97 period.

With the slid trends of COD_{Cr} and COD_{Mn} the situation is similar to the previous one with the remark that the first periods are missing here, and the improvement presented itself later, though more markedly then.

Oxygen saturation until 1968 - probably in relation to the increase of biologically decomposable organic pollution (natural purification!) - decreased compared with the 1955 concentrations, but the minimums did not become catastrophic even in that period. Concentrations have increased since 1977-86, but the process became consummate in the 1990s. This phenomenon is not clearly positive, because maximum concentrations show considerable supersaturation, which indicates the commencement of the eutrophication process of the river. *It is to be feared that in summer and early autumn excess growth of algae occurring more and more often in the 90s will contribute to the increase of COD and BOD, and because of the change of the milieu algae dying in the Tisza may or will lead to great lack of oxygen.*

We have already seen at the 1955 examinations that concentrations in different seasons show significant differences. For a more detailed presentation of this we have processed the concentration sequences of the COD_{Cr} for each season and month of the years 1976-90. The results are summed up in Table 4.

In order to get to know the concentration sequences in more detail we have arranged four 3-year sequences, and their total frequency is summed up in Table 4a. The table provides information about the improvement process as well, but it is more important that it informs us about the distribution of elements according to size. The proportion of the minimums and maximums of streamflow is 50-100, of the concentrations it is 15-50.

COD_{Cr} g/m^3

	n	M	s	Cv	min.	80%	95%	max.
Total	725	41	23	0.56	8	54	89	200
winter	178	43	23.5	0.54	11	52	87	200
spring	181	41	26.2	0.64	8	53	90	190
summer	183	40	20.4	0.51	14	52	81	120
autumn	183	40	21.6	0.54	9	55	80	140
January	65	42	20.1	0.48	11	56	76	112
February	555	43	28.2	0.65	15	50	89	200
March	59	44	25	0.57	13	55	92	151
April	58	37	20	0.54	8	48	78	100
May	64	41	31.5	0.76	10	53	90	190
June	559	40	24.4	0.61	14	49	104	120
July	62	40	19.7	0.5	15	55	72	100
August	62	40	17	0.42	15	51	68	92
September	60	40	21.4	0.54	11	54	72	140
October	64	37	18.5	0.49	12	49	70	106
November	59	43	24.6	0.57	9	70	86	120
December	58	45	22.5	0.5	17	57	84	140

Table 4.

Summarized frequency
River Szamos at Csenger

1. 1978-80 **2.** 1981**3.** 1988**4.** 1991-93

	COD_{Cr} g/m3				COD_{Mn} g/m3				BOD_5 g/m3			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
minimum	8	10	15	8	2,4	4	5	2,6	2	1,2	3	6
5%	15	16	19	12	5,9	6,2	5,9	3,8	3,2	3,1	3,4	2
10%	18	20	23	13	6,6	7,3	7,5	4,8	3,9	4	4	2,6
20%	20	24	28	17	7,5	8,4	9,8	5,6	4,3	5,1	4,9	3,6
30%	24	27	31	19	9	9,6	11,2	6,6	5	5,6	5,9	4,2
40%	25	30	36	22	9,8	10,7	12,5	7,2	5,7	6,1	6,8	5
50%	30	33	40	24	10,4	12,5	14,8	8	6,1	6,7	7,1	5,4
60%	33	38	49	26	12,9	13,9	16,8	8,6	6,4	7,7	7,9	6
70%	38	40	55	29	14,8	16,3	18,7	9,4	7,6	8,6	8,9	6,6
80%	46	48	61	36	19,5	19,1	22,7	12,7	9,3	9,9	10,5	7,3
90%	65	60	78	48	26,8	24,5	29,8	15,7	13,3	12	14,9	9,8
95%	88	76	90	52	33,2	30,5	38	22	16,8	16,2	19,6	11,9
maximum	190	151	200	85	102	78,5	86,4	32,4	42	38	30,7	22,3
average	37	38	47	28	14,7	14,8	17,5	9,5	7,7	8	8,5	6

Table 4a.

Looking through these tables it is surprising that although the different figures of streamflow, as we have seen it, are arranged to a certain extent according to the months, we do not encounter excessive differences in the monthly statistics of the oxygen demand.

We suspect the increase of point-like pollutants behind the increase of concentration, or at least a drastic human interference with the natural condition of the drainage basin. After we have seen that streamflow has decreased in the past 10-15 years and that COD's and BOD to a lesser extent change inversely to streamflow we become uncertain at acknowledging the improvement process because it might only be the play of nature: a considerable change in weather can reverse the whole process and after some years have passed we may have to endure a pollution similar to that of the 80s ... This uncertainty has been increased by the examination of the streams of mass, which we defined as the multiplication of concentrations and their respective streamflow. The stream of mass of the three main components, expressed in tons/day dimension:

year	COD_{Cr}	COD_{Mn}	BOD_5
1981	988	500	190
1982	608	225	104
4983	3224	108	67
1984	368	138	64
1985	698	254	83
1986	693	275	148
1987	564	212	69
1988	654	212	117
1989	649	304	128
1990	209	70	39
1991	305	111	70
1992	338	131	89
1993	280	95	51
1994	137	45	31
1995	269	104	64
1996	180	68	45
1997	210	86	63

Table 5.

Trends of average load (L) of pollution of the 17 years:

COD_{Cr}	Ln=757-35.3n	r=0.74	M=440 tons/day	s=234
COD_{Mn}	Ln=312-15.5n	r=0.67	M=173 tons/day	s=112
BOD_5	Ln=128-4.9n	r=0.59	M=84 tons/day	s=41

According to the equations under 17 average daily streams of mass decreased by 600 tons with COD_{Cr}, by 264 tons with COD_{Mn} and 83 tons with BOD_5.

As far as we remember, however, Budapest did not perform daily organic pollution of 600 tons even at the height of industrial production - 48% of the domestic industry was concentrated there! - so, although we do not know the pollution of Transylvania, we doubt

600 tons of daily decrease. The trends do not tell us lies, but they do not separate the changes in pollution caused by nature and those caused by human interference, either.

Our scepticism outlined here is supported by Figure 10., too. They confirm the fact of a change, but the differences of pollution from month to month, their spring maximums and autumn minimums exclude the explanation that decreases in industrial and communal pollution are the causes.

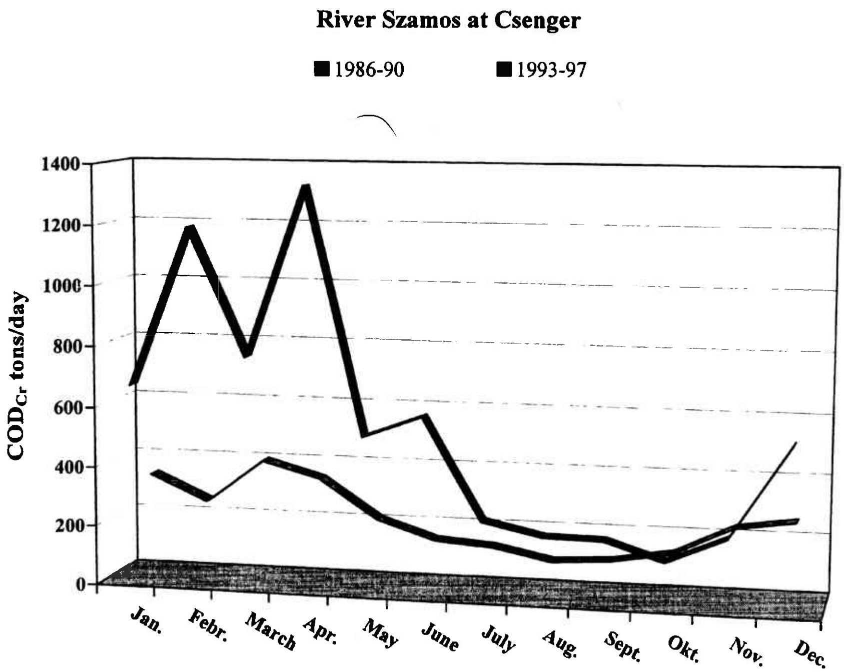


Figure 10.

The fact that the extent of changes expressed by the previous trends is unreal is „known“ by the trends as well, the question should only be put in a different way. The trend of streams of mass determined at or less than 100 m^3/sec streamflow:

COD_{Cr} Ln=194-4.22 r=0.48 M=148 tons/day s=52

so decrease is only 71.4 tons/day here for the 17 years.

To analyze the problem more thoroughly we have included in our examinations the time sequences of settled COD_{Cr} and COD_{Mn} that resumed in the 80s with the examination of the Csenger section. (COD of the original, so shaken, sample is proportional to all concentrations of organic matter, that of the settled sample is proportional to the dissolved and colloidal-phase ones, and the difference of the two is proportional to concentrations of organic matter in coarse disperse phase.)

The 7 thus gained concentrations of components characteristic of organic pollution have been arranged into 4-year periods according to the ranges of streamflow, parallel to streams of mass (Table 6.).

Table 6.

River Szamos at Csenger

1982-85

	n	Q	concentration g/m^3							stream of mass tons/day						
			COD_{Cr}			COD_{Mn}			BOD_5	COD_{Cr}			COD_{Mn}			BOD_5
		m^3/sec	total	diss.	susp.	total	diss.	susp.		total	diss.	susp.	total	diss.	susp.	
$Q \le 50$	66	38	44,3	34,4	8,9	14,4	5,9	8,5	9	117	89	28	38	31	7	23
$50 < Q \le 100$	59	70	35,5	23,6	11,9	11,4	7,5	3,9	6,6	214	142	72	69	44	25	40
$100 < Q \le 150$	19	131	42,2	26,8	15,4	13,5	8	5,5	7,7	445	286	159	145	86	59	82
$150 < Q \le 200$	19	177	32,6	20,4	12,2	10,2	6,5	3,7	5,2	500	314	186	156	100	56	77
$200 < Q \le 400$	30	258	39,1	21,5	17,6	15,4	6,8	8,6	6,3	905	468	437	369	147	222	141
$Q > 400$	10	578	57,4	26,4	31	26	10,2	16,1	11,2	3004	1254	1750	1346	498	1298	486

1986-89

	n	Q	concentration g/m^3							stream of mass tons/day						
			COD_{Cr}			COD_{Mn}			BOD_5	COD_{Cr}			COD_{Mn}			BOD_5
		m^3/sec	total	diss.	susp.	total	diss.	susp.		total	diss.	susp.	total	diss.	susp.	
$Q \le 50$	61	34	50,7	40,1	10,6	18	13,6	4,4	8,5	144	118	26	53	40	13	25
$50 < Q \le 100$	80	72	41,5	29,6	11,9	15,3	10,6	4,7	7,5	256	180	76	94	64	30	48
$100 < Q \le 150$	27	127	51,5	22,8	28,7	18,8	8,2	10	6,2	562	248	314	206	96	110	90
$150 < Q \le 200$	7	174	46,2	34,1	12	20,7	8,7	12	6,7	709	526	183	324	128	196	98
$200 < Q \le 400$	18	280	44,6	20,3	24,3	18,6	8,4	10,2	7,9	1120	517	603	490	224	266	201
$Q > 400$	13	639	85	28,5	56,5	31,8	10	21,5	15,8	4767	1593	3174	1812	583	1229	966

1990-93

	n	Q	concentration g/m^3							stream of mass tons/day						
			COD_{Cr}			COD_{Mn}			BOD_5	COD_{Cr}			COD_{Mn}			BOD_5
		m^3/sec	total	diss.	susp.	total	diss.	susp.		total	diss.	susp.	total	diss.	susp.	
$Q \le 50$	85	35	28	17,6	10,4	8,8	5,8	3	5,8	82	50	32	25	17	8	17
$50 < Q \le 100$	65	70	26,7	18,6	8,1	9,1	6	3,1	6,8	167	115	52	56	37	19	36
$100 < Q \le 150$	34	122	28	17,7	10,3	9,3	5,8	3,5	5,8	295	185	110	97	61	36	59
$150 < Q \le 200$	14	172	35,5	18,5	17	14,4	8,2	6,2	8,1	551	275	276	229	118	111	116
$200 < Q \le 400$	2	267	43,8	26	17,8	13,5	7,1	6,4	9	1107	600	507	278	171	107	210
$Q > 400$	5	678	56,5	35,1	21,4	29	10,4	19,4	16,8	3688	1936	1752	1760	613	1147	964

Tables containing the figures of concentration and stream of mass corresponding the ranges of streamflow tell us everything about the relationship between streamflow and pollution, though the facts reflected are to a certain extent distorted.

Distortion is caused by the fact that the figures of concentration and stream of mass are averages of elements characterizes by 30-40% dispersion in time, and like every statistics, the average bears estimation errors. According to the statistics estimation error of the averages is the smallest - $s_M=s/n^{1/2}$ -, but if dispersion (s) is high and the number of elements (n) is low, it may be considerable. Lines 1-3 of the tables provide more or less correct information, but with the streamflow increasing the number of elements decreases, so these lines may have a standard error of 10%.

It is a further problem that, besides streamflow, pollution is influenced by even more circumstances, of which trends are either the opposite of or the same as those of streamflow. What constitutes a change in the water quality are the mass of organic matter produced during eutrophication and degrading in the self-purification processes of the watercourse, daily, seasonal etc. fluctuation of point-like communal and industrial pollution, the characteristics of the hydrometeorological time sequence before the time the examination takes place, etc.

Examination of organic pollution in several watercourses of various streamflow and degree of pollution, according to the ranges of streamflow, however, allows us to draw some general conclusions:

With watercourses of no or insignificant pollution the lowest concentrations of COD and BOD - and the lowest streams of mass - can be detected at low waters.

With the streamflow increasing, oxygen demands in settled samples fluctuate only statistically, rather than change in a predicted direction, the shaken ones increase slightly, but surely.

From streamflow of middle-water mark onwards oxygen demands of both the settled and the shaken samples increase, at high waters dramatically, 2-5 fold. Increase in the stream of mass, naturally, intensifies with increasing streamflow.

Streams of mass of ranges at low waters may be exceeded manifold by those of ranges at high waters - according to the characteristics of the watercourse. With the Danube having more even streamflow this proportion does not reach 10, with the Tisza it exceeds 70. (These proportions are true for the cleanest sections.)

The most sensitive response to point-like pollution is at the ranges of streamflow at low waters. Expressed in percentage points they cause the most significant change in the stream of mass here. So the proportions indicated above usually decrease if pollution increases.

What is important in the above-mentioned conclusions, as far as the water quality of the Szamos is concerned, is that decrease of point-like pollution can be inferred from the decreases of stream of mass in ranges at low and mean stage. On the basis of the periods 1986-89 and 1994-97, therefore, decrease of pollution for every range of streamflow is the following:

	COD_{Cr}	COD_{Mn}	BOD_5
$Q \leq 50$	144-82= 62 t/day	53-23=30 t/day	25-16=9 t/day
$50 < Q \leq 100$	256-90=166 t/day	94-34=60 t/day	48-24=24 t/day
$100 < Q \leq 150$	562-167=395 t/day	206-65=141 t/day	90-46=44 t/day
$150 < Q \leq 200$	709-281=428 t/day	324-105=219 t/day	98-72=26 t/day
$200 < Q \leq 400$	1120-656=464 t/day	490-259=231 t/day	201-172=29 t/day
$Q > 400$	4767-1400=3367 t/day	1799-559=1229 t/day	966-352=614 t/day

Table 7.

Of these, concerning decrease of pollution, the first three lines should be considered. All in all, decrease of organic matter with regard to point-like pollutants can be put at 100-150 tons/day of COD_{Cr}, 50-80 tons/day of COD_{Mn} and 20-30 tons/day of BOD. With the last component, decrease of the pollution measured at the site of its discharge must have been greater, but some of it did in the past and does now already decompose by the time it reaches the site of sampling at the border section.

Figures of organic pollution has decreased, but they still exceed the desired degree significantly. Considering the unavoidable presence of purified industrial and communal sewage, by operating the purifying technologies at a high degree of efficiency a further decrease of 20-30% can be achieved. In ranges at low waters it should stabilize with concentrations at 12 g/m³ of COD_{Cr}, at about 4-5 of COD_{Mn} and at about 3-4 g/m³ of BOD.

At evaluating the Szamos no miracle should be expected. High waters will invariably wash in great amounts of humus and plant debris under humification, so because of COD_{Cr} as well as the other indicators of organic matter, the condition of the water quality will come out IV and V.

Pollution of plant nutriments

Plant nutriments - inorganic nitrogen and phosphorous derivatives (ammonium-ammonia NH_4^+-NH_3, nitrite NO_2^-, nitrate NO_3^- and PO_4^{3-}) - the survey data of all phosphorous and all nitrogen concentrations are only short-term ones. Characteristic annual statistics of the time sequences of the 4 important components are included in Figures 11-14.

Trends of the 25-year averages - 1973-97 - of the 3 important components:

NH_4^+	Cn= 1684-23.7n	r= 0.22	M= 1377 mg/m³	s= 634
NO_3^-	Cn= 4.7+0.071n	r= 0.52	M= 5.6 mg/m³	s= 0.98
PO_4^{3-}	Cn= 303-1.6n	r= 0.21	M= 263 mg/m³	s= 54.5

Table 8.

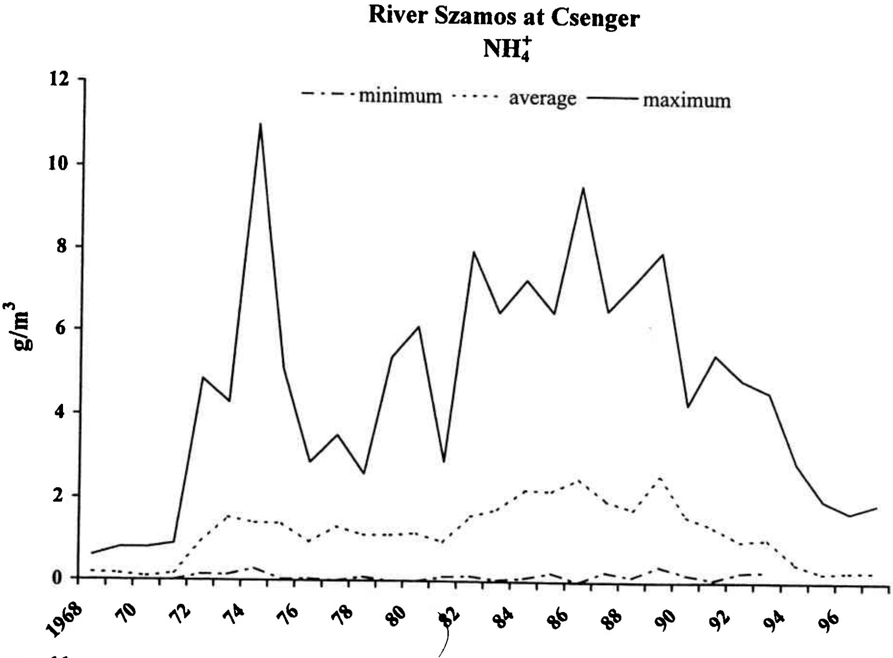


Figure 11.

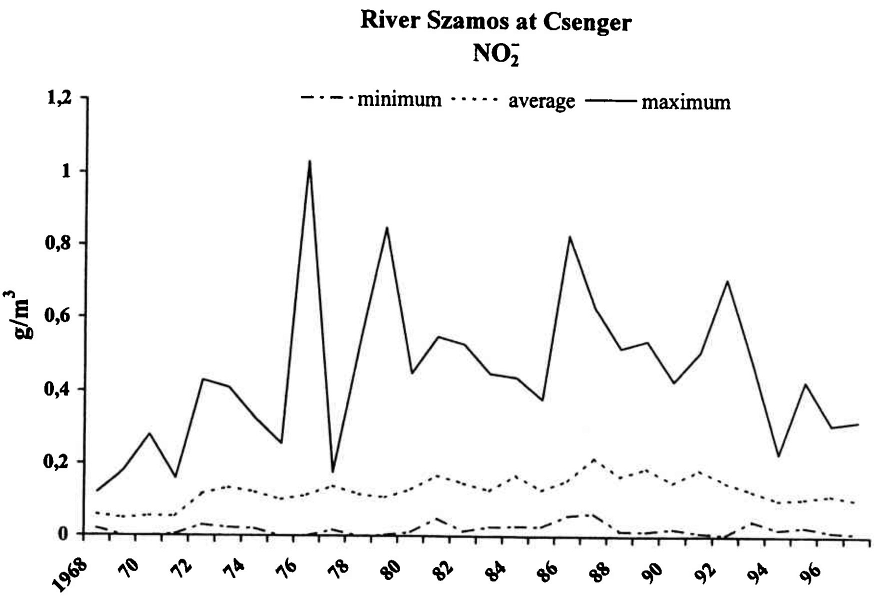


Figure 12.

River Szamos at Csenger
NO_3^-

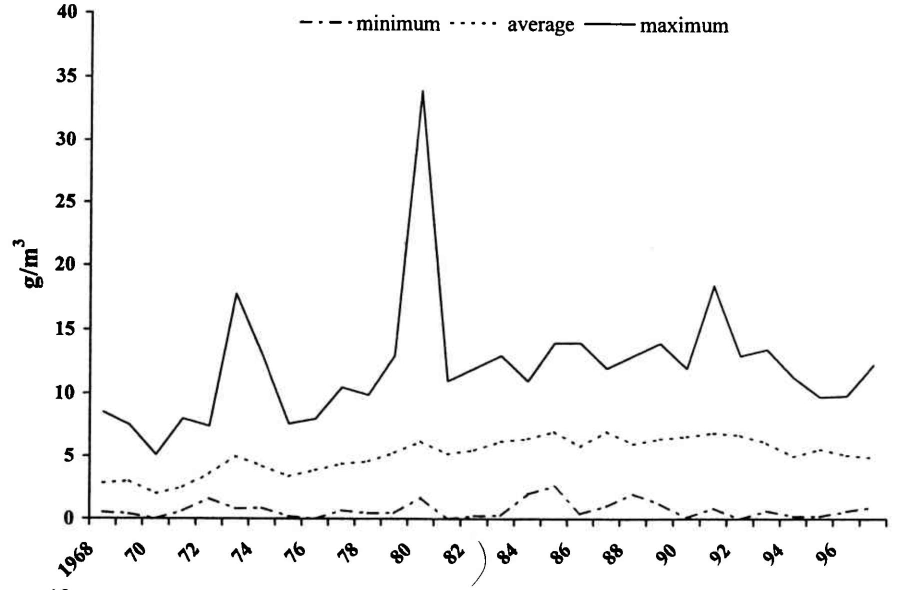


Figure 13.

River Szamos at Csenger
dissolved ortho-PO_4^{3-}

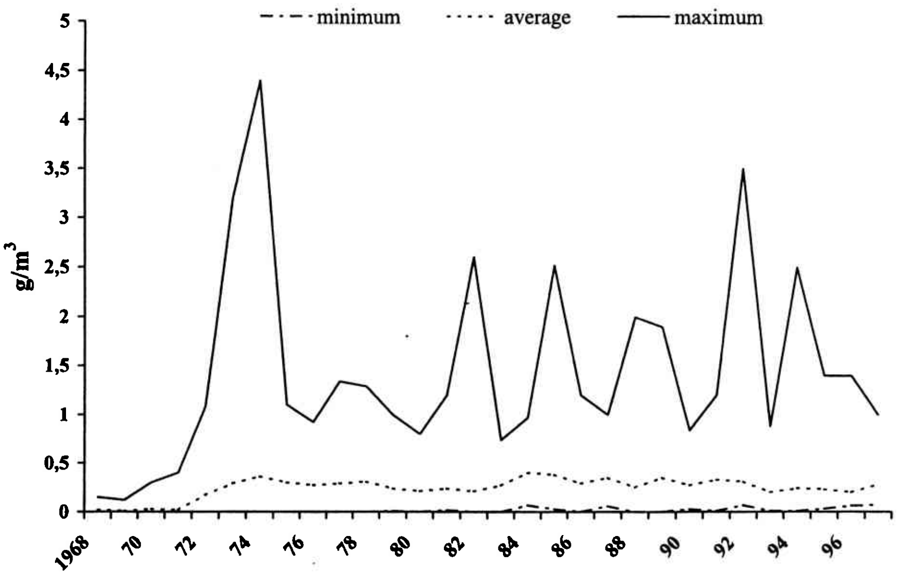


Figure 14.

Correlation factors indicate unstable relationships, which is natural, because there were deteriorations as well as improvements during the 25 years, not considering the loosening caused by natural fluctuation.

Average annual streams of mass have also been completed for the 15-year time sequence of the survey results:

	NH_4^+	NO_3^-	PO_4^{3-}
year	tons/day		
1983	13,1	57,5	1,7
1984	10,5	51,7	2,2
1985	29,8	128,3	4
1986	20,4	101,5	2,5
1987	18,3	76,7	2,8
1988	15,3	79,1	1,8
1989	26,6	78,4	2,8
1990	11,1	43,7	1,6
1991	11,3	69,6	2,7
1992	15,6	63,2	3,2
1993	12,1	64,7	1,7
1994	3,7	43,5	2,2
1995	2,1	58,2	2,3
1996	2,2	47,2	2,4
1997	2,6	52,5	3,3

Table 9.

If we assume that in the drainage basin of the Szamos there are about half a million people who live in areas with sewerage and the collected sewage water is purified at high-power sewage clarification plants decomposing 80-85% of the pollution, then nutriment pollution of the population can be estimated from the specific data. Communal pollution by our estimation can be put at 3500-4000 kg/day of ammonium ion and about the same amount of orthophosphate ion.

Comparing the estimated average pollution with the estimated streams of mass it should be remarked that stream of mass of ammonia-ammonium ions and orthophosphate ions in the last 4 years came primarily from communal sewage water. Great amounts of the previous years flowed into the receiver from food processing plants and animal (primarily swine) farms.

What is mainly responsible for nitrate ion pollution is agriculture, but some of it came from areas without sewerage trickling from nitrated ground water.

Surveying nitrate ion it should be highlighted that its concentrations in the Szamos are usually favourable, since 1968 its maximum has exceeded the limit value of class I only once and has come close to it once. It must, therefore, be assumed that the Hungarian wasteful use of artificial fertilizer was never the case in Transylvania.

The origin of phosphate and ammonium from point-like sources is proven by the fact that their sequences, arranged according to ranges of streamflow decreased with streamflow except for the range of maximum streamflow. The origin of nitrate pollution from diffuse sources is proven by their increase with streamflow, characteristic of dissolution.

Orthophosphate concentrations in themselves would not hurt the interest of those using water, but together with the excess of nitrogen compounds it reaches the degree of concentration which generates eutrophication processes. This situation has been the case for more than a decade, but biological overproduction in the Szamos was detected only in the 90s, primarily in the summer and early autumn seasons.

Determination of a-chlorophyll serves as the measurement of that component - alga production. Unfortunately it has been measured regularly only for the past 4 years - 1994-97. The previous period can be described by the samples of some fragments taken when algal bloom was detected. On the basis of evaluations of other surface waters, however, we know that in our watercourses, considering conditions of flowage within our country, oxygen supersaturation can only be measured if intense primary production, namely algal bloom, occurs. Maximums at times occurred indeed in past years, too, so eutrophication is not a new phenomenon in the Szamos either.

Monthly averages of a-chlorophyll are shown in Figure 15.

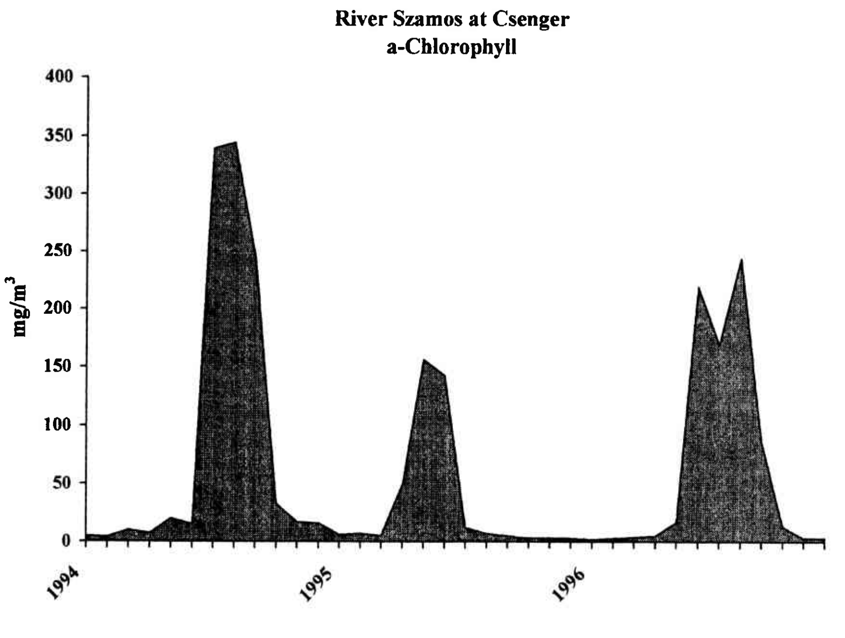


Figure 15.

Eutrophication of the Szamos is an especially dangerous phenomenon because the Upper Tisza is poorer in nutriments, so the conditions of survival of the alga production's great number of specimen is not provided. The biomass of algae dying in the Tisza starts to decompose rapidly, and the process is so intense that it uses up the river's oxygen reserves. The decreased content of dissolved oxygen may cause the destruction of the living world, among others the fish stock ...

This is the reason why it is more and more urgent to reconsider our sewage purification strategy. At our sensitive watercourses - which is not one? - sewage clarification stage III removing phosphorus must be implemented. Our domestic activities in themselves cannot reverse the unfavourable process, because, for instance, domestic pollution of the Szamos is nearly 0, we must therefore persuade our neighbours up the watercourses to undertake the job.

Doing the job should not be started with towns and villages of a couple of hundred inhabitants, which we assume watercourses the size of the Szamos will cope with, but with cities and towns of 5-10 thousand inhabitants.

Mineral salt components

Mineral salt content and composition of surface waters are primarily determined by geochemical features. Content of all salts, and conductivity proportionate to this are determined by specific flowage.

Trend of annual averages of the conductivity in the 30-year time sequence between 1968-97:

$S_n=527+1.6n$ $r=0.26$ M=551 uS/cm $s=51.9$

Machua`s radial figures - % ratio of ions equivalent- of the Tisza and its main tributaries can be seen in Figure 16. beside which average conductivity between the years 1976 and 1990 is also indicated. From this it is clear that watercourses coming from the Transylvanian Basin - Szamos, Maros - have a comparatively high sodium and chloride ion content, and have high concentrations of salt and conductivity as against the other 3 watercourses.

Considering the drainage basins it is acceptable, but we are convinced that the two watercourses have been polluted, besides natural components, with industrial sewage and mine water containing great amounts of salt, especially common salt, NaCl.

It is proven by, for example, the fact that there are close hyperbolic relations, characteristic of dilution, between streamflow and the specific concentrations. (If there is no point-like pollution, the nature of the relation will remain the same, though, but the correlation factors will be lower.)

Relations established in 1986

Conductivity	$S_n= 231+16594/Q$	$r= 0.93$	M= 668 uS/cm
Total dissolved matter	$C_n= 236+9493/Q$	$r=0.92$	M= 454 g/m^3
Sodium ion	$C_n= 17.8+2440/Q$	$r=0.94$	M= 67.3 g/m^3
Chlorid ion	$C_n= 42.8+2143/Q$	$r=0.77$	M= 89.7 g/m^3

Table 10.

According to the results point-like pollution in 1996 decreased, so the established relations became looser:

Conductivity	$S_n=418+9493/Q$	$r=0.57$	M=568 uS/cm

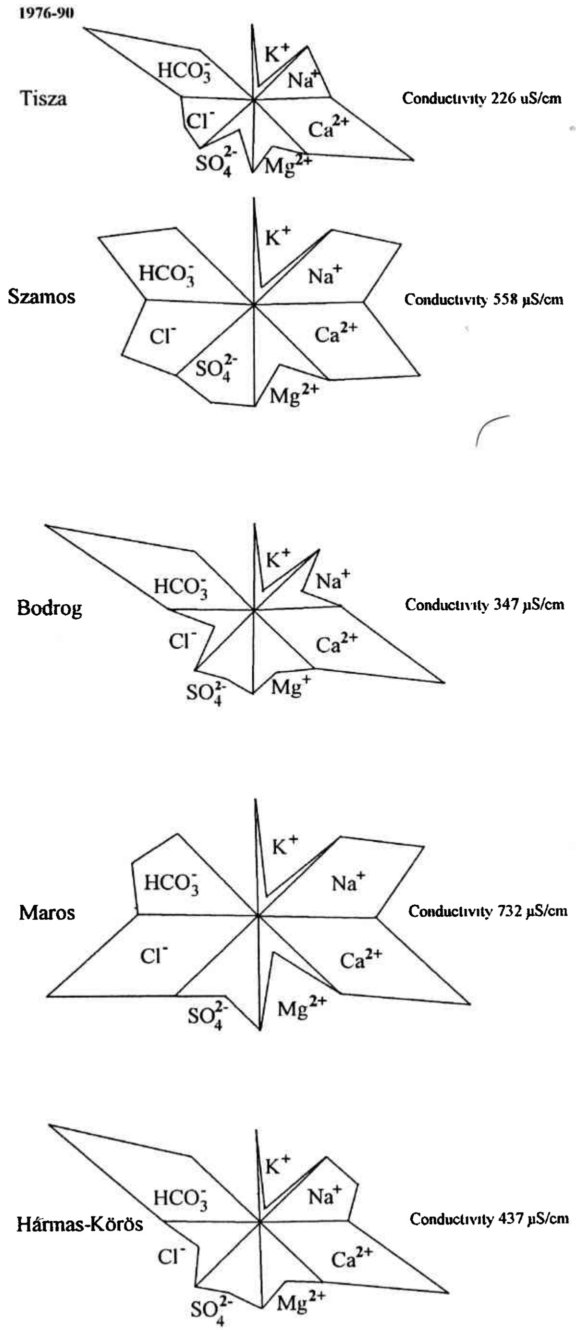

1976-90
Tisza
HCO3-
Cl-
SO4 2-
K+
Na+
Ca2+
Mg2+
Conductivity 226 uS/cm
Szamos
HCO3-
Cl-
SO4 2-
K+
Na+
Ca2+
Mg2+
Conductivity 558 µS/cm
Bodrog
HCO3-
Cl-
SO4 2-
K+
Na+
Ca2+
Mg+
Conductivity 347 µS/cm
Maros
HCO3-
Cl-
SO4 2-
K+
Na+
Ca2+
Mg2+
Conductivity 732 µS/cm
Hármas-Körös
HCO3-
Cl-
SO4 2-
K+
Na+
Ca2+
Mg2+
Conductivity 437 µS/cm

Figure 16.

Summary

Water quality of the Szamos between the years 1970-80 was determined by pollution of high contents of organic matter, which may have come partly from communal plants, but mainly from food processing and light industrial - probably paper and cellulose production - plants. Draining off thin manure from animal farms may also have contributed to that. In 1990 a considerable improvement process commenced, definitely at the cost of a decline in industrial production, when major plants stopped operation. Some of the organic pollution is still present, output of point-like sources can be estimated at 25-30 tons/day.

Organic pollution of high waters exceeding 3-400 m^3/sec of streamflow is stable, its cessation cannot be expected because it comes from humus and plant debris under humification washed in the river.

Mainly in the second half of the 80s, considerable amounts of ammonia-ammonium pollution was characteristic of the Szamos. Presumably it came from the draining off of thin manure from animal farms, most of which have stopped operation since then, into the recipient. We hope that in a more reasonable agricultural system this kind of pollution will not reoccur.

Probably from the plants of heavy industry and the mines of Dés and Nagybánya sewage and mine waters containing a high degree of salt, primarily sodium chloride, were received by the Szamos. As even the developed industrial countries have not been able to tackle this kind of pollution economically so far, with a lowered degree of production its decrease but not its termination can be expected.

We believe that our most important problems in the near future will be caused by the eutrophication of the Szamos. We must therefore go to any length to decrease the pollution of phosphorus feeding, generating this process. At our major towns sewage clarification stage III, providing elimination of phosphorus must be implemented, and we must win the countries up the watercourses over to it, too.

For that a sensible, balanced conservation policy should be pursued, because we will not achieve anything with impatience and unjustified demands.

I would like to thank my colleague József Hamar, for his hints.

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A short account on the algal flora of the River Someş/ Szamos[1] (Transylvania)

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Introduction

The catchment area of the River Someş is stretched in North Transylvania of the Carpathian basin. The region is beautifully varied orographically, pedologically, climatically and of course hydrographically. The diversity of the physical conditions brought about a wonderful biological diversity, including naturally the algal flora. The worthiest natural inheritance, the biological diversity is subjected, as everywhere, to the human impact. The Someş collects all waters from its area, meanwhile it has to endure and transport a huge amount of garbage poured in it by nearly 3 million people and by factories. Here and there the river purifies itself for a while only to become more loaded again and brings this polluted water into the Tisza.

Keywords: algal flora, River Someş, Transylvania

Results

In 1992 (02-12. June, 22.07-2.August) two trips have been taken by a joined Hungarian-Romanian team of researchers along the Someş/Szamos river, from its sources to the confluence with the Tisza, during which samples were collected and measurements were made in many significant localities and biotopes as well. From the samples, up to now, 615 algal taxa were determined (the work is not finished yet). Nevertheless, even from these species one can define some guiding groups which hold taxonomic or ecological implications, particularly significant regarding the object we were dealing with. Thus, according to literature data, some species are interesting for the Transylvanian algal flora, e.g.: *Lyngbya circumcreta, Schizothrix lateritia, Euglena clavata, Chlamydomonas paramucosa, Actinastrum fluviatile, Ankistrodesmus stipitatus, Cylindrocellis cylindrica, Fotterella tetrachlorelloides. Solenoderma malmeanano* is derma malmeanarous, composed of two categories of algae: the seasonal, topical species and the potential one's. The latent species, tolerating for a while the unfavourable prevailing conditions, can revive after easing the stresses and regain their place in the given ecosystem. Such species appear in samples collected in artificial nutrient media (e.g. soil-water biphasic medium) preserved in laboratory conditions. This is nothing else than the A. Scherffel's (1911, 1927) and A. Pascher's (1939) idea

[1] The first name is Romanian, and the second Hungarian

and method, which later was emphasized by C. van den Hoek (1964) and recently by D.M. John and L.R. Johnson (1991). Using this method they and other phycologists discovered many algal species, a lot of them belonging even to the *Chrysophyceae* and *Heterokontae* as well. "Investigations of cultures grown under controlled conditions combined with observations on living materials from the nature and, if useful, on herbarium collections should be the base for taxonomic studies" (C. van den Hoek, 1964). The necessity to know much better about most of all the tolerant, cryptic species of algae, primary promoters of the resilience of phycobiocoenoses in damaged biotopes, brings this principle timeliness again. *Cylindrocellis cylindrica* might be considered such species among others.

The coincidence of certain biotic and non-biotic factors could frequently produce algal water blooms. The Hungarian algological literature is abundant in this domain (I. Kiss, 1952, 1959, 1961; T. Hortobágyi, 1961; F. Nagy-Tóth, 1991). This interesting phenomenon was repeatedly observed during the trips along the Someş. It can indicate the ecological status and the trend of development in a biotop. Upstream of Cluj near the River Someş side in the tap-water trickling filter basins a dense water-bloom was observed, dominated by: *Chlorococcum infusionum, Chlorella acuminata, Scenedesmus acutus, Sc. obtusiusculus* (all 4 species were in different stages of development), *Sc. spinosus* and fairly frequent *Cosmarium undulatum* (26.August; temperature 27 °C, pH 9-9,5). Downstream of Cluj, after the Someş received all industrial and domestic wastewater, a rather deplorable water- and soil-bloom was found in the riverbed, produced almost by *Oscillatoria limosa* (26.June; temperature 23 °C, pH 7.5). More delightful was an other water bloom that came across a meadow of Mânău village (Sălaj County) in the valley of Sălaj rivulet, being a tributary of the Someş. This water bloom was dominated by *Dinobryon cylindricum var. alpinum* (23.May; temperature 21 °C; pH=7). Ecologically and regarding the monitoring of the Someş, the water-bloom caused by the huge amount of *Cyclotella meneghiniana* was more significant near Pomi (11.June; temperature 21 °C; pH = 8) after the Lăpuş and Săsar rivulets stream into the river; both of them heavily polluted by toxic metals and domestic wastes. This species emerges firstly here in the Someş water and its abundance appear in the Tisza many times until Szolnok. Its sudden disappearance might be due to the change of the osmotic value of the water, besides or together to with certain physico-chemical factors.

In quasi-normal natural conditions the succession of the phycobiocoenoses might be characterised by preponderance of certain groups of algae: diatoms, greens, blue-greens; obviously with significant variations in their specific compositions. Under anthropic impact more profound changes, alterations intervene not only in the species composition, but even as a consequence of stresses, in the trophic chains. The exceeding sensibility of the food chain can be settled (if necessary) from data gathered by artificial (short) food chain experiments, which are numerous. Thus, the copepod *Calamus* filters off the diatom *Ditylum brightwellii* at a greater rate than green *Chlamydomonas*. Similarly, other copepod species (*Mediaptomus meridianus* and *Tropodiaptomus spectabilis*) preferred *Chlamydomonas reinhardii* and *Cyclotella meneghiniana* instead of *Scenedesmus acutus* or *Selenastrum capricornutum*.

The food value of some blue-green algae (*Anabaena flos-aque, Anacystis nidulans, Flococapsa alpicola, Merismopedia sp., Synechococcus elongatus, S. cedrorum, Synechococcus sp.*) was higher than of green algae in a diet of *Daphnia pulex.* It is worth to mention that the toxicity of several blue-green algae to higher animals is quite well established, but few reports of their toxic effects on aquatic invertebrates exist (H. L. Golterman 1975).

Along the Someş and in the river as well, the phycobiocoenoses changes drastically; both in habitats and during the seasons, which is redoubled by the human impact. Upstream Cluj, near Gilău and Floreşti by "Zöldsapka" field, the phycobiocoenoses were dominated by diatoms, which were accompanied in a higher rate by green algae. *Asterionella formosa, Fragilaria crotonensis* and *Synedra ulna* (Table 1.) characterised the phytoplankton both of the artificial water reservoirs on the Someşul Cald by Gilău and Tarniţa. Downstream of Cluj at Someşeni the penurious algal flora was redundant in blue-green algae (*Lyngbya sp., Phormidium sp., Oscillatoria spp.).* At Pomi the percentile composition of the summarised algal flora on the two trips varied as follows (Table 2., 3.).

Species / Season	June 11, 1992	August 2, 1992.
Cyanophyta	24%	8%
Euglenophyta	Not sign.	8%
Chlorophyta	19%	62%
Bacillariophyta	57%	22%

Table 2.

It is interesting among others, that the summer (02.08) coenoses was characterised mainly by green algae (62%) but quantitatively was dominated by diatoms (*Cyclotella meneghiniana* produces the water-bloom). Nevertheless, in non-affected or moderately polluted rivers, in tributaries of the Someş (in rivulets or brooks), the diatoms generally reveal a higher variability of species than other algal groups. Altogether there are some 50 tolerant diatom species (marked with 2-4) which can be found, in variable percentage, in most of the polluted lotic waters (e.g. *Amphipleura pellucida, Caloneis silicula, Cymatopleura elliptica, Cymbella ventricosa, Diploneis elliptica, Frustulia rhomboides, Navicula cryptocephala, N. viridula, Synedra affinis, S. ulna, S. vaucheriae* –after Van den Hoek). Due to their tolerance and their reserve materials (lipids) diatoms can be/are present in the rivers during all seasons of the year.

The plant communities of the River Someş, as in general, are/would be considerably influenced by the riverside hydrophytic macrovegetation, which can have a favourable buffering function between the helpless aquatic organisms and the terrestrial adverse actions. Although the allelopathic effects can not be excluded, an existing vigorous phanerogam flora would promote efficiently the development of a diversified algal flora, which is a supplying source of the river plant communities; the essential constituents of the natural food chain. Unfortunately such a macrophytic vegetation does not exist or it is regrettably scantly, especially in the middle and the lower section of the Someş (cf. Drăgulescu, 1995).

Quantitative study of the phytoplankton showed drastic change along the river (Table 4.).

direction of water flow →

Someşul Cald source area	29				
		Someşul Mic at Gilău	43		
Someşul Rece source area	58	Someşul Mic above Cluj	280		
		Someşul Mic below Cluj	311000		
				Someş at Dej	373000
		Someşul Mare at source area	72	Someş at Someş Odorhei	1440
		Someşul Mare at Sângeorz Băi	250	Someş at Sălsig	38102
		Someşul Mare at Năsăd	760	Someş at Pomi	103680
		Someşul Mare at Beclean	936	Someş above Satu Mare	87000
				Someş below Satu Mare	112000
				Someş at Vásárosnamény	75000

Table 4. Quantitative dinamism of the phytoplankton, ind./ml. (August 1992)

The ecological status of the Someş is alarming. The mournful alteration of the water-body, the riverside and catchment area is mainly a consequence of the intolerant, neglect behaviour of people particularly during the last 75 years towards this wonderful natural inheritance. But this assertion can not be proved experimentally since such metamorphoses have no parallel control to compare with. Nobody can demonstrate how the environment assemblages would be without brutal human interference.

The ambiguous reality resides in the data gathered during the investigations accomplished. The first conclusion of the results obtained is warning, regarding the precarious situations; from which follows the second, that the misfortune of the Someş threatens the Tisa plain too. The third conclusions is that the damages are not irreversible yet and through a concerted action would be possible to reconstruct the Someş ecosystems, since there are still sections, places (e.g. at Bazarul Someşului, Beliş, Tarniţa, Gilău, Rodna, Jibou, Narrowpath from Ţicău, Fărcaşa, Tămaia) which were not completely destroyed.

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Table 1. Diatom flora of the Tarniţa (1, 3, 5 = plankton, 2, 4, = periphyton) and of the Gilău (6 = periphyton from upper side, 7 = plankton, 8 = periphyton from the downer side of the water-body) reservoirs.
(* occasional; + sporadic; ++ slightly frequent; +++ frequent; ++++ very frequent)

Species	1.	2.	3.	4.	5.	6.	7.	8.
Stephanodiscus astrea (Ehr.) Grun. var.. *minutula* (Kütz.) Grun.	*	-	-	-	-	-	-	-
Melosira var.ians G.A.Ag.	-	++	-	+	+	+++	+	++
Diatoma hiemale (Lyngb.) Heib. var.. *mesodon* (Ehr.) Grun	-	-	-	-	-	-	-	*
Diatoma vulgare Bory	-	*	*	*	*	-	+	++
Tabellaria fenestrata (Lyngb.) Kütz.	-	+	-	+	+	-	*	-
T. fenestrata var.. *asterionelloides* Grun.	-	-	-	*	-	-	-	-
T. flocculosa (Roth) Kütz.	*	+++	*	+++	+	-	-	*
Asterionella formosa Hass.	++++	-	++++	-	++	-	+++	*
Ceratoneis arcus Kütz.	+	+	+	*	*	+	+	+
C. arcus var.. *amphioxys* (Rabh.) Brun.	-	-	-	*	*	-	-	-
C. arcus var. *linearis* Holmb.	*	-	-	*	*	-	-	-
Fragilaria capucina Desm.	-	-	-	-	-	+	+	-
F. crotonensis Kitton	+++++	++	+++++	+++	+++++	-	+++++	-
Synedra acus Kütz.	+	+	++	+	+	*	+	*
S. rumpens Kütz.	-	-	-	*	-	-	-	-
S. ulna (Nitzsch) Ehr.	-	++	+	++	++	+++++	++++	+++
S. ulna var. *oxyrhynchus* (Kütz.) V.H.	*	*	+	+	*	-	-	+
S. vauchariae Kütz.	-	*	-	*	-	+	*	-
Achnanthes lanceolata Bréb.	*	-	-	*	-	+	*	*
A. linearis W. Sm.	-	+	-	+	+	-	-	-
A. minutissima Kütz.	++	++++	-	++++	++	+	+	++++
A. minutissima var. *cryptocephala* Grun	++	+	-	+	+	-	+	*

Table 1. continue

Species	1.	2.	3.	4.	5.	6.	7.	8.
Cocconeis pediculus Ehr.	-	-	-	-	-	+++	*	++
C. placentula Ehr. var. *euglypta* (Ehr.) Cl.	*	-	-	*	-	+	+	+
Amphipleura pellucida Kütz.	-	*	*	-	-	-	-	+
Caloneis bacillum (Grun.) Mer.	-	-	-	-	-	-	-	+
C. silicula (Ehr.) Cl.	-	-	-	*	-	-	-	-
C. silicula var. *truncatula* Grun.	-	-	-	*	-	-	-	-
Diploneis ovalis (Hilse) Cl. Var. *oblongella* (Naeg.) Cl.	-	-	-	-	-	-	-	*
Frustulia vulgaris Thwait.	-	*	-	*	-	-	*	+
Gyrosigma acuminatum (Kütz.) Rabh.	-	-	-	-	-	-	*	*
G. scalproides (Rabh.) Cl.	-	-	-	-	-	-	*	*
Navicula cryptocephala Kütz.	-	*	-	*	-	-	-	-
N. cryptocephala var. *intermedia* Grun	-	-	-	-	-	+	++	++
N. cryptocephala var. *veneta* (Kütz.) Grun.	+	++	+	++	+	-	*	*
N. cuspidata Kütz.	-	-	-	*	-	-	-	-
N. gracilis Ehr.	*	*	-	-	-	+	-	+
N. hungarica Grun var. *capitata* Mayer	-	-	-	-	-	-	-	+
N. peregrina (Ehr.) Kütz. var. *kefvingensis* (Ehr.) Cl.	-	*	-	-	-	-	-	+
N. radiosa Kütz.	*	+	-	++++	+++	+	*	-
N. rhynchocephala Kütz.	*	+	-	++	+	-	*	-
N. salinarum Grun.	-	*	-	-	-	-	*	+
N. viridula Kütz.	*	-	-	+	-	+	-	*
N. viridula var. *capitata* Meyer	-	-	-	*	-	-	-	*
N. viridula var. *slesvicensis* (Grun.) Cl.	-	*	-	-	-	-	*	-

Table 1. continue

Species	1.	2.	3.	4.	5.	6.	7.	8.
Neidium affine (Ehr.) var. *amphirhynchus* (Ehr.) Cl.	-	+	-	-	-	-	*	*
N. affine var. *amphirhynchus* fo. *capitatum* Skw. Et Mayer	-	-	-	*	-	-	-	-
Pinnularia borealis Ehr.	-	-	-	+++	++	-	-	-
P. gibba Ehr.	-	-	-	++	-	-	-	-
P. gibba fo. *subundulata* Mayer	-	-	-	+	-	-	-	-
P. gibba var. *mesogongyla* (Ehr.) Hust.	-	-	-	*	-	-	-	-
P. mesolepta (Ehr.) W. Sm.	-	-	-	++	+	-	-	-
P. microstauron (Ehr.) Cl.	-	-	-	+	-	-	-	-
P. microstauron var. *brebissonii* (Kütz.) Hust. Fo.*diminuta* Grun.	-	*	-	+	-	-	-	-
P. nodosa Ehr. var. *constricta* Meyer	-	-	-	-	-	-	-	*
P. subcapitata Greg.	-	-	-	*	*	-	-	-
P. viridis (Nitzsch) Ehr.	-	-	-	+	*	-	-	-
P. viridis var. *diminuta* Mayer	-	-	-	*	-	-	-	-
Stauroneis anceps Ehr.	-	-	-	*	-	-	-	-
St. phoenicenteron Ehr.	-	-	-	+	-	-	*	*
Amphora ovalis Kütz.	-	-	-	-	-	+	-	-
A. ovalis var. *libyca* (Ehr.) Cl.	-	-	-	-	-	+	*	+
Cymbella affinis Kütz.	-	+	-	+	+	-	+	+++
C. cistula (Hempr.) Grun.	*	+++	-	+++	++	-	+	+++
C. cymbiformis (Agardh? Kütz.) V.H.	*	+++	*	++	++	-	-	+
C. lanceolata (Ehr.) V.H.	-	++	-	*	-	+	-	-
C. naviculiformis Auersw.	-	*	-	+	*	+	*	*
C. prostrata (Berk.) Cl.	-	-	-	-	-	+	*	*
C. semielliptica Péterfi et Róbert	*	-	-	-	-	-	-	-

Table 3. The summer (2 August 1992) phytoplankton of the Someş at Pomi

Species	**Ecological characteristics**	**Frequency**
Lyngbya circumcreta G.S. West	Mesosaprobiotic	+
L. martensiana Menegh.	Mesosaprobiotic	+
Schizothrix lateritia (Kütz.) Gom.	Eutrophic, calcicolous	++
Euglena clavata Skuja	Mesosaprobiotic (Tisa)	+++
E. pisciformis Klebs	Mesosaprobiotic	+
E. proxima	Polysaprobiotic	++
Chlamydomonas paramucosa Schiller	Mesosaprobiotic, basiph.	++
Actinastrum fluviatile (Schröd.) Fott.	Rheophilic	+
Ankistrodesmus gracile (Reinsch) Korš.	Mesosaprobiotic-eutrophic	++
A. stipitatus (Chod.) Kom.-Legn.	-	+
Coelastrum microporum Näg.	Eutrophic	++
Cylindrocellis cylindrica (Hind.) Hind.	Rheophilic	+++
Fottarella tetrachlorelloides Buck	Eutrophic	+
Monoraphidium griffithii (Berk.) Kom.-Legn.	Mesotrophic-eutrophic	++

Table 3. continue

Species	**Ecological characteristics**	**Frequency**
Pesiastrum boryanum (Turp.) Menegh. var. *boryanum*	Cosmopolitan	++
P. boryanum (Turp.) Menegh. var. *ellesmerense* Croasd.	-	+
P. duplex Meyen var. *duplex*	Cosmopolitan	++
Scenedesmus acuminatus (Lagerh.) Chod. var. *acuminatus*	Cosmopolitan	+
S. acuminatus var. *bernardii* (G.M. Smith) Deduss	Cosmopolitan (Mureş, Tisa)	+
S. dimorphus (Turp.) Kütz.	Cosmopolitan	++
S. intermedius Chod. var. *intermedius*	Cosmopolitan, eutrophic	++
S. longispina Chod.	Mesosaprobiotic	+
S. opoliensis P. Richter	Cosmopolitan	++
S. ovalternans Chod.	Cosmopolitan	+
S. quadricauda (Turp.) Bréb.	Cosmopolitan	++
S. quadricauda f. *granulatus* Hortob.	Mesosaprobiotic	++
Siderocellis irregularis Hind.	Eutrophic	+
Solenoderma malmeana Bohl.	Benthic	+
Cosmarium undulatum Corda	-	+
Cyclotella meneghiniana Kütz.	Mesosaprobiotic-haloph.	+++ Water-bl
Fragillaria crotonensis Kitton	Eutrophic	++
Navicula bacillum Ehrenb.	Mesosaprobiotic, cosmopolitan	+
N. veneta Kütz.	Very eutrophic	++
Nitzschia fruticosa Hustedt.	Eutrophic, lotic	++
Pinnularia subcapitata Gregory	Cosmopolitan	++
Synedra actinastroides Lemn.	Mesosaprobiotic, lotic	++
S. vauchariae Kütz.	Cosmopolitan	++

Composition and structure of algal communities of the River Someş Basin

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Abstract

Species composition and algal community organisation were studied in 34 sample sites located along the main river courses of the Someş Basin. Relative abundance of species in the communities was performed and expressed as percentage. The frequency distribution pattern of the species has been described by employing the truncated normal curve model. Affinities at the level of algal communities have been tested by cluster analysis using the floristic similarity index of Sorensen. Species diversity, as well as relative information has also been computed according to Shannon's formula. Diatoms were found to be dominant in the river communities both as number of taxa and population density. They were used to evaluate the saprobic status of water in sampling sites. Floristic composition and structure of the investigated communities inhabiting the river sectors were found to differ according to the local conditions.

Key words: algae, Transylvanian rivers, diversity, relative abundance, floristic affinities, saprobic status.

Introduction

The algae of the Transylvanian running waters have not yet been well documented. The first phycological records were provided by Schaarschmidt (1879-1893) and forty five years later by Lepşi (1925-1926). The investigations carried out by Robert during the sixties (1960-1969) have mainly floristic character and concern a number of selected springs an rivers (the Mureş River at Târgu Mureş, some of the oxbow lakes of the Mureş, the Şieu River, some saline rivulets at Sângeorgiu de Mureş, freshwater springs at Cluj etc). Later, Péterfi & Momeu (1984, 1985), Momeu, Peterfi, Pandi-Gacsadi & Şipoş (1988) investigated the structure of diatom communities of the Arieş, Ampoi and Crişu Repede rivers. Algal communities inhabiting the running waters of the Retezat National Park have been investigated by Péterfi (1993). Recently, Hamar (1995) published the algae of the river Mureş.

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As concerning the Someş Basin, Prunescu-Arion & Baltac (1967) published the first hydrobiological investigation on the river Someşul Cald, one of the main branches, from the spring (Peştera Rădesei) to its confluence at Gilău with the Someşul Rece branch. Unfortunately, their data concerning the algal communities are rather unsatisfactory. The systematic studies on the composition and structure of algal communities on the whole Someş Basin started in the early nineties by the algology team of the Institute of Biological Research, Cluj-Napoca, by Péterfi, Momeu and Rasiga. They analysed the species composition of algal flora, the structure of communities in natural and polluted sectors of the river, from the mountainous regions to the lowland (Rasiga, Péterfi & Momeu, 1992, 1994, 1995/1996, 1996, 1997). It should be mentioned that more recently Nagy-Tóth (see in this volume) carried out floristic observations on the river Someş.

Material and methods

The algae were sampled from the main water courses of the Someş Basin, using standards methods for benthic river communities. The samples were taken from previously selected stand sampling sits, during the years 1993-1996 (in May 1993 from the River Someşul Rece, in May 1994 from the river Someşul Cald, in May 1995 from the Someşul Mic, in May 1993 and June 1996 from the Someşul Mare, and in July 1996 from the river Someş, 'united' Someş (Figure 1.).

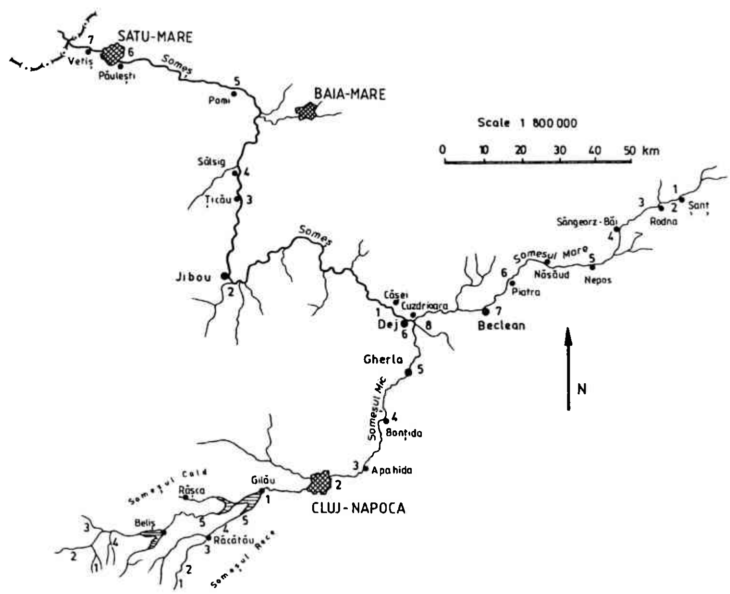

Figure 1. Sampling sites in the five investigated water courses of the Someş Basin. Someşul Rece: 1-downstream Blăjoaia, 2-downstream the dam, 3-upstream Răcătău, 4-at the electric plant, 5-upstream Someşull Rece-village. Someşl Cald: 1-Pârâul Rosu, 2-Izbuc Valley, 3-Ponor Valley, 4-Călineasa Valley, 5-at the electric power station; 1-Fântânele dam reservoir, 2-Tarniţa dam reservoir, 3-Gilău dam reservoir. Someşul Mic: 1-Gilău, 2-downstream Cluj-N., 3-Apahida, 4-downstream Bontida, 5-downstream Gherla, 6-upstream Dej. Someşul Mare: 1-upstream Şant, 2-upstream Rodna, 3-downstream Rodna, 4-downstream Sângeorz-Băi, 5-Nepos, 6-Piatra, 7-Beclean, 8-Cuzdrioara. 'united' Someş: 1-downstream Dej, 2-upstream Jibou, 3-icău, 4Sălsig, 5-Pomi, 6-Piăuleşti, 7-Vetiş.

There were also sampled by means of a plankton net (27 um mesh) the artificial dam reservoirs of the river Someşul Cald and the potamoplankton of the 'united' Someş. The samples were fixed with 4 % formalin and studied in light microscope (Npfk, Interfako - Carl Zeiss, Jena). For standard observations the diatoms were simply mounted in colophony and examined by Planchromat HI 100x/1,30 immersion lens. The relative quantitative studies on diatoms were performed by counting the individuals in 20 microscopic fields/sample. The contribution of each species to community structure (stand) was established in percentage. Species diversity in stand samples was computed by using Shannon's formula. Floristic affinities between communities was tested by the index attributed to Srenssen, based on the presence-absence data. The structure of community was described by truncated normal curves (Patrick et al., 1954). Based on floristic composition the saprobic degree of the water along the river was evaluated by the method of Zelinka and Marvan (1961).

Results

Comments on floristic aspects

In the samples collected in the river Someşul Rece 121 diatom species were identified (Table 1.), the other groups were neglected. In the river Someşul Cald, including dam reservoirs were found 181 algal species, which belong to the following divisions: *Cyanophyta* - 9, *Chrysophyta* - 6, *Bacillariophyta* - 158, *Chlorophyta* - 7 and *Dinophyta* - 2. The number os species was slightly different in the river (118) as compared to the reservoirs (139). In the river Someşul Mic (downstream the confluence of the two branches), 168 species were identified: *Cyanophyta* - 8, *Bacillariophyta* - 143, *Chlorophyta* - 14, *Euglenophyta* - 3.

The river Someşul Mare river was sampled twice, the total number of identified species being 272: 165 in May 1993 and 228 in June 1996, 122 being common for both samplings. They are distributed to the following divisions: 1993- *Cyanophyta* - 3, *Chrysophyta* - 1, *Bacillariophyta* - 152, *Chlorophyta* - 7, *Euglenophyta* - 2; 1996- *Cyanophyta* - 13, *Chrysophyta* - 2, *Xanthophyta* - 2, *Bacillariophyta* - 159, *Chlorophyta* - 32, *Euglenophyta* - 20.

In the 'united' River Someş 323 algal taxa were recognised: 272 in the potamoplankton (*Cyanophyta* - 8, *Chrysophyta* - 2, *Xanthophyta* - 1, *Bacillariophyta* - 137, *Chlorophyta* - 98, *Euglenophyta* - 30, *Dinophyta* - 1) and 220 in the benthic communities (*Cyanophyta* - 13, *Chrysophyta* - 2, *Bacillariophyta* - 142, *Chlorophyta* - 49, *Euglenophyta* - 14) (Figures 2., 3.).

According to the present findings, all communities are dominated by diatoms, a normal state in running waters, the other groups being less important quantitatively, except green algae in the 'united' Someş potamoplankton. The chlorophytes are very few indeed in the upper part of the basin (Someşul Cald, Someşul Mare), their diversity is growing slowly downstream, especially in June, and became really high in the 'united' Someş. The same is true for the euglenoid flagellates. They are few or lacking uphill the different branches and tributaries of the Someş, showing a growing tendency towards downstream (Figures 4., 5.).

The check lists of species for the five investigated water courses are given in Tables 1-4. Most of the species are common forms, widely distributed and have great ecological tolerance, like *Achnanthes minutissima, A. lanceolata, Amphora pediculus, Cymbella minuta, C. silesiaca, Diatoma vulgaris, Cocconeis placentula, Fragilaria ulna, Gomphonema parvulum, G. olivaceum, Navicula lanceolata, N. cryptocephala, Nitzschia dissipata, N. linearis, Surirella brebissonii etc - Bacillariophyta; Closterium moniliferum, Cosmarium formosulum, Kirchneriella obesa, Pediastrum boryanum, Scenedesmus* species - *Chlorophyta*).

In spite of this species group, almost common for the whole Someş Basin, the distinguishing pattern of the investigated water courses is given by the occurrence and abundance of those species which are less tolerant and are characteristic for overall local environmental conditions. As such, in the mountain water courses (Someşul Rece, Someşul Cald, Someşul Mare-upper part), especially towards their origins, the presence of clear water forms, characteristic for fast running cold rivers (rheophilous, katharobic, preferring lower mineral content) is obvious. To this category belong *Oscillatoria boryana, O. simplicissima - Cyanophyta; Chrysococcus rufescens, Hydrurus foetidus - Chrysophyta; Achnanthes bioretii, Diatoma mesodon, D. hyemalis, Fragilaria arcus, F. virescens, Meridion circulare, Navicula cryptotenella, Gomphonema angustum etc - Bacillariophyta; Ophyocytium cochleare, Goniochloris mutica, Ulothrix zonata - Chlorophyta* which are usually frequent, sometimes quite abundant in such uphill communities. There are also present in such habitats some alien species, which were washed into the rivulets from the surroundings (bogs, terrestrial habitats): *Achananthes subatomoides, Fragilaria pinnata, F. montana Tabellaria flocculosa, Navicula variostriata, N. contenta, N. gallica var. perpusilla, N. nivalis, Cymbella sinuata, Stauroneis smithii, Pinnularia* and *Eunotia* species etc - *Bacillariophyta*; *Netrium digitus - Chlorophyta* etc.

The communities inhabiting the lower portions of the mountain rivers (S. Rece upstream S. Rece-village, S. Cald at the water plant, S. Mare at Beclean and Cuzdrioara) exhibit a much higher species diversity due to the frequency of many ubiquistous forms, or species tolerating organic pollution, or adapted to more or less eutrophic conditions. Their occurrence clearly indicate the presence of eutrophication, as well as general pollution mainly due to human activities.

The communities inhabiting the Someşul Cald dam reservoirs are dominated by species characteristic for such habitats (*Asterionella formosa, Fragilaria crotonensis, F. construens)*, but also by the appearance of other phytoplanktonic species (*Oscillatoria lacustris, O. limosa, O. planctonica - Cyanophyta; Uroglena volvox, Dinobryon divergens, Mallomonas acaroides, Synura spinosa, Chrysosphaerella pseudospinosa-*

Chrysophyta; Fragilaria acus - Bacillariophyta; Oocystys lacustris, O. planctonica, Pseudosphaerocystis lacustris - Chlorophyta; Peridinium willei, Ceratium hirundinella - Dinophyta). The Fântânele reservoir exhibited the lowest phytoplankton diversity, the others, situated downstream, became more and more diversified. The number of species was lowest in the Fântânele reservoir, and the highest in Gilău (Fântânele - 10 species, Tarnița - 47 and Gilău - 68). In the Tarnița and Gilău reservoirs the phytoplnakton is more diversified than the others, due to the frequency of tychoplanktonic and indifferent forms. As concerning the benthic communities, they exhibit the same pattern: the lowest the altitude, the highest the species number and diversity (73 respectively 86 species). Besides the typical forms for such habitats (*Navicula pygmaea, Cymbella lanceolata* etc) there are many coenoxene and tychocoenotic ones.

In the river Someșul Mic the communities are dominated by ubiqiustous and cosmopolitan elements. For these communities, as compared with the montane water courses, the quantitative spectra exhibit diversity and heterogenity, with several frequent or abundant species. One should note in the Someșul Mic river downstream Cluj-Napoca, the occurrence of some tolerant species, adapted to high organic loading (*Navicula accomoda, N. subminuscula, Nitzschia palea - Bacillariophyta; Euglena proxima, E. texta - Euglenophyta*). Some of them were found subdominant others occurred less abundant.

In the 'united' Someș there are many new algal forms, lacking upstream some of them are typical plankton forms mostly chlorophytes (*Chlamydomonas metapyrenigera, C. monadina, Chlorella luteo-viridis, Coelastrum microporum, C. sphaericum, Eudorina elegans, Gonium pectorale, Pandorina morum, Pediastrum boryanum*) and euglenophytes (*Euglena acus, E. ehrenbergii, E. polymorpha, Lepocinclis ovum, Trachelomonas hispida, Strombomonas gibberosus, S. verrucosa* etc) but plankton diatoms are not lacking (*Asterionella formosa, Fragilaria crotonensis, Aulacoseira italica, Surirella splendida*). The number of preferentially eutrophic or saprophilous species is quite high (*Ankyra lanceolata, Cladophora glomerata, Closterium acutum, Euglena spirogyra, E. tristella, E. variabilis, Ceratium hirundinella, Oscillatoria brevipes, O. chlorina, O. princeps, O. tenuis, Pyrobotrys casinoensis, Stigeoclonium tenue, Lepocinclis ovum, L. texta, Nitzschia acicularis, Navicula viridula, N. trivialis* etc), among them some became dominant or abundant (*Cyclotella meneghiniana, Nitzschia palea, Navicula subminuscula, Nitzschia inconspicua*).

It is worth to mention the occurrence of many halophilous diatoms, most often recorded from sea water, littoral zone, estuaries or continental salt waters (*Gyrosigma scalproides, Navicula cincta, N. cuspidata, N. goeppertiana, N. pygmaea, N. slesvicensis, N. trivialis, Nitzschia calida, N. constricta, N. hungarica, N. inconspicua, N. intermedia, N. nana, N. reversa, N. sigma, N. sigmoidea, N. umbonata, N. vermicularis, Achnanthes brevipes, Amphora veneta, Entomoneis paludosa v. subsalina, Gomphonema augur, Navicula bacillum, N. halophila, N. salinarum, N. spicula, Nitzschia dubia, N. geitlerii, N. levidensis, N. lorenziana, N. tryblionella* etc). Some of them are quite frequent in the communities (*Cyclotella meneghiniana, Navicula erifuga,* *Thalassiosira weissflogii*). The number of halophilous species is high in the 'united' Someş towards downstream Sălsig, then exhibits a lowering tendency, downstream Pomi they became quite rare.

Structure of the communities

The truncated normal curves suggest that the structures of communities inhabiting the upper part of the Someşul Rece, and partly the Someşul Cald and the Someşul Mare rivers are very near to those describing the natural character of unpolluted waters (Patrick et al., 1966). On the other hand the curves describing the structure of communities occurring in the lower part of the above mentioned rivers (ex. at the water plant station on the S. Rece) are characterised by somewhat flattened curves, with their modal interval shifted to the right, indicated slightly altered community structures.

The form of the curve obtained for the community inhabiting the Pârâu Roşu (branch of the Someşul Cald near its origin) looks very similar with those published by Patrick et al. (1966) for communities living in a distrophic stream or in a heavy polluted river. Because the Pârâu Roşu is a clear watered, fast running montane rivulet in which any pollution should be excluded, our findings could be explained by the somewhat distrophic, extreme conditions of the water. These conditions should be responsible for the low number of species (30) and their frequency distribution, with the dominance of a single species (*Diatoma mesodon* formed 85 % of the community).

The curves constructed for the communities inhabiting the lower part of the Someşul Cald (electric power station) and Someşul Mare (at Piatra) rivers, as well as the Someşul Mic (downstream Bonţida) indicate marked alteration of the structures. The shape of curves, namely the height and shifting of the modules, number of covered intervals, the values of H, 2, k, all suggest community diversification, caused by eutrophication and general pollution stress.

Based on floristic affinity there are two different community types (similarity level 65 %) in the River Someşul Rece, one characteristic for the upper course (stands 1, 2), the other for the lower sector (stands 3-5). The communities of the River Someşul Cald exhibit a similarity level of 50-60 %, those occurring in the Izbuc and Călineasa Valleys form a group joining at 65 % similarity level

It is normal that the plankton community of the Fântânele dam reservoir differs very much from those of Tarniţa and Gilău, being practically unispecific. The different communities of Gilău dam reservoir exhibits floristic affinities at 65 % level. The phytoplanktonic and epiphytic ones were the most similar.

High floristic similarity (over 70 %) show the communities of the river Someşul Mic, the highest being between the heavily polluted Bonţida and Gherla stands (about 80 %).

As concerning the river Someşul Mare, in May 1993 the communities of its upper course (stands 2-4) exhibited the highest (70 %) floristic affinity. The downstream communities joined this aggregate, one by one, at lower levels. In June 1996, the communities were distributed in three small groups, corresponding to the upper, middle and lower courses of the river.

The plankton communities of the 'united' River Someş are rather homogenous, excepting the Păuleşti stand (6), very poor in algal species, these exhibit floristic affinity at 65-70 % similarity level. The benthic communities inhabiting the upper course (stands 1-3) are grouped at 70 % similarity level, those from the downstream course join the group at lower levels .

The specific diversity index exhibit a growing tendency from upstream towards downstream, namely from the montane towards the lower sectors of the rivers (Someşul Rece, Someşul Cald, Someşul Mare). The communities from the Someşul Mic river show an opposite tendency. In the 'united' Someş the diversity is rather uniform, being somewhat higher in the upper portion (downstream the confluence of its two branches).

The analysis of saprobity, based on diatoms, pointed out the xeno-, oligo- or beta-mesosaprobic character of the rivers from the upper basin. In the lower course of the Someşul Mare, but especially in the Someşul Mic rivers, the saprobity index show step by step, evident growth tendency towards their lower sectors. The same gradual growing tendency is true for the 'united' River Someş .

Conclusions

1. The natural character of the algal floras in the Someş Basin given mainly by geographic and hydrologic factors, sometimes is markedly affect by anthropic influences.

- The specific pattern of the montane water courses is given by the occurrence of rheophilous, katharobic, microthermal species, adapted to low mineral content.
- The lower sectors are characterised by the frequency of species with eutrophic preferences, the water courses being affected by the growing amount of nutrients and organic substances, dischharged into the rivers, partly due to human activities.
- The high frequency of tolerant algal species, preferencially eutrophic or saprobionts, indicated strongly eutrophic water courses (downstream Cluj, Dej, and on the lowland), with marked organic loading, due to intensive agriculture, industry and household wastes.

2. The structural features of the communities (relative abundance, frequency distribution of the species, floristic affinity and species diversity) confirm the presence of specific ecological algal groups characteristic for the different watercourses.
3. The analyses performed on the saprobic status of the river, by employing indices based on diatom populations structure, emphasised the gradual reduction of water quality along the longitudinal section of the Someş Basin, especially in the water courses found under human impact.

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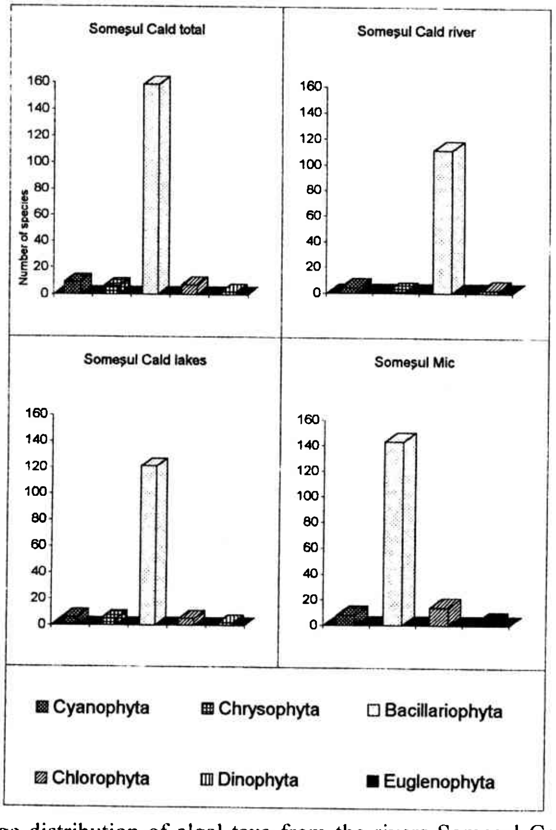

Figure 2. Percentage distribution of algal taxa from the rivers Someşul Cald and Someşul Mic rivers, to the main divisions

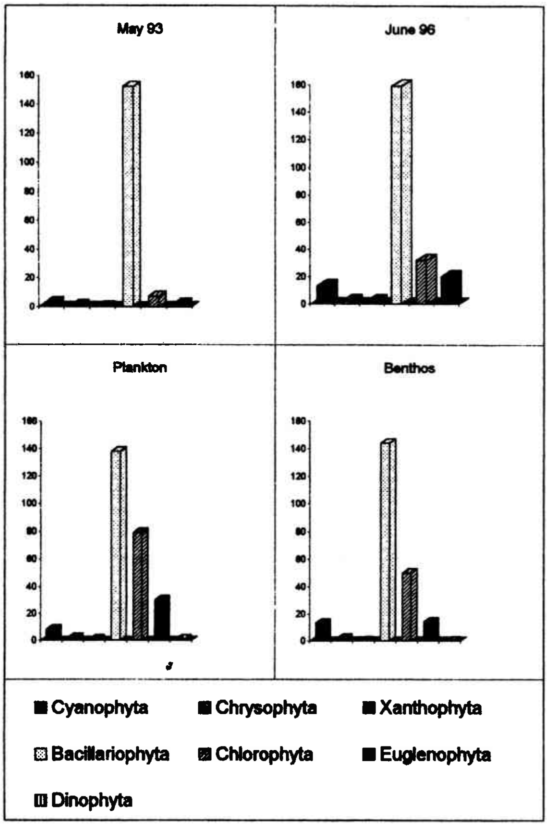

Figure 3. Percentage distribution of algal taxa from the Someşul Mare and 'united' Someş, to the main divisions

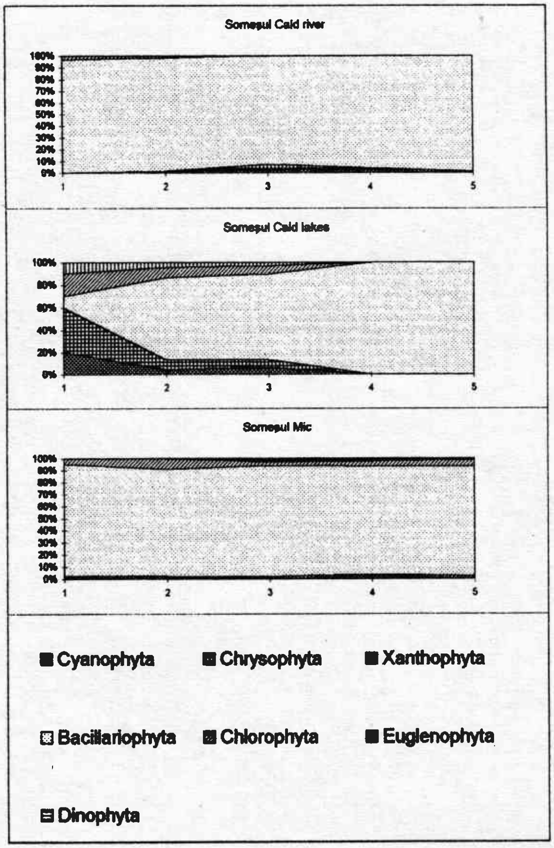

Figure 4. Changes in the number of taxa in the various sampling sites from the rivers Someşul Cald and Someşul Mic

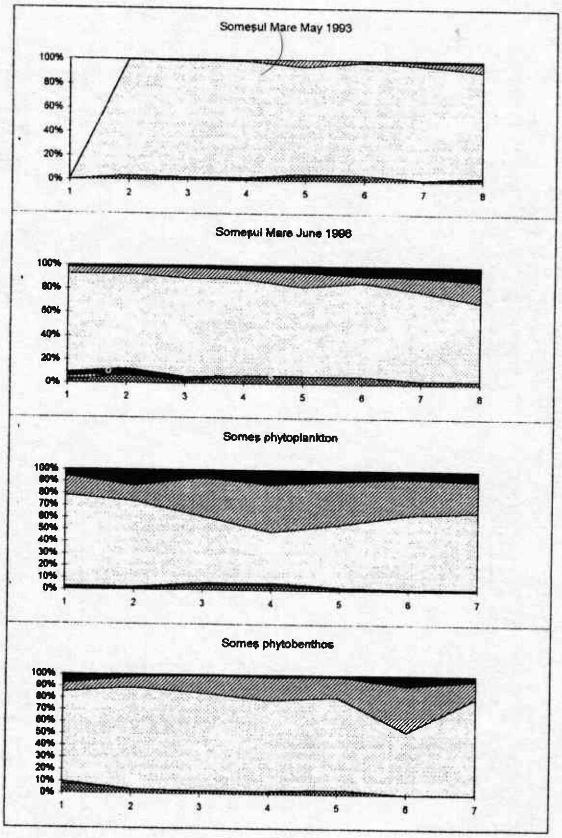

Figure 5. Changes in the number of taxa in the various sampling sites from the rivers Someşul Mare and 'united' Someş

Table 1. Floristic composition of algal communities in the Someşul Mic river

Nr crt.	Taxa	Sampling sites															
		Someşul Rece					Someşul Cald					Someşul Mic					
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6
	CYANOPHYTA																
1	*Microcystis aeruginosa*												+		+		
2	*Oscillatoria boryana*									+		+	+		+		
3	*O. chalybaea*											+		+	+		
4	*O. deflexoides*							+		+							
5	*O. gemminata*															+	
6	*O. limosa*											+					
7	*O. pseudogemminata*															+	
8	*O. simplicissima*										+						
9	*Phormidium molle*																
10	*P. uncinatum*													+			
	CHRYSOPHYTA																
1	*Hydrurus phoetidus*								+								
	BACILLARIOPHYTA																
1	*Achnanthes bioretii*	+	+	+	+	+		+	+	+	+	+	+		+		
2	*A. clevei*			+									+				
3	*A. conspicua*							+		+	+						
4	*A. exigua*			+													+
5	*A. hungarica*																+
6	*A. lanceolata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
7	*A. laterostrata*										+						+
8	*A. minutissima*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
9	*A. oblongella*		+														
10	*A. peragalli*										+						
11	*A. subatomoides*	+	+	+	+	+	+	+		+	+		+				
12	*A. thermalis*			+													
13	*Amphora libyca*					+		+				+	+	+	+		+
14	*A. ovalis*			+		+					+	+		+			+
15	*A pediculus*	+		+	+	+	+	+	+	+	+	+	+	+	+	+	
16	*A veneta*					+											
17	*Anomoeoneis brachysira*			+													+
18	*A. sphaerophora*											+		+	+	+	+
19	*Asterionella formosa*										+	+	+	+	+	+	+
20	*Aulacoseira distans*	+			+	+					+						
21	*A. italica*										+						
	A. italica v. subarctica	+															
22	*A. granulata*												+				+
23	*Caloneis amphisbaena*					+						+			+	+	
24	*C. bacillum*						+	+			+	+					
25	*C. silicula*					+		+			+	+	+	+			+
26	*Cocconeis neodiminuta*							+		+	+	+	+				+
27	*C. pediculus*				+	+		+		+	+	+	+		+	+	+

Table 1. continue

28	*C. placentula*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
29	*Cyclotella comensis*											+	+	+	+	+	+
30	*C. meneghiniana*										+		+	+	+	+	+
31	*C. radiosa*											+	+		+	+	+
32	*Cymatopleura solea*											+		+	+	+	+
33	*Cymbella affinis*			+		+	+			+		+	+	+		+	
34	*C. amphicephala*							+				+					
35	*C. aspera*							+									
36	*C. caespitosa*											+		+	+	+	+
37	*C. cistula*		+	+	+	+					+	+	+	+	+		
38	*C. cuspidata*														+		
39	*C. cymbiformis*	+				+											
40	*C. gracilis*							+			+						+
41	*C. helvetica*	+	+	+	+	+					+	+	+	+	+	+	
42	*C. lanceolata*											+		+			
43	*C. mesiana*	+								+							
44	*C. microcephala*									+		+					+
45	*C. minuta*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
46	*C. naviculiformis*		+	+		+		+			+	+		+	+		+
47	*C. prostrata*					+						+	+	+	+	+	+
48	*C. silesiaca*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
49	*C. sinuata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
50	*C. subaequalis*							+									+
51	*C. tumida*				+							+		+	+	+	
52	*C. turgidula*											+		+	+		
53	*Diatoma anceps*	+									+						+
54	*D. mesodon*	+	+	+	+	+	+	+	+	+	+	+	+		+		+
55	*D. moniliformis*											+	+	+	+	+	
56	*D. tenuis*											+					+
57	*D. vulgaris*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
58	*Denticula kutzingii*											+					+
59	*D. tenuis*			+			+	+		+		+	+	+	+	+	
60	*Diploneis elliptica*			+							+	+		+			
61	*D. oblongella*			+		+											
62	*D. ovalis*							+		+	+						
63	*D. puella*												+				
64	*Epithemia sorex*											+					
65	*E. turgida*													+			
66	*Eunotia bilunaris*			+								+					
67	*E. exigua*			+			+	+									
68	*E. minor*							+	+								
69	*E. muscicola v. tridentula*	+	+														
70	*E. praerupta*										+						
71	*E. soleirolii*	+		+													
72	*E. sudetica et v. bidens*	+			+	+	+		+								
73	*E. tenella*	+	+	+											+		+

Table 1. continue

74	*Fragilaria acus*											+	+	+	+	+	+
75	*F. arcus*	+	+	+	+	+	+		+		+	+	+	+	+	+	+
76	*F. capucina*	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+
77	*F. construens*	+	+	+	+	+				+	+	+	+	+	+	+	
78	*F. crotonensis*										+	+					
79	*F. dilatata*											+		+			
80	*F. leptostauron*	+		+								+					
81	*F. montana*			+		+					+						
82	*F.parasitica v. subconstricta*										+		+				
83	*F. pinnata*	+	+	+	+		+	+	+	+	+						+
84	*F. ulna*	+	+	+	+	+			+	+	+	+	+	+	+	+	
85	*F. virescens*	+	+		+	+					+						
86	*Frustulia vulgaris*			+	+	+					+	+		+		+	
87	*Gomphonema acuminatum*	+	+		+							+		+		+	
88	*G. cf angustatum*	+		+	+	+	+	+		+	+						+
89	*G. cf. angustum*			+			+	+	+	+	+						
90	*G. clavatum*	+		+	+			+		+	+				+		
91	*G. gracile*													+	+	+	
92	*G. cf. minutum*											+	+	+	+		+
93	*G. olivaceum*	+				+			+		+	+	+	+	+	+	+
94	*G. parvulum*	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
95	*G. tergestinum*						+	+			+	+					+
96	*G. truncatum*				+					+	+	+	+	+	+	+	+
97	*Gyrosigma acuminatum*											+	+	+	+	+	
98	*G. attenuatum*											+					
99	*G. nodiferum*					+						+					+
100	*G. scalproides*											+				+	
101	*G. spencerii*					+					+						+
102	*Hantzschia amphioxys*					+		+				+	+	+			+
103	*Melosira varians*										+	+	+	+	+	+	+
104	*Meridion circulare*	+	+	+	+	+	+	+		+	+	+		+		+	+
105	*Navicula accomoda*										+	+	+	+	+	+	
106	*N. angusta*									+							
107	*N. capitata*										+	+		+	+	+	+
108	*N. capitatoradiata*										+	+	+	+	+	+	
109	*N. cincta*											+					
110	*N. cocconeiformis*												+	+			
111	*N. contenta*			+													
112	*N. cryptocephala*	+		+	+	+		+		+	+	+	+	+	+	+	+
113	*N. cryptotenella*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
114	*N. cuspidata*											+		+			
115	*N. decussis*				+	+					+	+					
116	*N. elginensis*		+	+		+					+	+					
117	*N. gallica v. perpusilla*			+							+						
118	*N. goeppertiana*													+	+	+	+
119	*N. gregaria*	+		+	+	+					+	+	+	+	+	+	

Table 1. continue

120	*N. insociabilis*			+													+
121	*N. lanceolata*	+	+	+	+	+	+	+	+		+	+	+	+	+	+	
122	*N. medioconvexa*	+															
123	*N menisculus*							+		+				+		+	+
124	*N minima*	+	+	+	+	+		+		+	+	+	+	+	+		
125	*N minuscula*	+	+	+	+	+		+				+			+	+	+
126	*N. mutica*	+	+	+								+		+			+
127	*N nivalis*									+							
128	*N. oppugnata*											+					
129	*N. pelliculosa*			+	+					+	+		+	+	+	+	
130	*N. pseudobryophila*			+													
131	*N. pseudoscutiformis*	+															
132	*N. pupula*	+		+	+	+		+	+	+	+	+					
133	*N. pygmaea*											+	+			+	
134	*N radiosa*						+	+		+		+	+	+		+	
135	*N. recens*										+						
136	*N. reinhardtii*							+									
137	*N. rhynchocephala*	+	+		+	+					+			+			
138	*N. salinarum*													+			
139	*N. schroeterii*											+					
140	*N seminulum*												+	+			
141	*N. slesvicensis*													+		+	
142	*N striolata*							+									+
143	*N. subminuscula*										+	+	+	+	+	+	
144	*N. tenelloides*			+	+	+											+
145	*N. tripunctata*	+		+		+		+			+	+	+	+	+	+	
146	*N. trivialis*										+	+	+	+	+		
147	*N. variostriata*	+															
148	*N. veneta*														+	+	
149	*N. viridula*										+	+		+	+	+	
150	*Neidium affine*			+								+					
151	*N. ampliatum*											+					
152	*N binodeformis*									+							
153	*N bisulcatum*	+		+													
154	*N. dubium*									+		+		+			+
155	*Nitzschia acicularis*										+	+			+	+	
156	*N. amphibia*	+		+							+	+					
157	*N. brevissima*											+				+	+
158	*N. capitellata*											+		+	+	+	
159	*N. constricta*													+			+
160	*N. dissipata*			+	+	+	+	+		+	+	+	+	+	+	+	
161	*N. dubia*													+			
162	*N. cf. filiformis*															+	
163	*N. fonticola*											+		+	+		+
164	*N. frustulum*					+		+	+	+	+	+	+	+	+	+	
165	*N. gracilis*										+						

Table 1. continue

166	*N. hantzschiana*			+	+	+		+	+		+	+					
167	*N heufleriana*										+	+					
168	*N. homburgiensis*	+		+							+						
169	*N. hungarica*											+		+	+		+
170	*N inconspicua*										+	+	+	+	+	+	+
171	*N. linearis*			+	+	+		+			+	+	+	+	+	+	
172	*N microcephala*	+											+				+
173	*N. palea*	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
174	*N. paleacea*											+		+	+	+	
175	*N pura*								+	+							
176	*N pusilla*							+		+	+	+	+	+	+	+	
177	*N. recta*											+		+	+		
178	*N. sigmoidea*											+					
179	*N. sinuata*									+							
	N. sinuata v. tabellaria					+						+	+				
180	*N. sociabilis*											+					
181	*N. sublinearis*										+	+	+	+	+	+	
182	*N. tryblionella*											+			+		
183	*N. vermicularis*											+	+	+			
184	*Pinnularia borealis*	+								+	+						
185	*P. gibba*				+												
186	*P interrupta*	+		+		+					+						
187	*P. microstauron*	+		+		+	+					+					
188	*P. subcapitata*	+	+	+		+		+	+		+	+					
189	*P. viridis*	+	+	+		+	+				+	+					+
190	*Rhoicosphaenia abbreviata*			+	+	+				+	+	+	+		+	+	
191	*Rhopalodia brebissonii*											+					
192	*R. gibba v parallela*			+													
193	*Stauroneis anceps*							+		+	+	+					
194	*S. kriegerii*	+							+								
195	*S. phoenicenteron*	+		+	+					+							
196	*S. smithii*			+						+		+					+
197	*Stephanodiscus cf. dubius*											+					
198	*S. hantzschii*											+					+
199	*Surirella angusta*			+	+	+				+	+	+		+			
200	*S. bifrons*					+											+
201	*S. brebissonii*			+		+					+	+	+	+	+	+	
202	*S. linearis*											+	+		+	+	+
203	*S. minuta*											+	+	+	+	+	
204	*S. ovalis*							+		+	+			+		+	
205	*S. splendida*										+	+					
206	*Tabellaria fenestrata*											+					
207	*T. flocculosa*	+	+					+	+		+	+		+		+	
	CHLOROPHYTA																
1	*Chlorella vulgaris*															+	
2	*Closterium acerosum*														+		

Table 1. continue

3	*C. moniliferum*						+					+	+				
4	*Kirchneriella subcapitata*											+					
5	*Monoraphidium arcuatum*												+				
6	*M. contortum*												+				
7	*Netrium digitus*							+									
8	*Pediastrum boryanum*											+				+	
9	*Scenedesmus acutus*											+	+	+			
10	*S. armatus*											+		+	+		
11	*Schroederia setigera*												+				
12	*Staurastrum tetracerum*												+				
13	*Stigeoclonium fasciculare*												+	+	+	+	
14	*S. tenue*															+	
15	*S. variabilis*														+		
	EUGLENOPHYTA																
1	*Colacium epiphyticum*													+	+		
2	*Euglena proxima*													+	+	+	
3	*E. texta*													+			

Table 2. Floristic composition of algal communities in the dam reservoirs of Someşul Cald river

Nr crt	Taxa	Sampling sites				
		Fântânele	Tarniţa	Gilău		
		plankton	plankton	plankton	benthos	epiphyton
	CYANOPHYTA					
1	*Chroococcus turgidus*	+	+			
2	*Merismopedia glauca*	+	+			
3	*Oscillatoria boryana*			+		
4	*O. lacustris*			+		
5	*O. limosa*			+		
6	*O. planctonica*			+		
	CHRYSOPHYTA					
1	*Uroglena volvox*	+	+	+		
2	*Dinobryon divergens*	+	+	+		
3	*Mallomonas acaroides*	+	+	+		
4	*Synura spinosa*			+		
5	*Chrysosphaerella brevispinosa*	+	+	+		
	BACILLARIOPHYTA					
1	*Achnanthes bioretii*		+	+		+
2	*A. clevei v. rostrata*					+
3	*A. lanceolata*		+	+	+	+
4	*A. laterostrata*					+
5	*A. minutissima*		+	+	+	+ D
6	*A. peragalli*					+
7	*Amphora inariensis*			+		+
8	*A. libyca*		+		+	+
9	*A. montana*				+	
10	*A. pediculus*			+	+	+
11	*Anomoeoneis vitrea*			+	+	+
12	*Asterionella formosa*	+ D	+ D	+ CD	+	+
13	*Caloneis amphisbaena*				+	
14	*C. silicula*				+	
15	*Cocconeis placentula*			+	+	+
16	*Cyclotella meneghiniana*			+		+
17	*Cymatopleura solea*				+	
18	*Cymbella caespitosa*			+		+
19	*C. cistula*			+	+	+
20	*C. cuspidata*		+		+	
21	*C. helvetica*			+	+	
22	*C. lanceolata*			+	+	+
23	*C. microcephala*					+
24	*C. minuta*			+	+	+
25	*C. prostrata*		+			
26	*C. proxima*					+
27	*C. silesiaca*		+	+	+	+
28	*C. sinuata*			+	+	+
29	*C. subaequalis*		+			

Table 2. continue

30	*C. tumida*				+	
31	*C. turgida*				+	
32	*C. turgidula*		+		+	+
33	*Diatoma mesodon*		+		+	
34	*D. vulgaris*		+	+	+	+
35	*Denticula kuetzingii*			+		+
36	*D. tenuis*			+	+	+
37	*Diploneis parma*		+		+	+
38	*D petersenii*		+			
39	*D puella*		+	+		+
40	*Eunotia bilunaris*			+		
41	*Fragilaria arcus*		+	+	+	+
42	*F. capucina*		+	+	+	+
43	*F. construens*			+	+	+
44	*F. crotonensis*		+ CD	+ D		+ CD
45	*F. delicatissima*			+	+	+
46	*F. dilatata*			+	+	+
47	*F. leptostauron*					+
48	*F. parasitica v. subconstricta*				+	
49	*F. pinnata*		+	+	+	+
50	*F. ulna*		+	+	+	+
51	*F. virescens*					+
52	*Frustulia vulgaris*			+	+	+
53	*Gomphonema acuminatum*			+	+	+
54	*G. cf. angustatum*			+	+	
55	*G. gracile*					+
56	*G. olivaceum*				+	
57	*G. parvulum*				+	+
58	*G. tergestinum*		+			
59	*Gyrosigma nodiferum*				+	
60	*G. scalproides*				+	
61	*G. spencerii*		+	+	+	+
62	*Hantzschia amphioxys*				+	
63	*Melosira varians*			+		+
64	*Meridion circulare*				+	+
65	*Navicula bacillum*			+		
66	*N. bryophila*		+			
67	*N. capitata*		+	+	+	+
68	*N capitatoradiata*			+	+	
69	*N. cryptocephala*		+	+	+	+
70	*N. cryptotenella*				+	+
71	*N. decussis*				+	+
72	*N. elginensis*					+
73	*N. gregaria*				+	+
74	*N. hambergii*				+	
75	*N. kraskeii*				+	

Table 2. continue

76	*N. lanceolata*		+		+	+
77	*N. menisculus*			+	+	
78	*N. minima*			+		+
79	*N. minuscula*				+	+
80	*N. oppugnata*				+	
81	*N. pelliculosa*					+
82	*N. pupula*				+	+
83	*N. pygmaea*				+ CD	
84	*N. radiosa*		+	+	+	
85	*N. rhynchocephala*		+	+	+	+
86	*N. subminuscula*				+	
87	*N. submolesta*				+	+
88	*N. tripunctata*				+	+
89	*N. trivialis*			+		
90	*N. utermoehlii*					+
91	*N. viridula*		+		+	
92	*N. vitabunda*		+			
93	*Nitzschia amphibia*				+	
94	*N. angustata*					+
95	*N. brevissima*				+	
96	*N. dissipata*			+	+	+
97	*N. fonticola*			+	+	+
98	*N. frustulum*				+	+
99	*N. gracilis*			+		
100	*N. heufleriana*			+	+	+
101	*N. homburgiensis*				+	
102	*N. linearis*		+	+	+	+
103	*N. palea*				+	+
104	*N. pusilla*			+	+ D	
105	*N. pura*				+	
106	*N. recta*				+	
107	*N.sinuata v.tabellaria*					+
108	*N. sublinearis*		+	+	+	+
109	*Pinnularia borealis*				+	
110	*P. divergens*		+			
111	*P. interrupta*				+	
112	*P. microstauron*				+	+
113	*P. subcapitata*				+	+
114	*P. viridis*				+	
115	*Rhoicosphaenia abbreviata*				+	+
116	*Stauroneis anceps*				+	
117	*S. smithii*		+			
118	*Surirella angusta*				+	+
119	*S. linearis*			+		
120	*S. minuta*				+	
121	*S. ovalis*				+	

Table 2. continue

122	*S. splendida*		+	+		
123	*Tabellaria fenestrata*					+
124	*T. flocculosa*		+	+	+	+
	CHLOROPHYTA					
1	*Oocystis lacustris*		+	+		
2	*O. planctonica*		+	+		
3	*Pseudosphaerocystis lacustris*	+	+	+		
4	*Eudorina elegans*	+	+	+		
5	*Microspora willeana*			+		
	DINOPHYTA					
1	*Peridinium willei*	+	+	+		
2	*Ceratium hirundinella*		+	+		

Table 3. Floristic composition of algal communities in the Someşu Mare river

Nr. crt.	Taxa	Sampling sites 1993								1996							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
	CYANOPHYTA																
1	*Calothrix kossinskaje*																+
2	*Chamaesiphon incrustans*		+			+	+										
3	*Oscillatoria boryana*									+	+	+					
4	*O. curviceps*														+		
5	*O. inigna*										+		+		+		
6	*O. gemminata*										+			+	+	+	+
7	*O. granulata*										+		+	+	+	+	+
8	*O. limosa*												+		+	+	
9	*O. princeps*													+			
10	*O. simplicissima*												+				
11	*Phormidium ambiguum*													+	+		+
12	*P. frigidum*													+	+	+	
13	*P. inundatum*		+			+	+	+	+								
14	*P. molle*		+	+	+		+					+	+				
15	*P. uncinatum*													+			
	CHRYSOPHYTA																
1	*Chrysococcus rufescens*									+			+				
2	*Hydrurus phoetidus*			+	+	+			+	+	+	+	+				
	XANTHOPHYTA																
1	*Goniochloris mutica*									+	+	+					
2	*Ophiocytium cochleare*									+	+`	+					
	BACILLARIOPHYTA																
1	*Achnanthes bioretii*		+	+	+		+		+	+	+	+	+	+	+	+	+
2	*Achnanthes flexella*			+													
3	*A. cf. helvetica*		+														
4	*A. hungarica*															+	
5	*A. lanceolata*			+	+	+	+			+	+	+	+	+	+	+	+
6	*A. minutissima*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
7	*A. subatomoides*			+	+					+		+	+		+		
8	*Amphipleura pellucida*			+									+				
9	*Amphora aequalis*				+												
10	*A. inariensis*											+					+
11	*A. libyca*					+			+				+		+		
12	*A. montana*				+		+								+		
13	*A. ovalis*			+				+	+								+
14	*A. pediculus*		+	+	+		+	+	+		+	+		+	+	+	+
15	*Aulacoseira ambigua*																+
16	*A. granulata*		+														
17	*Caloneis amphisbaena*														+	+	+
18	*C. bacillum*		+	+	+		+	+				+	+	+	+	+	+
19	*C. silicula*		+	+	+		+				+	+	+		+		

Table 3. continue

20	*Cocconeis neodiminuta*		+	+	+		+		+								
21	*C. pediculus*				+	+	+	+	+					+	+	+	+
22	*C. placentula*		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
23	*Cyclostephanos invisitatus*							+									
24	*Cyclotella atomus*															+	+
25	*C. meneghiniana*						+	+	+							+	+
26	*C. ocellata*												+				
27	*Cymatopleura solea*							+	+					+	+	+	+
28	*Cymbella affinis*		+	+	+	+	+	+			+		+	+	+	+	+
29	*C. amphicephala*		+	+			+			+	+	+	+	+		+	+
30	*C. aspera*		+	+								+		+			
31	*C. caespitosa*																+
32	*C. cesatii*				+								+				
33	*C. cistula*			+	+	+	+	+	+						+	+	+
34	*C. cuspidata*				+			+									
35	*C. cymbiformis v. nonpunctata*		+														
36	*C. gracilis*								+								
37	*C. helvetica*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
38	*C. lanceolata*						+	+									
39	*C. minuta*		+	+	+	+		+		+	+	+	+	+	+	+	+
40	*C. naviculiformis*				+				+								
41	*C. perpusilla*		+		+												
42	*C. prostrata*					+	+	+	+						+	+	+
43	*C. proxima*							+	+								
44	*C. reichardtii*						+				+	+	+		+	+	+
45	*C. silesiaca*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
46	*C. sinuata*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
47	*C. subaequalis*			+	+		+					+	+				
48	*C. tumida*							+	+						+	+	+
49	*Denticula kutzingii*		+				+							+			
50	*D. tenuis*		+	+	+		+			+		+	+				
51	*Diatoma anceps*										+						
52	*D. ehrenbergii*		+	+	+	+	+	+	+			+	+		+	+	+
53	*D. hyemalis*		+														
54	*D. mesodon*		+	+		+	+	+		+	+	+	+	+	+	+	+
55	*D. moniliformis*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
56	*D. tenuis*			+												+	
57	*D. vulgaris*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
58	*Diatomella balfouriana*											+					
59	*Diploneis elliptica*		+											+			
60	*D. oblongella*													+			
61	*D. ovalis*			+	+					+		+	+				
62	*Ellerbeckia arenaria*							+									
63	*Entomoneis palludosa v. subsalina*															+	
64	*Epithemia adnata*		+						+				+		+	+	
65	*Eunotia bilunaris*				+												

Table 3. continue

66	*E. exigua*				+												
67	*E. implicata*											+					
68	*E. minor*			+													
69	*E. pectinalis*				+												
70	*E. praerupta*					+											
71	*E. soleirolii*												+				
72	*E. sudetica*			+													
73	*E. tenella*											+					
74	*Fragilaria arcus*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
75	*F. capucina*		+	+	+	+	+	+		+	+	+	+	+	+	+	
76	*F. construens*			+			+	+		+		+					
77	*F. leptostauron*		+	+													
78	*F. montana*		+													+	+
79	*F. pinnata*		+	+	+		+								+		
80	*F. ulna*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
81	*F. virescens*					+					+	+					
82	*Frustulia vulgaris*		+	+	+	+	+	+				+	+	+	+	+	+
83	*Gomphonema acuminatum*																+
84	*G. cf. angustatum*		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
85	*G. cf. angustum*		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
86	*G. clavatum*		+	+	+							+		+			
87	*G. gracile*		+	+	+							+	+		+		
88	*G. olivaceum*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
89	*G. parvulum*		+	+	+			+		+	+	+	+	+	+	+	+
90	*G. tergestinum*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
91	*G. truncatum*				+				+					+	+		
92	*Gyrosigma acuminatum*						+		+						+		+
93	*G. attenuatum*						+										+
94	*G. nodiferum*		+						+								
95	*G. scalproides*							+								+	
96	*G. spencerii*														+		
97	*Hantzschia amphioxys*		+	+	+		+	+	+			+	+	+	+	+	+
98	*Melosira varians*					+		+	+			+		+	+	+	+
99	*Meridion circulare*		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
100	*Navicula accomoda*				+			+				+	+		+	+	+
101	*N. bacillum*														+		
102	*N. capitata*															+	
103	*N. capitatoradiata*						+	+		+	+	+	+	+	+	+	+
104	*N. cincta*								+					+		+	+
105	*N. clementis*		+														
106	*N. cocconeiformis*		+	+	+	+	+	+		+	+	+	+	+	+	+	
107	*N. contenta*				+		+										
108	*N. cryptocephala*		+	+	+				+	+	+	+	+	+	+	+	+
109	*N. cryptotenella*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
110	*N. cuspidata*							+	+			+			+	+	
111	*N. decussis*		+			+								+			

Table 3. continue

112	*N. elginensis*		+	+	+	+			+		+					+	
113	*N. gallica v. perpusilla*								+	+	+	+					
114	*N. goeppertiana*															+	+
115	*N. gregaria*		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
116	*N lanceolata*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
117	*N. libonensis*																+
118	*N menisculus*												+		+		+
119	*N. minima*		+	+	+		+		+	+		+	+		+	+	+
120	*N minuscula*		+	+		+	+	+	+	+	+	+	+	+	+	+	
121	*N mutica*		+		+		+	+		+		+	+	+	+		
122	*N oppugnata*				+							+					
123	*N pelliculosa*													+		+	
124	*N pupula*		+					+		+			+	+	+	+	
125	*N. pygmaea*							+	+							+	+
126	*N radiosa*		+	+	+				+			+			+	+	+
127	*N rhynchocephala*						+	+									+
128	*N salinarum*															+	
129	*N splendicula*											+					
130	*N subhamulata*											+					
131	*N subminuscula*			+	+		+	+	+							+	+
132	*N tenelloies*		+	+	+							+					
133	*N tripunctata*		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
134	*N trivialis*		+	+		+			+	+	+	+			+	+	+
135	*N. variostriata*				+												
136	*N. viridula*		+		+	+	+	+	+	+		+	+	+	+	+	+
137	*Neidium affine*			+			+						+				
138	*N. ampliatum*														+		
139	*N. binodeforme*														+		
140	*N. dubium*				+				+								+
141	*N. cf. hercynicum*			+													
142	*N cf. septentrionale*		+														
143	*Nitzschia acicularis*			+	+		+	+						+	+	+	+
144	*N. amphibia*													+		+	+
145	*N. brevissima*													+			
146	*N. calida*														+	+	+
147	*N. capitellata*				+			+	+			+	+	+		+	+
148	*N. communis*			+													
149	*N constricta*														+	+	+
150	*N dissipata*		+	+	+		+	+		+	+	+	+	+		+	+
151	*N dubia*																+
152	*N filiformis*															+	
153	*N. fonticola*		+								+	+					
154	*N. frustulum*		+	+	+	+	+					+	+	+			
155	*N. hantzschiana*		+		+		+	+			+	+	+				
156	*N. homburgiensis*												+			+	+
157	*N. hungarica*							+	+						+	+	+

Table 3. continue

158	*N. inconspicua*			+		+	+	+				+		+	+	+	
159	*N. intermedia*														+		
160	*N. levidensis*														+	+	
161	*N. linearis*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
162	*N. microcephala*								+								
163	*N. palea*		+	+	+	+	+	+				+	+	+	+	+	+
164	*N. paleacea*			+	+	+		+									
165	*N. pellucida*																
166	*N. pusilla*		+	+	+	+	+	+		+		+		+			
167	*N. recta*														+		
168	*N. sinuata v. tabellaria*																+
169	*N. sociabilis*													+	+	+	
170	*N. sublinearis*			+			+			+		+			+	+	+
171	*N. umbonata*							+	+				+		+	+	
172	*N. vermicularis*													+	+	+	
173	*Pinnularia borealis*		+	+	+	+	+	+	+			+	+	+	+		
174	*P. divergens*			+													
175	*P. interrupta*			+						+							
176	*P. microstauron*		+	+				+	+			+	+	+	+		
177	*P. obscura*			+	+												
178	*P. stomatophora*			+													
179	*P. subcapitata*		+	+	+							+				+	
180	*P. viridis*		+	+	+	+	+		+		+	+	+	+	+	+	+
181	*Rhoicosphaenia abbreviata*				+		+								+	+	+
182	*Rhopalodia brebissonii*			+													
183	*R. gibba*			+				+									
184	*Stauroneis anceps*		+	+	+	+	+		+	+					+	+	+
185	*S. kriegerii*							+									
186	*S. phoenicenteron*														+		
187	*S. smithii*		+					+									
188	*Surirella angusta*			+	+	+	+		+	+	+	+	+	+	+	+	+
189	*S. brebissonii*		+	+	+	+	+	+		+	+	+	+	+	+	+	+
190	*S. minuta*		+	+	+	+	+	+	+		+	+	+	+	+	+	+
191	*S. ovalis*							+							+		+
192	*S. splendida*													+			
193	*Tabellaria fenestrata*										+						
194	*T. flocculosa*		+	+	+								+				
195	*Tetracyclus rupestris*											+		+			
196	*Thalassiosira weissflogii*							+	+							+	+
	CHLOROPHYTA																
1	*Chlorella luteo-viridis*													+			+
2	*C. vulgaris*								+			+					+
3	*Cladophora glomerata*													+		+	+
4	*Closterium acerosum*											+		+	+	+	+
5	*C. leibleinii*															+	+
6	*C. moniliferum*													+		+	+

Table 3. continue

7	*Coelastrum sphaericum*													+			+
8	*Cosmarium formosulum*															+	+
9	*Cylindrocapsa geminata*										+	+					
10	*Hormidium flaccidum*									+	+		+				
11	*Kirchneriella obesa*													+	+	+	+
12	*K. subcapitata*								+				+			+	
13	*Monoraphidium arcuatum*																+
14	*M. contortum*							+	+							+	+
15	*Pediastrum boryanum*													+	+	+	+
16	*Scenedesmus acuminatus*															+	+
17	*S. acutus*											+			+	+	+
18	*S. armatus*											+					
19	*S. ecornis*											+		+	+		
20	*S. denticulatus*															+	+
21	*S. gutwinskii*															+	+
22	*S. opoliensis*													+			+
23	*S. quadricauda*															+	+
24	*Schizomeris leibleinii*													+			+
25	*Stichococcus bacillaris*							+	+	+			+				
26	*Stigeoclonium amoenum*					+							+				
27	*S. flageliforme*																+
28	*S. lubricum*												+				+
29	*S. subsecundum*											+	+				
30	*S. tenue*													+	+	+	+
31	*S. variabile*																+
32	*Ulothrix tenue*					+											
33	*U. zonata*			+	+	+	+			+	+	+	+				
	EUGLENOPHYTA																
1	*Euglena ehrenbergii*														+		
2	*E. gracilis*								+			+	+	+	+	+	+
3	*E. oxyuris*															+	+
4	*E. pisciformis*															+	+
5	*E. polymorpha*							+							+	+	+
6	*E. proxima*														+	+	+
7	*E. spirogyra*														+		
8	*E. stellata*																+
9	*E. texta*													+			+
10	*E. viridis*													+	+	+	+
11	*Lepocinclis ovum*																+
12	*L. radiata*												+		+	+	+
13	*Peranema micromastix*															+	+
14	*Phacus arnoldii*														+		
15	*P. orbicularis*														+		+
16	*P. platalea*																+
17	*P. tortus*													+		+	+
18	*Strombomonas verrucosa*												+	+		+	+
19	*Trachelomonas oblonga*															+	+
20	*T. volvocina*									+	+	+					

Table 4. Floristic composition of algal communities in the 'united' Someş river

Nr crt	Taxa	Sampling sites													
		Plankton							Benthos						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
	CYANOPHYTA														
1	Aphanizomenon flos-aquae										+				
2	Gomphosphaeria aponina		+	+	+										
3	Microcystis aeruginosa	+		+	+										
4	Oscillatoria amoena								+						
5	O. boryana								+	+					
6	O. brevis						+		+						
7	O chlorina			+	+				+						
8	O. granulata			+	+				+		+				
9	O. limnetica								+						
10	O. limosa			+	+			+	+	+					
11	O. princeps			+	+	+							+		
12	O. splendida												+		
13	O. tenuis			+	+	+		+	+	+		+	+		+
14	Phormidium ambiguum								+	+		+			
15	P molle										+				
	CHRYSOPHYTA														
1	Chrysococcus rufescens				+				+						
2	Dinobryon divergens	+	+	+	+	+		+	+			+			
	XANTHOPHYTA														
1	Goniochloris mutica	+	+	+	+	+									
	BACILLARIOPHYTA														
1	Achnanthes biasolettiana	+	+	+		+	+	+	+	+	+	+	+		+
2	A. brevipes									+					
3	A. lanceolata	+	+	+	+	+	+	+	+	+	+	+	+		+
4	A. minutissima	+	+	+	+	+	+	+	+	+	+	+	+		+
5	Amphipleura pellucida														+
6	Amphora libyca					+	+	+		+	+	+			
7	A. montana			+		+		+	+	+		+	+		+
8	A. ovalis				+			+			+	+			
9	A. pediculus	+	+	+	+	+		+	+	+	+	+			+
10	A. veneta		+												
11	Asterionella formosa	+	+	+	+			+	+	+	+	+	+		+
12	Aulacoseira granilata										+				
13	A. italica	+		+	+	+									
14	Bacillaria paradoxa														+
15	Caloneis amphisbaena	+	+	+	+	+	+	+	+	+	+	+	+		
16	C. bacillum					+		+	+	+	+		+		+
17	C. silicula			+		+	+	+	+	+	+		+		+
18	Centric mic			+	+	+	+	+		+	+	+	+		+
19	Cocconeis pediculus	+	+	+	+	+	+	+	+	+	+	+	+		+
20	C. placentula	+	+	+	+	+	+	+	+	+	+	+	+		+
21	Cyclostephanos invisitatus	+	+	+	+	+	+	+	+	+	+	+			+
22	Cyclotella atomus			+	+	+	+	+				+	+		
23	C. meneghiniana	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Table 4. continue

24	C srelligera														+
25	Cymatopleura solea	+	+	+	+	+	+	+	+	+	+		+		+
26	Cymbella affinis		+	+	+	+	+	+	+	+	+	+	+		+
27	C amphicephala							+		+			+		+
28	C. caespitosa					+	+	+		+	+				
29	C. cistula	+		+						+					
30	C. helvetica	+	+	+		+	+	+	+	+	+	+	+		+
31	C lanceolata	+													
32	C mınuta	+	+	+		+	+	+	+		+		+		
33	C. naviculiformis														+
34	C. prostrata		+				+	+		+	+				
35	C. reichardtii					+			+		+				
36	C. silesiaca	+	+	+	+	+	+	+	+	+	+	+	+		+
37	C. sinuata	+	+	+	+	+	+	+	+	+	+	+	+		+
38	C. tumida	+		+		+		+	+	+	+				
39	Denticula kutzingii		+								+				
40	Dıatoma mesodon	+	+	+		+	+	+	+		+		+		+
41	D moniliformis	+	+	+	+	+	+	+	+	+	+	+	+	+	+
42	D. tenuis										+				
43	D. vulgaris	+	+	+	+	+	+	+	+	+	+	+	+		+
44	Dıploneıs oblongella												+		
45	D. oculata							+							
46	D. ovalis														+
47	Entomoneis paludosa v. sub	+		+											
48	Epithemia adnata						+	+							
49	Fragilaria acus	+	+		+	+	+	+	+						
50	F. arcus	+	+	+	+	+	+	+	+	+	+	+	+		+
51	F. capucina	+	+	+		+	+	+	+	+	+	+	+		+
52	F. construens					+					+				+
53	F. crotonensis	+	+	+	+	+		+	+	+					
54	F. delicatissima		+												
55	F. pulchella	+													
56	F. ulna	+	+	+	+	+	+	+	+	+	+		+		+
57	Frustulia vulgaris				+	+		+	+	+	+		+		+
58	Gomphonema angustatum	+	+	+	+			+	+	+	+		+	+	+
59	G. cf. angustum		+	+					+	+	+				+
60	G. augur									+					
61	G. clavatum											+			
62	G. gracile									+	+	+			
63	G. cf. micropus											+			
64	G. olivaceum,	+	+	+	+	+		+	+	+	+	+	+	+	+
65	G. parvulum		+	+	+	+		+	+	+	+	+	+	+	
66	G. cf pumillum											+			
67	G. cf sarcophagus									+					
68	G. tergestinum	+	+		+			+	+	+	+	+	+	+	+
69	G truncatum								+	+					
70	Gyrosigma acuminatum	+	+	+	+	+		+	+	+	+	+	+		+
71	G. attenuatum														+
72	G. scalproides		+	+	+	+		+	+	+	+	+	+		+
73	G. cf spencerii			+											

Table 4. continue

74	Hantzschia amphioxys							+		+	+			+	
75	Melosira varians	+	+	+	+	+	+	+	+	+	+	+	+		+
76	Meridion circulare	+	+	+	+	+	+	+	+	+	+	+			+
77	Navicula accomoda	+	+	+	+		+	+	+	+	+	+			+
78	N. bacillum							+							+
79	N. capitata	+		+		+		+	+	+	+				
80	N. capitatoradiata	+	+	+	+	+	+	+	+	+	+	+	+		+
81	N. cincta		+	+							+	+			
82	N. clementis														+
83	N. cocconeiformis						+								+
84	N. cryptocephala		+			+		+	+	+	+				+
85	N. cryptotenella	+	+		+			+	+	+	+	+			+
86	N. cuspidata	+	+	+	+	+	+	+	+	+	+	+	+		+
87	N. decussis							+			+				+
88	N. elginenesis	+		+		+		+							+
89	N. erifuga	+	+	+	+	+	+	+	+	+	+	+	+		+
90	N. cf fracta					+					+				
91	N. gallica v. perpusilla					+									
92	N. goeppertiana		+					+		+	+	+			
93	N. gregaria	+	+	+		+		+	+		+	+	+		+
94	N. halophila		+												
95	N. lanceolata	+	+	+	+	+	+	+	+	+	+	+	+	+	
96	N lapidosa								+						
97	N. menisculus				+			+	+	+	+	+	+		
98	N. minima		+		+	+		+	+	+	+	+	+		+
99	N. minuscula	+	+		+				+	+		+			+
100	N. mutica	+				+		+							+
101	N. nivalis									+					
102	N. pelliculosa									+	+				
103	N. pupula	+	+	+				+	+	+	+	+			+
104	N. pygmaca		+	+	+	+		+	+	+	+	+	+		+
105	N. radiosa							+			+				+
106	N. recens				+	+		+	+	+	+	+	+		
107	N. salinarum	+							+		+				
108	N. slesvicensis		+			+			+	+					
109	N. spicula	+													
110	N. subminuscula	+	+	+	+	+	+	+	+	+	+	+	+		+
111	N. tripunctata	+	+	+	+	+		+	+	+	+	+			+
112	N trivialis	+	+	+	+	+	+	+	+	+	+	+	+		+
113	N. veneta					+				+					
114	N. viridula	+	+	+	+	+	+	+	+	+	+	+	+		
115	Neidium ampliatum	+					+		+		+				+
116	N. binodeforme							+	+						
117	N. binodis		+												
118	N. dubium					+		+					+		+
119	Nitzschia acicularis		+	+	+			+	+	+	+	+	+	+	
120	N. amphibia		+	+	+			+		+		+			
121	N. calida	+	+	+	+	+			+	+	+	+			+
122	N. capitellata	+	+	+	+	+	+	+	+	+	+				+
123	N. constricta	+	+	+	+	+	+	+	+	+	+	+	+		+

Table 4. continue

124	N. dissipata	+	+	+	+	+		+	+	+	+	+	+		+
125	N. dubia			+		+				+					
126	N. frustulum	+							+	+					
127	N. cf. geitleri			+											+
128	N. gracilis	+	+	+				+	+	+	+				
129	N. hungarica	+	+	+	+	+		+	+	+	+	+			+
130	N. inconspicua	+	+	+	+	+		+	+	+	+	+			
131	N. intermedia		+		+				+						+
132	N. levidensis			+					+	+					
133	N. linearis	+	+		+	+	+	+	+	+	+		+	+	+
134	N. lorenziana			+							+				
135	N. microcephala										+				
136	N. cf. nana								+	+	+	+			
137	N. palea	+	+	+	+	+	+	+	+	+	+	+	+	+	+
138	N. paleacea	+	+	+	+				+	+	+	+			+
139	N. parvula											+			
140	N. pusilla										+				+
141	N. recta		+		+				+	+	+				+
142	N. reversa								+		+				
143	N. sigma			+						+	+				
144	N. sigmoidea		+	+						+					+
145	N. sociabilis		+	+					+	+	+				
146	N. tryblionella			+						+					
147	N. umbonata		+	+	+	+			+	+	+	+			+
148	N. vermicularis			+				+		+	+				
149	Pinnularia borealis	+									+				+
150	P. divergens							+							
151	P. gibba		+			+				+					
152	P. interrupta							+							
153	P. microstauron					+				+	+	+			+
154	P. nodosa					+									
155	P. obscura							+		+	+				
156	P. viridis		+	+	+	+		+		+	+	+			+
157	Rhoicosphaenia abbreviata	+	+		+			+	+	+	+	+	+		+
158	Stauroneis anceps			+							+				
159	S. phoenicenteron		+		+	+		+							+
160	S. smithii									+					
161	Surirella angusta			+	+	+	+	+	+	+	+		+		+
162	S. brebissonii	+	+	+	+	+	+	+	+	+	+	+	+	+	
163	S. elegans							+							
164	S. linearis			+									+		+
165	S. minuta		+				+	+	+	+	+	+	+		+
166	S. ovalis	+				+			+	+	+				+
167	S. splendida		+	+		+	+	+	+		+				+
168	Thalassiosira weissflogii	+	+	+	+	+	+	+	+	+	+	+	+		+
	CHLOROPHYTA														
1	Actinastrum hantzschii	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	Ankistrodesmus bibraianus				+										
3	A. fusiformis				+										
4	Ankira lanceolata				+	+									

Table 4. continue

5	Carteria abiscoensis			+	+							+			
6	Cephalomonas granulata				+							+			
7	Chlamydomonas composita					+	+						+	+	
8	C. debaryana					+							+		
9	C. metapyrenigera			+	+	+									
10	C. monadina	+	+	+	+	+		+				+			
11	C. neglecta											+	+		
12	C passiva		+												
13	C. polypyrenoidosa			+											
14	C pseudopertusa				+	+						+			
15	C. reinhardtii			+	+										
16	Chlorella luteo-viridis				+	+									
17	C vulgaris				+	+						+			
18	Chlorococcum aquaticum	+						+							
19	C. schizochlamys					+	+								
20	Chlorogonium elongatum								+						
21	Cladophora glomerata									+		+			
22	Closterium acerosum			+	+		+		+		+		+		
23	C. acutum							+							
24	C. ehrenbergii			+	+				+						
25	C. moniliferum						+				+				
26	Coelastrum astroideum				+	+						+			
27	C. microporum				+	+	+	+							
28	C. proboscideum				+										
29	C. reticulatum							+							
30	C. sphaericum	+		+	+	+	+	+	+		+				
31	Cosmarium formosulum	+	+	+	+	+	+	+	+	+	+	+	+	+	+
32	Crucigenia apiculata				+	+									
33	C. quadrata							+							+
34	C. rectangularis				+	+									
35	Dictyosphaerium ehrenbergianum				+			+							
36	D. pulchellum			+	+	+						+			
37	D. simplex			+	+							+			
38	D. tetrachotomum			+	+										
39	Didymocystis planctonica				+							+			
40	Eudorina elegans	+	+	+	+	+	+	+							
41	E. ilinoisensis				+			+							
42	Franceia ovalis				+	+									
43	Golenkinia radiata				+	+		+							
44	Gonium pectorale			+	+	+		+							+
45	Hofmania lauterbornii				+			+							
46	Korschikoviella limnetica					+									
47	Kirchneriella mucosa														+
48	K. obesa	+		+		+	+	+							
49	K. subcapitata			+		+								+	
50	Lagerheimia citriformis					+									+
51	L. gerevensis					+									
52	L. wratislawiensis			+	+										
53	Lambertia ocellata			+							+				
54	Micractinium pusillum				+										

Table 4. continue

55	Monoraphidium arcuatum			+	+	+	+	+				+	+		+
56	M. contortum		+	+	+	+	+	+		+	+	+		+	+
57	M. griffithii		+	+	+	+		+							
58	M. indicum							+							
59	M. irregularis				+	+	+								
60	M. longiusculum				+										
61	Neochloris dissecta					+									+
62	Oocystis coronata				+										
63	O. lacustris				+	+									
64	O. marsonii					+		+							
65	O. planctonica					+									
66	O. verrucosa			+		+									
67	Pandorina morum	+		+	+	+	+	+							
68	P. smithii							+							
69	Pediastrum angulosum					+		+							
70	P boryanum	+	+	+	+	+	+								
71	P. duplex				+	+	+								
72	P. tetras			+	+	+	+								+
73	Pseudococcomyxa simplex														+
74	Pseudosphaerocystis lacustris					+									
75	Pyrobotrys casinoensis			+	+										
76	Quadricoccus laevis			+		+		+					+		
77	Radiophylum irregulare								+						
78	Scenedesmus acuminatus		+	+	+	+		+			+	+			
79	S. acutus	+	+	+		+		+		+	+	+	+		+
80	S. alternans		+	+	+						+				
81	S. arcuatus				+										
82	S. armatus				+	+		+							
83	S. denticulatus			+	+										
84	S. dispar				+	+						+			
85	S. ecornis			+	+	+		+			+				+
86	S gutwinskii	+			+	+					+				
87	S. intermedius	+	+	+	+	+	+	+	+		+	+	+	+	+
88	S. opoliensis	+	+	+	+	+	+	+			+				+
89	S. ovalternus					+							+		
90	S protuberans			+		+	+	+						+	
91	S. quadricauda	+	+	+	+	+	+	+			+	+	+	+	+
92	S, spinosus			+		+		+			+				
93	Siderocelis ornata				+										
94	Sphaerellopsis fluviatilis					+									
95	Stigeoclonium tenue	+		+	+		+			+		+	+	+	
96	Tetrachlorella alternans			+	+			+							
97	Tetraedron caudatum				+			+		+	+				
98	T. incus				+										
99	T. minimum				+					+					
100	Tetraselmis cordiformis		+	+	+				+		+				
101	Tetrastrum glabrum			+				+							
102	T. punctulatum			+	+					+	+				
103	T. staurogeniaeforme			+			+								
104	Treubaria planctonica			+	+										

Table 4. continue

##	T. varia							+							
	EUGLENOPHYTA														
1	Euglena acus	+	+	+	+	+		+							
2	E. ehrenbergii	+	+		+	+				+					
3	E. gracilis	+	+	+	+		+	+	+				+		+
4	E. oxyuris			+	+	+	+	+							
5	E. pisciformis			+	+	+	+	+				+		+	+
6	E. polymorpha		+		+	+		+	+						
7	E. proxima		+	+	+		+		+						
8	E. spirogyra		+		+				+	+					
9	E. tristella			+	+										+
10	E. variabilis		+												
11	E. viridis		+	+				+	+			+			+
12	Lepocinclis ovum	+	+	+		+		+	+						+
13	L. playfariana		+												
14	L. texta		+		+			+		+	+				
15	Phacus acuminatus				+										
16	P. longicauda				+										
17	P. orbicularis		+		+				+						
18	P. platalea	+							+						
19	P. pseudonordstedtii				+		+							+	
20	P. pusillus								+						
21	P. tortus		+												
22	P. triqueter					+		+							
23	Strombomonas fluviatilis							+							
24	S. gibberosa		+	+		+		+							
25	S. verrucosa		+	+	+	+		+							
26	Trachelomonas hexangulata				+										
27	T. hispida			+	+	+									
28	T. oblonga		+			+									
29	T. planctonica					+									
30	T. volvocina					+									
31	T. volvocinopsis				+	+									
	DINOPHYTA														
1	Ceratium hirundinella				+			+							

The Oligochaeta and the chironomida fauna in the River Someş/Szamos[1] system

András Szító and Katalin Mózes

Abstract

The epiphiton and benthos were examined in the Rivers Someşul Cald/Meleg Szamos, Someşul Rece/Hideg Szamos, Someşul Mic/Kis Szamos, Someşul Mare/Nagy Szamos, and „United" Someşul/Szamos to the mouth of the river system near Vásárosnamény in Hungary in 16 sections. The sampling took place between 1 and 22 August of 1992, and repeated between 1 and 21 August of 1996. Main results of the first expedition: *Isochaeta michaelseni Last.*, *Eiseniella tetraedra Savigny* were dominant in high mountain river parts, *Potamothrix vejdovskyi Hrabe* and *Tubifex nevaensis Brinkhurst* on middle mountain river parts in clean water. The Oligochaeta fauna was changed because of anthropogen effects (pollution): *Limnodrilus hoffmeisteri Claparéde* and *Tubifex ignotus Ditlevsen* were dominant and abundant.

Tubifex nevaensis Brinkhurst was found and dominant in self-purificated river parts. High density of chironomid larvae was found in biotecton: *Tanytarsus gregarius Kieffer* and *Prodiamesa olivacea Meigen* were dominant here. *Eukiefferiella brevicalcar Kieffer* and *Polypedilum laetum Meigen* were dominant on the high mountain river parts. *Polypedilum laetum Meigen* and *Prodiamesa bathophila Kieffer* were dominant in clean water on the middle mountain river parts. The chironomid fauna was deteriorated and changed very strongly because of anthropogenic effects. *Cricotopus bicinctus Meigen* was almost the only species in high density in biotecton on this polluted parts of river system. Presence of *Chironomus riparius Meigen* indicated the self-purification of water on the lower parts of rivers.

Results of the second expedition: the benthos diversity (Oligochaeta and chironomid fauna) decreased, but the density of epiphytic chironomid species increased between Năsăud and A-Letea.

Keywords: river ecology, invertebrate, Oligochaeta, chironomid, water quality

Introduction

There were sporadic literature sources of Oligocheta and chironomid fauna in the Someş River System (*Pop, 1943, 1950; Albu, 1966; Cure, 1984, 1985*), therefore our present data will be basic about the situation of Oligochaeta of the species and their richness in different parts of the river system, to find the character and chironomid fauna nowadays.

[1] The first name is Romanian, and the second Hungarian

The main goals were as follows: identification species on different river courses. We tried the qualification of the river profiles by presence or absence of indicator species during the river courses, and to make recommendations for the recreation of the water and sediment quality in the river system.

Materials and methods

Sediment samples were carried out from the spring area of Someşul Cald/Meleg Szamos, Someşul Rece/Hideg Szamos, Someşul Mic/Kis Szamos, Someşul Mare/Nagy Szamos, and „United" Someşul/Szamos to the mouth of the river system in 16 sections (Figure 1.).

Qualitative samples were taken from the surface of the stone and gravel pieces by washing into a benthometer in each profiles. Sampling sites were at various distance from the left, the right bank and in the main current as well when it was possible. Three quantitative samples were taken from each sampling sites. One sample contained the macrozoobenthos from 882 cm^2.

Each sample was washed through a metal screen with pore mesh size of 200 µm. The retained material was separated into groups of Oligochete, Chironomids and other group of animals by a Zeiss stereo microscope, with a 4 to 6 times magnification, and they were preserved in 80 % ethylic alcohol.

For taxonomic identification the following works were used*: Bíró, 1981; Brinkhurst, 1963, Brinkhurst and Jamieson, 1971; Cranston et al., 1983, Ferencz 1979, Fittkau, 1962, Fittkau et al., 1983; Hirvenoja, 1973; Pinder et al.,1983; Pop, 1950; Tsernowskii, 1949*. Individual density was extrapolated to square meter and the frequency of the species was calculated.

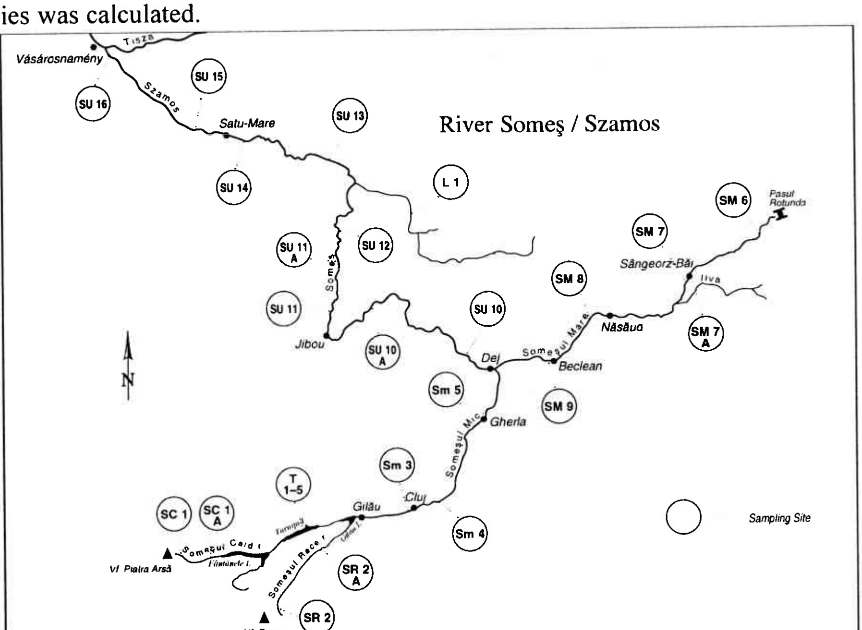

Figure 1. Sampling sites (Sárkány et al., 1999)

Results

The first expedition

Oligochaete

There were found 16 species of Oligochaete in the Someş River System. *Eiseniella tetraedra* was present near the springs and in high mountain river parts in clean water as soon as the *Isochaeta michaelseni* in the River Someşul Rece/Hideg-, Someşul Cald/Meleg-, Someşul Mic/Kis-, Someşul Mare/Nagy-, and „United" Someşul/Szamos as well. *Enchytraeus buchholzi* was found in the River Someşul Mare/Nagy Szamos, while *Stilodrilus heringeanus* was detected once in Someşul Cald/Meleg Szamos (Table 1.).

Tablel. Oligochet fauna and the individual density in Someş River System (First Expedition)

August 1-22, 1992	1. Someşul Cald	2. Someşul Rece	3. Upstream Cluj	4. Downstream Cluj	5. Downstream Gherla	6. Confluence with Arin brook	7. Downstream Singeorz Băi	8. Downstream Năsăud	9. Downstream Beclean	10. Downstream of Dej	11. Someş Odorhei	12. Sălsig	13. Pomi	14. Păuleşti	15. Vetiş	16. Vásárosnamény	Frequency (%)
Species	ind./m2																
1. Eiseniella tetraedra (Savigny 1826)	4	34				5	4										7
2. Enchytraeus buchholzi Vejdovsky 1879						1											1
3. Isochaeta michaelseni (Lastockin 1937)	7	21				1	4										7
4. Limnodrilus hoffmeisteri (Claparède 1862)			2	9000	7660	4			683	2	13	20	12	4	65	96	23
5. Limnodrilus udekemianus (Claparède 1862)					301									12			3
6. Peloscolex speciosus (Hrabe 1931)			1				4										3
7. Peloscolex ferox (Eisen 1879)										1							1
8. Potamotrix hammoniensis (Michaelsen 1901)												1	1				3
9. Potamotrix vejdovskyi (Hrabe 1941)		11	2						33	9							7
10. Psammoryctides moravicus (Hrabe 1934)					1204												1
11. Psammoryctides barbatus (Grube 1861)												1	1				3
12. Stilodrilus heringianus (Claparède 1862)		4															1
13. Stylaria lacustris (Linnaeus 1767)			1														1
14. Tubifex nevaensis (Michaelsen 1903)			1							17	7	4	68	12	4	36	16
15. Tubifex ignotus (Stolc 1886)				1000	3400			2	532	7		14	34	7	12	22	19
16. Tubifex tubifex (Müller 1774)												4	6				3
Species	2	4	5	2	4	4	3	1	3	5	3	5	6	4	3	3	

Tubifex nevaensis was detected by Upstream Cluj in clean water, but absent after the sewage water inflow of Cluj, and this species was found after Dej again. This species was present on all river part to the mouth (Figure 1., Table 1.).Oligochete were present in all rivers as follows: Someşul Mic/Kis Szamos contained 5, Someşul Rece/Hideg Szamos: 4, Someşul Mare/Nagy Szamos: 3, Someşul Cald/Meleg Szamos 2 and in the United Someşul/Szamos by Dej/Dés 8 species down-stream. *Peloscolex ferox, Potamothrix hammoniensis, Stylaria lacustris* and *Tubifex tubifex* were present sporadically only in the River System.

The frequency of Oligochete was as follows: *Limnodrilus hoffmeisteri*: 22,8 %, *Tubifex ignotus*: 18,7 % and *Tubifex nevaensis:* 15,6 % (*Table 1.*).

Chironomids

57 species were found on the 16 sampling places. The fauna with 30 species was the richest by Upstream Cluj, but they were absent by Downstream Cluj. *Chironomus riparius* was the only species, present Downstream Gherla. Eukiefferiella and Cricotopus species were characteristic by Gherla, where 10 chironomid species were present. *Cricotopus bicinctus* was dominant with 39 ind./m^2. A rich biotecton developed on the boulders and gravels here. Macrozoobenthos was formed by *Cryptochironomus redekei* and *Endochironomus nymphoides*.

The chironomid fauna was bad both in species and individual density. *Tanypus punctipennis* and *Rheotanytarsus curtistylus* were present in the sediment, *Cricotopus bicinctus* and *Propsilocerus orielius* lived in the biotecton. *Cricotopus bicinctus* was the characteristic for the chironomid fauna. 6 species were found by Dej from which 3 species were present in sediment (*Cryptochironomus redekei*, *Polypedilum convictum*, *Tripodura (Polypedilum) scalaenum*), while *Nanocladius bicolor*, *Cricotopus trifascia* and *Cricotopus bicinctus* were in biotecton.

The species density decreased after Someş Odorhei, but some were characteristic, living in biotecton. The species richness increased in biotecton by Vásárosnamény, at the mouth . *Cricotopus bicinctus* was dominant almost in every sampling site, and had the biggest frequency (62.5 %), following by *Tripodura scalaenum* (37.5 %), and *Eukiefferiella similis* (25 %). Other species were additional elements (Table 2.).

The river system showed clean, polluted and mostly high polluted parts (Table 3.).

The 2nd Expedition

Oligochaete and chironomids were present in 6 sampling sites only, and absent in 10 former sampling places. 5 Oligochaete and 39 chironomid species and larvae of 2 other Insect species were collected. The individual density was higher and the species richness was lower than during the former expedition. Oligochaete were not found in River Someşul Rece/Hideg Szamos, but 5 species were present in River Someşul Mare/Nagy Szamos near Năsăud, and they all absent by Beclean. *Potamothrix vejdovskyi* was only present with 4 ind./m^2 in the „United" Someş/Szamos River near A-Letea (Table 4.). That same species was dominant (22 ind./m^2) by Năsăud.

18 chironomid species lived in the biotecton and 21 species formed the macrozoobenthos in the river system. *Cricotopus algarum* was dominant in biotecton by Beclean (294 ind./m^2). Species richness was higher in that same sampling places than in former expedition (Table 2.,4.).

The species density of Cricotopus and Eukiefferiella genus, living in biotecton, increased in all sampling sites. Dominant species were as follows: *Eukiefferiella brevicalcar* (129 ind./m^2) in River Someşul Rece/Hideg Szamos, *Polypedilum laetum* (121 ind./m^2) near Năsăud, and *Cricotopus algarum* (294 ind./m^2) by Beclean, while *Paratanytarsus lauterborni* was subdominant (150 ind./m^2) by Beclean. Both the species richness and larval density decreased hardly by A-Letea (SU10, Figure 1.).

The frequency of the different species changed between 6.25-37.5 % . *Polypedilum laetum* had the biggest frequency (Table 4.).

Table 2. Chironomid species and their density of the Someș/Szamos River System (1-22 August, 1992)

Species	Sampling places																
	S. Cald/Meleg Sz.	S. Rece/Hideg Sz.	Upstr. Cluj	Downstr. Cluj	Downstr Gherla	Confl. with Arin brook	Sângeorz Băi	Downstr Năsăud	Downstr Beclean	Downstr Dej	Someș Odorhei	Sălsig	Pomi	Păulești	Vetiș	Vásárosnamény	Frequency (%)
Tanypodinae	ind./m2																
1. Anatopynia plumipes (Fries, 1823)			2														6.2
2. Apsectrotanypus trifascipennis (Zetterstedt, 1838)	1	2															12.5
3. Macropelopia notata (Meigen, 1818)			1														6.2
4. Natarsia punctata (Fabricius, Meigen, 1804)			1														6.2
5. Procladius choreus (Meigen, 1804)															1		6.2
6. Tanypus punctipennis (Meigen, 1818)			1						1								12.5
Orthocladiinae																	
7. Brillia longifusca (Kieffer, 1921)			1														6.2
8. Bryophaenocladius nitidicollis (Goetghebuer, 1913)						1		2									12.5
9. Cricotopus bicinctus (Meigen, 1818)			11					3	12	39	127	12	36	21	5	22	62.5
10. Cricotopus fuscus (Kieffer, 1909)																1	6.2
11. Cricotopus trifascia (Edwards, 1929)										1							6.2
12. Eukieferiella bravicalcar (Kieffer, 1911)	2	1															12.5
13. Eukiefferiella clypeata (Kieffer, 1923)								2									6.2
14. Eukiefferiella coerulescens (Kieffer, 1926)		1															6.2
15. Eukiefferiella gracei (Edwards, 1929)								2									6.2
16. Eukiefferiella lobifera (Goetghebuer, 1934)	1	1															12.5
17. Eukiefferiella similis (Goetghebuer, 1939)	11	5	1					2									25.0
18. Euorthocladius (Orthocladius) thienemanni (Kieffer, 1906)			1														6.2
19. Isocladius (Cricotopus) sylvestris (Fabricius, 1794)	1							8									12.5
20. Nanocladius bicolor (Zetterstedt, 1838)			1							16							12.5
21. Orthocladius saxicola (Kieffer, 1911)			6														6.2
22. Orthocladius sp.			7														6.2
23. Paracladius conversus (Walker, 1856)			8					3									12.5
24. Propsilocerus danubialis (Botnariuc et Albu, 1956)	1		2						1								18.7
25. Propsilocerus paradoxus (Lundström, 1915)		1															6.2
26. Psectrocladius barbimanus (Edwards, 1929)	1																6.2
27. Psectrocladius obvius (Walker, 1856)	1																6.2
28. Psectrocladius simulans (Johannsen, 1937)			3														6.2
29. Smittia aterrima (Meigen, 1818)								6									6.2
30. Thienemannia gracilis (Kieffer, 1909)	1		1			1											18.7
31. Zalutschia mucronata (Brundin, 1949)																2	6.2
Diamesinae																	
32. Monodiamesa (Prodiamesa) bathyphila (Kieffer, 1918)			2														6.2
33. Prodiamesa olivacea (Meigen, 1818)			1			7											12.5
34. Pseudodiamesa branickii (Nowicki, 1853)	1																6.2
Corynoneurinae																	
35. Corynoneura scutellata (Winnertz, 1846)	4																6.2
Chironomini																	
36. Chironomus annularius (Meigen, 1818)							22										6.2
37. Chironomus riparius (Meigen, 1804)			5		1						1						18,7
38. Cryptochironomus defectus (Kieffer, 1913)		2															6.2
39. Cryptochironomus holsatus (Lenz, 1959)			1														6.2
40. Cryptochironomus redekei (Kruseman, 1933)								2		26				3			18.7
41. Endochironomus tendens (Fabricius, 1775)								1									6.2
42. Microtendipes tarsalis (Walker, 1856)			1														6.2
43. Paracladopelma camptolabis (Kieffer, 1913)		6															6.2
44. Microtendipes pedellus (De Geer, 1776)			20														6.2
45. Microtendipes tarsalis (Walker, 1856)			8														6.2
46. Microtendipes chloris (Meigen, 1818)			10														6.2
47. Polypedilum convictum (Walker, 1856)										3	1						12.5
48. Polypedilum laetum (Meigen, 1818)			2														6.2
49. Tripodura (Polypedilum) scalaenum (Schrank, 1803)		45								5	8		2		2	1	37.5
50. Stictochironomus crassiforceps (Kieffer, 1922)			38								1						12.5
51. Zavreliella marmorata (v. d. Wulp, 1858)			6														6.2
Tanytarsini																	
52. Micropsectra apposita (Walker, 1856)						1											6.2
53. Micropsectra junci (Meigen, 1818)			2														6.2
54. Paratanytarsus lauterborni (Kieffer, 1909)									1								6.2
55. Rheotanytarsus curtistylus (Goetghebuer, 1921)	1																6.2
56. Tanytarsus gracilentus (Holmgren, 1883)			2													2	12.5
57. Tanytarsus gregarius (Kieffer, 1909)	43	6	6														18.7
Species number	13	10	30	0	1	4	1	10	4	6	5	1	2	2	3	5	

Table 3. Qualification of the Someş River Syst

Sampling places	I. (excellent)	II. (good)	III. (polluted)	IV (high polluted)
1. Somcşul Cald	x			
2. Someşul Rece	x			
3. Upstream Cluj	x			
4. Downstream Cluj				x
5. Downstream Gherla				x
6 Confluence with Arin brook				x
7 Downstream Sîngeorz Băi				x
8. Downstream Năsăud		x		
9. Downstream Bcclcan				x
10. Downstream of Dej				x
11. Someş Odorhci				x
12. Sălsig				x
13. Pomi			x	
14. Păuleşti			x	
15. Vetiş				x
16. Vásárosnamény			x	

Different injuries and deformities were found on labium of chironomid species during the determinations collected in Năsăud, Beclean and A-Letea sampling sites. The injuries or deformities were as follows: *Cricotopus bicinctus* (26 per cent), *Cricotopus fuscus* (100 per cent, 4 ind./m^2 only), *Polypediulum laetum* (6 per cent) in Downstream Năsăud. *Cricotopus algarum* (22 per cent), *Cricotopus fuscus* (12 per cent), *Cricotopus tremulus* 30 (per cent) and *Cricotopus triannulatus* (26 per cent) in Downstream Beclean, *Cricotopus algarum* (14 per cent) near A-Letea (Table 5.).

Table 4 Oligochaete and chironomids in Someş River System in 2nd Expedition (August 1-21, 1996)

Species	2. Someşul Rece/Hideg Sz.	SR 2A Downstream Blejoaia	6. Confluence with Arin brook	8. Downstream Năsăud	9. Downstream Beclean	10. A-Letea	Frequency (%)
Oligochaeta							
1. Limnodrilus hoffmeisteri (Claparéde, 1862)				7			6.25
2. Aulodrilus limnobius (Bretscher, 1899)				4			6 25
3. Uncinais uncinata (Orsted,1842)				4			6.25
4. Potamothrix vejdovskyi (Hrabe, 1941)				22		4	12.5
5. Limnodrilus hoffmeisteri (Claparéde, 1862)				7			6.25
Chironomidae							
1. Guttipelopia guttipennis (v d. Wulp, 1861)				7			6.25
2 Macropelopia nebulosa (Meigen, 1804)	4						6.25
3. Krenopelopia binotata (Wiedemann, 1817)	11				4		6.25
4. Krenopelopia nigropunctata (Staeger, 1839)					7		6.25
5. Natarsia punctata (Meigen,1804)						4	6.25
6. Rheopelopia ornata (Meigen, 1838)		29					6.25
7 Trissopelopia longimana (Staeger, 1839)	4			22	4	33	25 00
8. Cardiocladius fuscus (Kieffer, 1924)					4		6 25
9 Cricotopus algarum (Kieffer, 1911)				22	294	18	18.7
10 Cricotopus bicinctus (Meigen, 1818)	4			15			12.5
11 Cricotopus flavocinctus (Kieffer, 1924)					15		6.25
12. Cricotopus fuscus (Kieffer, 1909)				4	33		12.5
13. Cricotopus tremulus (Linnaeus, 1758)		4		11	66		18.75
14. Cricotopus triannulatus (Macquart, 1826)					92		6.25
15 Diplocladius cultiger (Kieffer, 1908)	4						6.25
16 Eukiefferiella brevicalcar (Kieffer, 1911)		121					6.25
17. Eukiefferiella clypeata (Kieffer, 1923)		26					6.25
18 Eukiefferiella gracei (Edwards, 1929)		22					6 25
19 Psectrocladius barbimanus (Edwards, 1929)				33			6.25
20 Psectrocladius psilopterus (Kieffer, 1906)		4		22	7		18.7
21 Synorthocladius semivirens (Kieffer, 1909)				7			6 25
22 Thienemannimyia lentiginosa (Fries, 1823)	4			18			12 5
23 Thienemannimyia northumbrica (Edwards, 1929)				15	4		12.5
24 Tventenia (Eukiefferiella) bavarica (Goetgh., 1934)		22					6.25
25 Tventenia (Eukiefferiella) calvescens (Edwards, 1929)		18					6.25
26 Chironomus riparius (Meigen, 1804)					4		6.25
27 Dicrotendipes modestus (Say, 1823)					7		6.25
28. Cryptochironomus redekei (Kruseman, 1933)				4			6.25
29. Microchironomus tener (Kieffer, 1918)		4					6.25
30 Paracladopelma camtolabis (Kieffer, 1913)		7			4		12.5
31. Polypedilum laetum (Meigen, 1818)	7	70	4	121	44	4	37.5
32. Pentapedilum sordens (v. d. Wulp, 1874)				11			6.25
33. Tripodura scalaenum (Schrank, 1803)				4	4		12.5
34 Cladotanytarsus mancus (Walker, 1856)					4		6.25
35 Heterotanytarsus apicalis (Kieffer, 1921)		4					6.25
36 Micropsectra junci (Meigen,1818)				7	4		12.5
37 Paratanytarsus lauterborni (Kieffer, 1909)	18			7	150	18	25.0
38. Tanytarsus curticornis (Kieffer,1911)						48	6.25
39 Tanytarsus gregarius (Kieffer, 1909)				7	7		12.5
Others							
Simulium brevicale Dorier and Grenier			4	4			12.5
Eriocera sp.			4				6.25
	Species density						
Oligochaete	0	0	0	0	5	1	
Chironomids	8	12	3	24	20	7	

Species	Downstr. Năsăud	Downstr. Beclean	10. A-Letea
	Rate (%)		
1. Cricotopus algarum (Kieffer, 1911)		22	14
2. Cricotopus bicinctus (Meigen, 1818)	26		
3. Cricotopus fuscus (Kieffer, 1909)	100	12	
4. Cricotopus tremulus (Linnaeus, 1758)		30	
5. Cricotopus triannulatus (Macquart, 1826)		26	
6. Polypedilum laetum (Meigen, 1818)	6		

Table 5.

Discussion

The anthropogenic pollution effects were detected by the presence of *Limnodrilus hoffmeisteri, Limnodrilus udekemianus* and *Psammoryctides moravicus* as soon as the T*ubifex ignotus* species. Their density was high because of sewage water inflow by Cluj below (Table 1.). The hypertrophic water resulted an extreme situation here: a „red plain" during about 70 km long river part From Cluj to Gherla (Figure 1., Table 1.).

The zoobenthos community was almost only formed by Oligochete, but some Chironomus larva was present at the littoral zone, mainly at the shore line.

Three species were characteristic in River Someş after the Someşul Mare. *Limnodrilus hoffmeisteri* and the *Tubifex ignotus* had a tolerance against the extreme environment.

Tubifex nevaensis was detected by Cluj before, in clean water, but it was absent because of the sewage water inflow of Cluj and this species was found after Dej again because of self-purification of the water and was present on all river part to the mouth, flowing into the River Tisza at Hungary (Figure 1., Table 1.).

Low species richness of Oligochaetewas detected in both clean and polluted sampling sites. A qualification of the river parts was tried to use by the presence or absence of indicator species, living in sediment of river system in different profiles (Figure 2.).

While the variations of the fauna of different rivers are determined by different geographical situations and water chemistry parameters (*McCulloch, 1986*), e.g. the pH (*Townsend et al., 1983*), the variation of the fauna inside a river are caused by the variability of the ecological factors (*Minshall and Minshall, 1977; Reice, 1980; Brown and Brown, 1984; Botos et al., 1990*). The structure and activity of the zoobenthos community of a stream are adapted to the morphological, physical and biological variables, like the current of the streams (*Ambühl, 1959*), the flooding of the streams (*Albrecht, 1959; Schwank, 1981*), the structure and nutrient content of the bottom

(*Wachs, 1967; Cushing et al., 1983*), the size of organic matter particles in the water bodies (*Szító et al., 1983*), the light conditions and in relation to them the primary production (*Hughes, 1966; Szító et al., 1989*).Their role is very important in the high polluted water bodies on different river parts, principally near big towns and industrial-, or agricultural centres.

Almost 90 % of the collected Oligocheta individuals was found by Cluj below and Gherla before, where the pollution was strong. High Oligocheta density was at the sewage water inflow by Beclean too, but a lower peak of individual density was detected here (Table1., Figure 1.).

Chironomid larvae were not present in Downstream Cluj only, because of the concentrate waste water inflow. The river system may be detailed to two parts by the species richness of the Oligochaete and chironomids: the clean (mountain) river parts, where the species richness was high, and the polluted river part, where the river system got different pollutants continuously, or temporary. The chironomid fauna had a species richness in biotecton on the mountain parts, developed on the surface of the boulders, and some species were already found in the sediment of the lenitic river parts too (River Someşul Cald/Meleg Szamos, Someşul Rece/Hideg Szamos R.), 12 chironomid species formed the benthos Upstream Cluj. The species richness decreased on the polluted part of the river system. Chironomids (Orthocladiinae), living in the biotecton, were absent Downstream Cluj and they were detected by Năsăud only as *Eukiefferiella clypeata, E. longicalcar, E. similis, Cricotopus bicinctus, Isocladius (Cricotopus) sylvestris, Briophaenocladius nitidicollis, Smittia aterrima and Procladius conversus. Cricotopus bicinctus* was present from Beclean to the mouth (Vásárosnamény) and dominant, the other, above listed species were absent. *Cricotopus bicinctus* was more tolerant to the pollution effects, than the other species probably. Its high individual density, dominance and continuous presence showed the biotecton presence as food for them. That same food source might be served for other Cricotopus species too, like on the former sites, when their tolerance would be more to the environmental factors. It seems that other chironomid species tolerate the pollution effects neider in biotecton, nor in the sediment. A low species richness of (1-6 species/sampling site) was detected from Beclean to the mouth (Table 2.).

Oligochete were present everywhere in the river system and we can use some species to qualify the ecosystem. Indicator species of Oligochete and chironomids showed a good self-purification in the river system, but this ability of the river is inappropriate to eliminate the anthropogenic pollution effects. The quantity and the quality of the pollution sources would be necessary to determine along the Someş River System. because they have been not covered up nowadays.

The qualification of water was presented by sensitive Oligocheta species but I am afraid, we have not enough information about the environmental factors determining the zoobenthos communities in different courses of the River System.

The 2nd Expedition

Sampling sites were partly the same, than former, or not far away from them. Nevertheless, Oligochaete were present by Beclean and A-Letea. Species richness changed between 1 and 6. 10 sampling sites were free from Oligochaete and chironomids, but the reason was not known.

Low individual density of Oligochaete were present on the sampling places, therefore we supposed, that the pollutants had lasting effect in the sediment. The worms indicated that condition as by other investigations (*Kaniewska-Prus, 1983; Malacea, 1969; Marcoci et al., 1966*). Their reproduction confined to the Spring and Autumn season, therefore the individual density decreasing by lethal concentrations of pollutants could be regenerated slowly.

Chironomid had three or more generations, which overlapped each- other, the fauna regeneration was possible shorter. Drifting of their larvae was common, settled the river parts downstream.. Although, Oligochete and chironomids were present in the mountain and middle part of the river system only (Someşul Rece/Hideg Szamos, and 2A, Confluence with Arin brook, Năsăud, Beclean, A-Letea). The River System got probably hard pollution pressures after A-Letea too.

The lack, or presence of animals indicated the environment quality in sampling sites. The rate of the deformed and injured chironomid labiums showed the damage of pollutants to animals. Heawy metals were dangerous, accumulated in the sediment and in the macrozoobenthos (*Cushman, 1984; Cushman et al., 1984; Frank, 1983; Warwick, 1988, 1989, Szító and Waijandt, 1989*).

Conclusions and proposals

River Someşul Cald/Meleg Szamos was clean, and not showed anthropogenic pollution effects. Plecoptera, Ephemeroptera, species were characteristic with chironomids, and Simulid (black fly) larvae, living the biotecton. Chironomid species showed clean water here too. River Someşul Rece/Hideg Szamos was clean, Trichoptera, Ephemeroptera and chironomid species indicated that same quality.

River Someşul Mic/Kis Szamos was also clean to Cluj, but hardly polluted after Cluj, therefore the self-purification was slow. The red plain of Oligochaete was detected in this river part to Gherla providing a high saprobity.

The clean and the polluted parts followed each-other in River Someşul Mare/Nagy Szamos. The rapid water currency helped the self-purification. It got the tons of the sawdust and shaving from the factories. That was the most important pollution source here. Species density was bad, forming the benthos.

The „United" Someşul/Szamos river got communal, agricultural and industrial pollution. Oligochaeta and chironomid fauna indicated, that its self-purification was effective, but showed an eutrophic, often hypertrophic habitat by investigations of the expeditions.

1. Instead of former sporadic data now we have a wide range of the information's about both the number and species of Oligochete : 14 species of Oligochete and 57 chironomid were found in river system during the first Expedition.

2. Oligochete were present everywhere in the river system and we can use some species to qualify the ecosystem.

The epiphytic chironomid community was most important, than the other group, living in sediment. The sediment was poor in chironomid species because of frequent (or continuous) pollution effects, consisting of communal-, industrial and\or agricultural sources.

3. Indicator species of Oligochete and chironomids showed a self-purification in the river system, but this ability of the river is inappropriate to eliminate the pollution effects.

4. The qualification of water was presented by sensitive Oligochaeta species by the results of the first Expedition.

5. General economical and environmental protection precautionary measures would be necessary to save the river system. After making such a project, an international aid would be needed to realise it probably.

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The occurrence and significance of moss animals (Bryozoa) in the River Someş/Szamos[1]

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Abstract

Till now very few data has been reported concerning the occurrence of bryozoans in the Someş. In the „united" Someş *Plumatella emarginata* var. *spongiosa* (Krapelin, 1887) was found. Earlier data are not known about this species in Romania. It can be found almost on every stone of the bed covering 25-30 % of their surface along a 45 km long section of the river. Considering the occurrence and the distribution of colonies at the sampling sites of Someş-Odorhei, Ţicău and Sălsig, it is supposed that they play an important role in the biological purification of this mesosaprobe water.

Keywords: Bryozoa, River Someş, natural purification.

Introduction

Researchers has not studied systematically the bryozoans in Transylvanian rivers before and there are also only sporadic data referring to other parts of Romania.

Sebestyén (1959) gave a modern system of this class but concerning their distribution she still leans on Vángel's works (1894, 1897, 1897a). Vángel summarised the literature references up to that time but he could find reliable data only about *Plumatella repens* L. in Transylvanian river valleys:

- Someş/Szamos Valley: var. *fungosa* Pall. - Park Lake, Cluj (leg. Dezső B.)
  - Gherla Lake (leg. Mártonfi L.)

- Mureş/Maros Valley: - Park Lake, Arad (leg. Simonkai L.)
  - var. *fungosa* Pall. - skating lake, Arad (leg. Daday J.)

Vángel also mentions Cserni's data according to which he collected the *Plumatella Ehrenbergii, Cristatella mucedo* Cuv. and *Plumatella repens* L. var. *fungosa* Pall. species in the vicinity of Alba Iulia but both Daday and Vángel doubt the reliability of these data.

Having studied the White Criş / Körös in 1993, at Inău we also found moss animal colonies on bed stones but unfortunately we could not examine living individuals and since the lack of statoblasts only the genus (*Plumatella sp.*) could be determined from the material preserved in formalin.

[1] The first name is Romanian, and the second Hungarian

The literature references mention the role of bryozoans in the consumption of organic detritus. It is also well known that they serve as food for snails, and caddisflies (Sebestyén, 1959) and for fish (Kolosváry, 1968). Nevertheless Lampert (1904) and Sebestyén (1959) do not attach great importance to these organisms in the material conversion of waters.

Materials and methods

The moss animal samples were collected mostly by hand from the stones and from underwater macrophytes. In the same time they got into the Surber benthometer together with other benthic organisms. The collected animals were examined alive in little water under stereomicroscope while they were stretching their tentacles, then they were fixed in alcohol and in order to prepare them in statoblasts we enlarged them.

The material from the Park Lake of Cluj was collected in September, 1995. The larvae grew on the water-plants and the colonies were bred in an aquarium for two months. The material from Someş-Odorhei, Ţicău and Sălsig was collected in June and July 1992, as well in August 1996. In 1997 at the beginning of September specimen having statoblasts were collected again.

Discussion

The Park Lake in Cluj receives its water from the mill-canal of the Someşul Mic, thus its fauna is closely related to that of the Someş. The occasionally collected moss animals were put in an aquarium arranged from this lake. These colonies were determined as *Plumatella repens* L. Based on the shape of growth of the colonies Sebestyén (1959) differentiates three forms of this species. When the colonies were very young, meaning they had only 2-12 individuals, we could not follow the forms of growth. Unfortunately, when the closely related colonies reached this stage of development, a *Cloeon dipterum*L. larva swallowed them during the observation.

The *Plumatella repens* var. *fungosa* Pall. quoted by Vángel (1894) from this place in Sebestyén's (1959) opinions is identical to *Plumatella fungosa* Pallas. Consequently we collected another species from the same place. We identified the *P. fungosa* in the Fizeş brook (a tributary of the river Someş) in Ţaga Lake, where it is quite frequent.

We consider really significant the occurrence of *Plumatella emarginata* Allman var. *spongiosa* Krapelin in large numbers on a 45 km long section of „united" Someş between Someş-Odorhei and the inflow of Lăpuş. We mention at the same time that this species has not been identified either in Someş or in other Transylvanian rivers. The occurrence of this species and distribution of colonies were examined at the following sampling places: Someş-Odorhei, Ţicău and Sălsig. At a cross-section of the river we lifted out 20-25 stones and estimated the percentage of moss animals on them. The average results were as follows: Someş-Odorhei 25 %, Ţicău 27 % and Sălsig 21 %. The

Plumatella colonies occur only in fast-flowing and stony riverbeds. River Someş between Dej and Someş-Odorhei (approximately 80 kilometres) due to chemical and biological natural purification the pollution decreases. At Someş-Odorhei the oxygen supply of the water, which is not so deep and running on a stony bottom, is really good and the polluting organic substances probably serve as food for the extended moss animal colonies. They filtrate and purify the water, thus making suitable to develop their shells. Unfortunately this process is only possible until the inflow of Lăpuş. The Lăpuş river brings the polluted waters of Săsar brook, which is loaded with industrial residuals from the factories of Baia Mare. This wastewater contains not only organic materials but also lots of xenobiotics that poison both the moss animals and shells. This example, in agreement with literature data shows clearly that the bryozoans can have an effective role in the epuration of communal sewage. Related to this it is worth to mention that Pavlovski and Jadin (1950, ap. Sebestyén, 1959) rank *Pl. repens* and *Pl. articulata* among B-mesosaprobic organisms.

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Freshwater mollusc species from the River Someş/Szamos[1], related to their ecological conditions

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Abstract

The freshwater molluscs of the Someş/Szamos rivers have poorly been studied so far; only a few species and sampling points were mentioned in the last 150 years. The authors have found 22 mollusc species, and pointed out the disappearance of three species, namely *Theodoxus transversalis* (probably extinct from the whole Transylvania), *Bithynia leachi* and *Unio pictorum.* Most of the species have a patched distribution along the river, due to pollution and hydrotechnical works. On the basis of the present-day areas of some species, especially that of the family Unionidae, we have ranked the ecological state of the river sections.

Keywords: freshwater molluscs, Someş river, ecological conditions

Introduction

The study of the aquatic molluscs on the Someş rivers was carried out in two periods, namely in 1992 and 1996, during the multidisciplinary research programmes organised by the Pro Europa Liga, Târgu Mureş (Romania) and the Tisza Klub, Szolnok (Hungary). The data concerning the malacofauna of this hydrographic system have been very summary until now. The authors (Bielz, 1862, 1867; Clessin, 1887; Csiki, 1906; Rotarides, 1941; Soós, 1943; Grossu, 1962, 1986, 1987) mentioned only a few species and their sampling points. However, the few quoted data compared with the results of the authors, illustrates the serious changes that took place in this rivers, due to the pollution and to the hydrotechnical works. Through the geomorphological and hydrological features of the Someş rivers, to which the anthropogenic impacts can be added, they represent a particular zonation of the mollusc fauna.

Materials and methods

The freshwater molluscs were collected manually, or sampled with the Van Veen dredge or with a Surber benthometer. The authors have chosen 24 sampling points along the river valley, which are given in Table 1. Only qualitative samples have been collected because of the low abundance of most of the populations. These samples were collected to illustrate the diversity of the mollusc fauna.

[1] The first name is Romanian, and the second Hungarian

Results and discussions

In the Someş rivers 25 species of freshwater molluscs have been identified (Table 1.), from which 22 were found during the expeditions and 3 species become extinct (*Theodoxus danubialis, Bithynia tentaculata* and *Unio pictorum*) and one is probably disappeared (*Aplexa hypnorum*). The Someşul Mic is formed by the confluence of the Someşul Cald and the Someşul Rece. The Someşul Mic with the Someşul Mare form the united Someş, which flows into the Tisza river in Hungary.

The Someşul Cald river on its upper reach, at Ic Ponor, has the aspect of a mountain rivulet, being populated by *Ancylus fluviatilis* (in the bed) and by *Radix peregra* (in pools from the valley). On this river there is a row of dam-lakes like Beliş, Tarniţa and Gilău. The latter captures also the water of the Someşul Rece, as it is situated at the confluence of the two rivers. On the Tarniţa lake, the authors collected the benthic fauna from four places, without identifying any species of molluscs. On the upper part of the river Someşul Rece *A. fluviatilis* was not found because of the acidity of the water, which flows through bogs in the neighbourhood of the source. At the level of the Blejoaia cottage, in a silt-up dam-lake, numerous individuals of *Pisidium çasertanum* were collected, and in pools from the flood-area *R. peregra* was identified. On the river Someşul Mic (formed by the union of the two rivulets), downstream Gilău up to Fântânile Clujului (in the vicinity of the town), can reduced populations of *Unio crassus* and *Anodonta cygnea. Ancylus fluviatilis* be found until the river reaches Cluj municipality, then they disappear because of communal sewage discharge. In the last century Bielz (1862) mentioned the presence of this species in the riverbed in the area of the town. In 1954 a large population still existed in the Someş channel of the city (collected by Béla Kis). At the level of the dam-lake, near the Babeş Sports Park, a lot of individuals of *A. cygnaea* appeared in 1993, having a proper condition for their reproduction. Downstream of Cluj (the sampling points at Someşeni and Gherla) up to the confluence with the Someşul Mare, the river is seriously polluted with decaying organic material. Because of the pollution, this reach is populated only by *Physa acuta*, a species of Mediterranean-West-European origin, well adapted to such conditions. At Gherla *Theodoxus transversalis* was also found previously,but this species disappeared (collected by Oros E., quoted from Soós, 1943).

In the upper zone of the Someşul Mare, upstream of Şanţ village, we highlight the presence of *Anisus spirorbis*, quoted in scientific papers as a typical lowland species (Grossu, 1987). The authors collected some individuals from a pool in the Mărie Mare valley, above an altitude of 600 m. We also found huge populations of *R. peregra* and *P. amnicum* in artificial trout-breeding pools. Downstream Şanţ, the water and sediment quality is damaged because of sawdust, coming from the local industry of timber conversion. The sawdust changes the structure of the sediments and decay, a process consuming huge amounts of dissolved oxygen, thus becoming the main limiting factor for the benthic assemblages. For these reasons, *A. fluviatilis* disappears from the river, although specific biotopes exist. This situation is also valid for many tributaries, such as

	1	1A	2	3	4	5	6A	6	7	7A	8	8A	8B	9	10	10A	11	11A	11B	12	13	14	15	16
Theodoxus transversalis C. Pfeiffer, 1828						Ex									Ex									
Viviparus contectus Millet, 1813																					W			
Bithynia leachi Sheppard, 1823				Ex																				
Physa acuta Draparnaud, 1805					+	+									+	+	+	+	+	+	+	+	+	+
Aplexa hypnorum Linnaeus, 1758				E?																				
Stagnicola palustris (O. F. Müller, 1774)						+															+			
Lymnaea stagnalis (Linnaeus, 1758)												W									W			
Radix auricularia (Linnaeus, 1758)									+			W		+	+			+				+		
Radix peregra (O. F. Müller, 1774)	+	+	W+				W	W	+		+													
Galba truncatula (O. F. Müller, 1774)										+	+					+	+	+		+			+	
Ancylus fluviatilis O. F. Müller, 1774	+	+		+			+	+									+	+		+				
Planorbis planorbis (Linnaeus, 1758)																		+			W			
Anisus spirorbis (Linnaeus, 1758)							W																	
Gyraulus albus (O. F. Müller, 1774)													W											
Gyraulus laevis Alder, 1838														+										
Planorbarius corneus Linnaeus, 1758																					W			
Succinea putris (Linnaeus, 1758)				+					+					+							+			
Oxyloma elegans (Risso, 1826)								+	+		+	W		+	+	+					W			
Unio pictorum Linnaeus, 1758																						*		
Unio crassus Philipsson, 1788				+										+			+	+	+	+		+		
Anodonta cygnaea Linnaeus, 1758				+													+	+	+			*		+
Pisidium amnicum (O. F. Müller, 1774)								+																
Pisidium casertanum (Poli, 1791)			+																					
Sphaerium corneum (Linnaeus, 1758)								+													W			
Sphaerium lacustris (O. F. Müller, 1774)												W									W			

Table 1.

the Ilva river, in which we found only one living species, namely *Galba truncatula*, on the riverbanks. At Sângeorz Băi, the flow is slower and forms lenthic habitats towards the banks, with fine sediments, where *Radix auricularia* appears, and on the marsh vegetation *Succinea putris* and *Oxyloma elegans* can be found. Downstream Salva, in a dead riverbed, we also found *Sphaerium lacustris.* In spite of the organic pollution of this river, at the level of Beclean village, 1 individual of *Unio crassus* was found. The presence of the fish species *Rhodeus sericeus ammarus* indicates the existence of some populations of Unionidae, inhabiting probably some tributaries.

Downstream the confluence of the Someşul Mare and the Someşul Mic, at Căşei, the river is polluted not only by the residual waters brought by the two rivers, but also by the industrial wastewater discharged from the cellulose and paper factory of Dej. Except *Physa acuta* other species was not found, although in 1992 some individuals of *Radix auricularia* were collected. The empty shells found in the river sediments prove the existence of a past population of *Unio crassus*. In the same place Soós (1943) speaks about the presence of *Theodoxus transversalis,* that disappeared forever from the river basin. Downstream Dej there are no pollution sources at all, thus the quality of the water and sediments improve, permitting the reappearance of the family Unionidae. At Somes Odorhei, near Năpradea village, *A. fluviatilis* and the species of the family Unionidae appear again. The dispersion of the bivalves is grouped and discontinuous, because of the distribution of the specific habitats. In the Defile from Ţicău abundant populations of *Unio crassus* and *Anodonta cygnaea* exist, having an specimen proportion of 38% and 62% respectively. Downstream the Defile, at Sălsig, the water-flow is faster. We identified only *Unio crassus* there, as the single living species of the family Unionidae, having an ecological density of 5.4 individuals/m^2. Downstream the confluence with Lăpuş river, the ecological state of the Someş river is degrading again. The Lăpuş collects the water of the Săsar rivulet, loaded with heavy metals and other xenobiotics discharged by the industry of Baia Mare, and it also collects the wastewater of the Cavnic river, loaded with wastewater from mining industry. In the Lăpuş river a population of *U. crassus* has been found in its upper part. These bivalves disappear at the confluence with Cavnic. Thus, all species of the family Unionidae disappear together with all the stenobiotic species, and *P. acuta* is prevailing again on the banks. In a ditch near the river, we found *Viviparus contectus, Planorbis planorbis, Sphaerium lacustris* and *Sphaerium corneum.* The lower reach of the Someş is characterised by an extremely low diversity of molluscs. Except *P. acuta,* which will be found along the riverbed until its confluence with Tisza, we note upstream of Satu Mare two individuals of *U. crassus* appearing probably accidentally in the river from some tributaries whose mollusc fauna is unknown. Satu Mare is the last pollution source, and this influence will remain unchanged until its mouth. At Olcsva we found only 1 individual of *A. cygnaea* which was probably washed from the flood area by high-waters.

In Figure 1. the number of the mollusc species can be seen, as it varies along the Someş riverbed (the flood area and the wetlands are not considered). The sampling points are codified in the same way as it is displayed in Tab. 1. The low number of species in the sites S1, S2 and S6 is owed to the high altitude and to the mountain aspect of this river. Along the hill areas the relative diversity is increasing (S3). Due to pollutants, the number of species is very low in other sampling points of the Someşul Mic and the Someşul Mare. The diversity increases towards the Defile from Ţicău and reach a maximum there. Afterwards it declines again because of pollution. In Figure 2. we represent the areas populated by Unionidae, and those which are polluted.

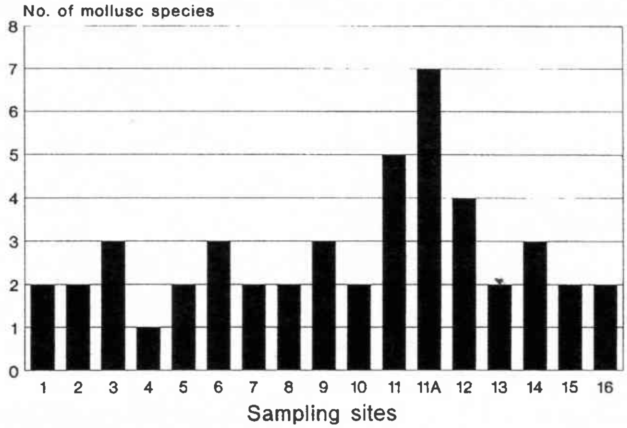

Figure 1. The number of mollusc species, found in the Someş river-bed

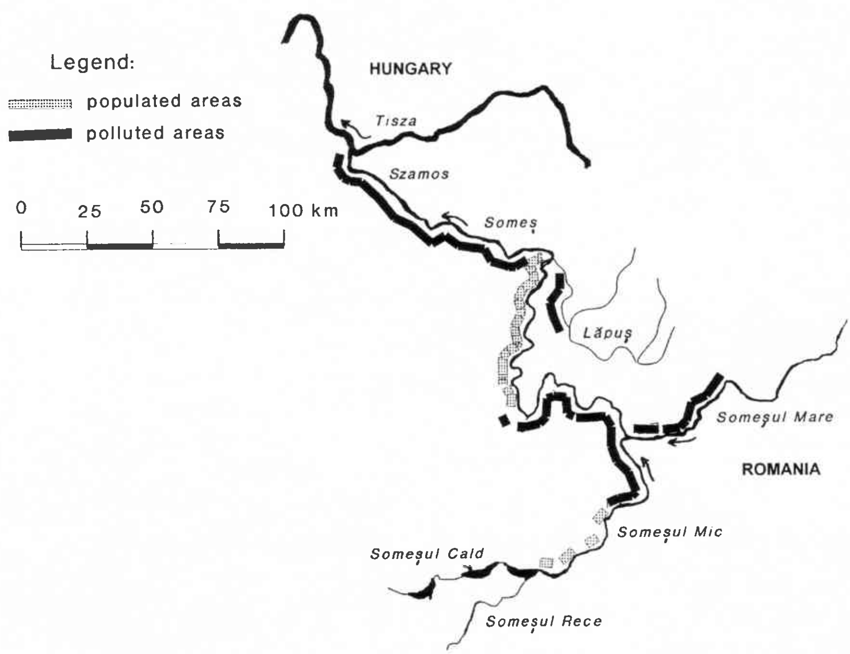

Figure 2. The range of the Unionidae species and the polluted reaches

Conclusions

1. In present the Someş is one of the most polluted river in Transylvania and also affected very much by anthropogenic activities.

2. The highly polluted sections divide the dispersion areas of the freshwater molluscs, especially those of the species belonging to the family Unionidae. The communication between these patches is impossible because of the barriers represented by the affected reaches. The abundance of the individuals is decreasing towards a critical surviving number.

3. The mollusc communities consist of common eurybiotic species of pulmonates.

4. Comparing to 1992 the ecological state of the river slightly improved, probably due to the reduction of industrial works.

5. The Someş river is an important polluting factor of the Tisza.

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The occurrence of mayfly (*Ephemeroptera*) larvae along the River Someş/Szamos[1]

Noémi Szállassy

Abstract

The distribution of mayfly *(Ephemeroptera)* larvae along the river Someş was studied from its spring to its mouth. We have found 18 species belonging to 4 different families. Knowing their density the collected mayfly species can be used as indicators of the water quality. The biodiversity (calculated with Shannon-Wiener formula) reached the maximum value (HS=1,502) at the first sampling point of the Someşul Mare/Nagy Szamos (6 SM1). According to the lower biodiversity of mayfly larvae the river was very polluted downstream of big cities (Beclean, Năsăud, Dej, Satu Mare).

Keywords:Ephemeroptera, water quality classification.

Introduction

The present paper describes the mayfly fauna of the river Someş/Szamos. The mayfly larvae are important elements of water communities, therefore they can be used as indicator organisms.

The mayfly fauna of the river Someş/Szamos had been studied only once before our investigation (Găldean 1992a, 1992b). The present paper completes the study made by Găldean, with a special regards to water quality classification.

Materials and methods

The samples were collected in August 1996 in the Someş/Szamos expedition organised by Pro Europa Liga and Tisza Klub. We had one sample point at the Someşul Rece, one at the Ilva Creek, four at the Someşul Mare and six at the United Someş. The quantitative samples were collected with benthometer from a 0,1 m^2 surface of various substrates from both sides and from the middle of the river. The qualitative samples were taken by tweezers from the surface of stones.

The quantitative samples were preserved in 5 % formalin, the quantitative ones in 80 % alcohol. The larvae were identified under microscope, some species with the help of buccal preparations. I used the works compiled by Ujhelyi (1959), Macan (1970) and Studemann (1992).

[1] The first name is Romanian, and the second Hungarian

The diversity of the sampling points were characterised by the Shannon-Wiener formula.

Results and discussion

In 12 sampling points we have found 18 species of 4 families. Their occurrence at different sampling sites is represented in Table. The values of biodiversity are shown together with the number of individuals (Figure 1.).

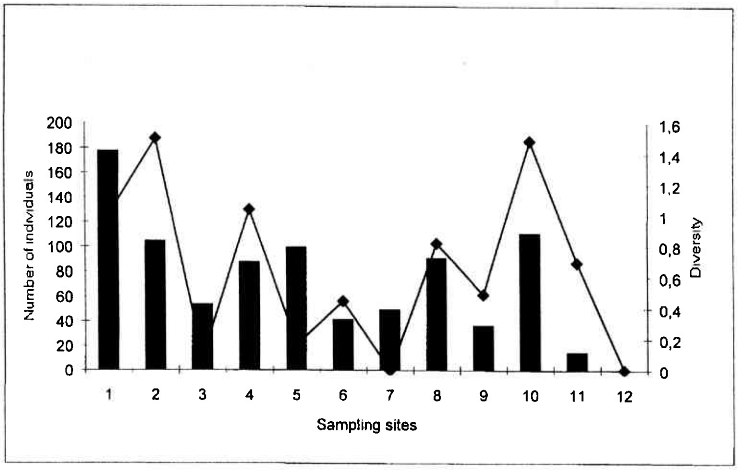

Figure 1. Values of biodiversity (line) and number of individuals (bars) of mayflies larvae along River Someş/Szamos

On the Someşul Rece (SR) we found rheophilic species characteristic to rithron that adapted themselves to the presence of materials arising from erosion (Găldean, 1992). The presence of *R. semicolorata* and *Ecdyonuridae* species refer to oligosaprobic water of first-class quality.

The greatest biodiversity (HS = 1,502) was found at the first sampling sites of the Someşul Mare (6 SM1) which indicates a natural state. Here the substrate consisted of different middle sized plate stones.

Near Năsăud (8 SM3) the water is polluted by organic matters coming from a textile factory. Here we observed *Baetis* larvae and caddisflies, these being better survivors in polluted area.

After Beclean (9 SM4) at the inflow of wastewater *Sphaerotilus natans* appears in great masses. Upstream the inflow where the stones are covered densely with algae we could find larvae of caddisflies, Chironomidae and leech, and we identified *B. rhodani* and *C. macrura* mayfly species. At this point the water is beta-mesosaprobic. After the inflow of wastewater the mayfly larvae disappeared completely from the river.

At the United Someş the stony and sandy sections are mosaic-like, thus a characteristic patch-like biocoenosis forms (Găldean,1992).

At Letca (10 SU2) at the bottom of the river showing a very strong pollution we found only *B. rhodani.*

At Someş Odorhei (11 SU3) as a result of natural purification processes the biodiversity grows to a certain extent (HS = 0,82). The stones were covered by biotecton and at the substrate there was a great density of *Trichoptera* and *Oligochaeta.*

Upstream Ţicău (14 SU4) we identified two mayfly species. Here the riverbed is wide and the substrate is covered by black residua.

At Sălsig (12 SU5) the mayfly larvae appeared again in great masses. On a slow flowing section we found mayfly larvae belonging to *Heptageniidae* which are sensitive to pollution and *Bryozoa.* The majority of shells and snails found here were dead. It is caused by the waves being rich in organic and toxic materials.

Upstream Satu Mare (15 SU 8) the substrate is sandy and stony, with detritus agglomerations in some places. Here we did not find mayfly larvae at all.

As a conclusion we draw the followings: the Someş presents an interesting image because of its biotop diversity and because of changes of degraded and regenerated sections. In some places we found *Baetidae* and *Canidae* populations. Only one of the following species could be observed: *T. belgica, Habroleptoides carpatica, Habrophlebia fusca.* As the river is full of organic matters the sensitive *Heptageniidae* species *(Rhitrogena, Ecdyonuridae)* gradually disappear from the river. The *Heptagenia flava, H. fuscogrisea* and *H. coerulans* species appear again at the lower sections, although the water is full again of organic matters. This proves the beginning of a natural purification process on certain parts of the river.

Acknowledgement

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	SR	6 SM1	7 SM2	I1	8SM3	9SM4	10SU2	11SU3	14SU4	12SU5	13SU6	15SU8
Baetis muticus	-	-	-	-	1	2	-	-	-	-	-	-
Baetis niger	-	-	-	-	1	-	-	2	-	-	-	-
Baetis rhodani	-	45	52	56	96	36	49	46	7	20	-	-
Baetis scambus	46	-	-	-	-	-	-	-	-	-	-	-
Baetis sp.	108	3	-	9	-	-	-	13	-	1	7	-
Acentrella sinaica	-	28	-	16	1	-	-	-	-	-	-	-
Cloeon rufulum	-	-	-	-	-	-	-	15	-	24	-	-
Rhitrogena loyolea	-	2	-	-	-	-	-	-	-	-	-	-
Rhitrogena semicolorata	4	2	-	-	-	-	-	-	-	-	-	-
Ecdyonurus venosus	-	2	-	-	-	-	-	-	-	-	-	-
Ecdyonurus sp.	2	-	-	-	-	-	-	-	-	-	-	-
Heptagenia coerulans	-	-	-	-	-	-	-	-	-	1	-	-
Heptagenia flava	-	-	-	-	-	-	-	-	-	44	-	-
Heptagenia fuscogrisea	-	-	-	-	-	-	-	-	-	1	-	-
Heptagenia sp.	17	-	-	-	-	-	-	-	-	-	-	-
Ephemerella ignita	-	18	1	-	-	-	-	-	-	-	-	-
Torleya major (belgica)	-	1	-	-	-	-	-	-	-	-	-	-
Caenis macrura	-	-	-	5	-	3	-	14	29	20	7	-
Caenis sp	-	-	-	1	-	-	-	-	-	-	-	-
Paraleptophlebia cincta	-	2	-	-	-	-	-	-	-	-	-	-
Habroleptoides carpatica	-	1	-	-	-	-	-	-	-	-	-	-
Habrophlebia fusca	-	-	-	-	-	-	-	-	-	1	-	-
Nr. of individuals	177	104	53	87	99	41	49	90	36	110	14	-

Table 1.: Occurrence of mayfly larvae at different sample points

Odonatological survey on the River Someş/Szamos[1] in Romania

Attila Huber

Introduction

Species richness of dragonfly fauna provide important information about the water quality of a wetland, since dragonfly nymphs can be considered as indicator organisms of natural waters sensitive to water pollution. In August 1996 an expedition was organised by the Tisza Klub of Szolnok and the Pro Europa Liga of Tărgu Mureş to get information about the ecological conditions of the Someş/Szamos. As a part of this expedition an odonatological survey was carried out in the river with the aim of revealing its dragonfly fauna and these results are summarised in this paper.

There were no literature found referring to the Odonata fauna of the Rumanian section of the river. In the Hungarian section of the Someş Ambrush et al. (1995, 1998) collected 7 species as nymphs and 7 species as adults altogether. In their papers the larval occurrence of 4 riverine dragonfly (*Gomphidae*) species is mentioned, in addition these 4 species occur together in some points of the river. Dévai et al. (1993) collected only 3 frequent species as imagoes near the Someş also in Hungary.

Keywords: Odonata, River Someş

Materials and methods

Both nymphs and adult dragonflies were collected in this expedition. Generally data come from the nymphs are very important because these prove undoubtedly which wetlands are used for reproducion. Exuvia were not found because the expedition took place in August by the time nymphs of almost all species moulted into adult.

A butterfly-net was used to catch adult dragonflies and a squared frame pond net for nymphs. The pond net could be used effectively in the lowland where the river formed fine silt and sand depositions. The animals were preserved in a 70% ethyl alcohol solution in little glass vials. Identification of species was made by using the keys and descriptions of Askew (1988), Benedek (1965), Carchini (1983), Dreyer and Franke (1987), Jödicke (1993), Laister (1991) and Steimann (1984).

The dragonfly nymphs were collected mainly from the Someş river itself and the adult insects from its surroundings. Besides nymphs and adults were also collected from a spring and from some still waters near the river and these results are also presented in this paper. The sampling stations were the following ones:

[1] The first name is Romanian, and the second Hungarian

1. Someşul Cald gorges (Ic Ponor) - 2. Someşul Cald, 2 km downstream Ic Ponor - 3. Lake Tarniţa - 4. Spring near Lake Tarniţa - 5. Someşul Rece (Blăjoaia) - 6. Someşul Rece, 10 km downstream Blăjoaia - 7. Someşul Mic (Cluj) - 8. Someşul Mic (Someşeni) - 9. Someşul Mic (Gherla) - 10. Someşul Mare (Şanţ) - 11. Lake near Someşul Mare (Şanţ) - 12. Someşul Mare (Sngeorz-Băi) - 13. Someşul Mare (Năsăud) - 14. Backwater of Someşul Mare (Salva) - 15. Someşul Mare (Piatra) - 16. Someşul Mare (Beclean) - 17. United Someş (Dej) - 18.. United Someş (Letca) - 19. United Someş (Someş-Odorhei) - 20. United Someş (Ţicău) - 21. United Someş (Sălsig) - 22. United Someş (Pomi) - 23. Channel near United Someş (Pomi) - 24. United Someş (Păuleşti) - 25. United Someş (Vetiş)

Although the expedition extended to the whole length of the river, the odonatological survey took place only in its Romanian section.

In the next chapter and in the tables I am going to refer to the sampling sites by numbers signed above.

Results and discussion

During this study 26 dragonfly species were recorded in the Romanian section of the river and in four nearby waters (4, 11, 14, 23), 16 of them as nymphs and 20 of them as imagoes.

Dragonfly nymphs were found in neither sampling site of the Someşul Cald (1-2). This is partly due to the fact that in such a fast flowing stream nymphal occurrence of at most few dragonfly species is expected. The larval growth of *Aeshna cyanea* and *Sympetrum meridionale*, which were collected as imagoes probably does not take place in the Someşul Cald but in little astatic and semistatic ponds, which were found near the river. Lake Tarniţa (3) is resulted from damming back of the Someşul Cald. The aquatic macrophytes and the marsh vegetation were very poor. The only dragonfly species collected was *Platycnemis pennipes*, besides *Aeshna cyanea* was observed. The larval growth of *Platycnemis* can take place in the lake, but *Aeshna cyanea* larvae were found in little springs with many detritus near the lake (4).

Similarly to Someşul Cald the Someşul Rece (5-6) is a fast flowing stream with bouldery substratum. Dragonfly nymphs were not found in the river itself. Indeed sampling site (6) was a little branch of the river with stagnant water and with rich aquatic vegetation (mainly with *Callitriche* spp.). Since the nymphs of adult dragonflies collected here normally grow in still waters, it is probable, that they all grow in this and in other similar branches. However the sample collected here contained the nymphs of only two *Aeshna* species.

The Someşul Cald and the Someşul Rece join in the Someşul Mic (7-9) upstream Gilău. Its flow is much slower but still with bouldery substratum. Dragonfly nymphs were not found either here but I collected 6 species as imagoes (see *Table 2.*). Reaching Cluj the river gets a large amount of communal and industrial sewage, so I could not find any dragonfly nymph downstream the town and only two frequent species were collected (*Platycnemis pennipes* and *Agrion splendens*) as imagoes but only in low number.

The upper reaches of the Someşul Mare (10) is fast flowing with bouldery substratum where dragonfly nymphs were not found. Nevertheless one of the most interesting result of the expedition was the occurrence of *Cordulegaster bidentatus* at Şanţ. Only one adult specimen was collected but I did not find its nymphs. Generally the nymphs of this species grow in such fast flowing streams, therefore its larval occurrence is expected there. The nymphs of *Aeshna cyanea* and *Agrion splendens* were collected from a little marshy branch of the river. Sampling site (11) was a little artificial pond near the Someşul Mare with silty bed and without macrovegetation where *Aeshna cyanea* larvae were very frequent. Reaching the lowland the river flows slower and slower and in some places its substratum is not bouldery but it forms fine silt depositions (at sampling site 12, 13, 15, 16). The riverine dragonfly nymphs (*Gomphidae*) could be collected very effectively in such places, but the nymphs of *Platycnemis pennipes* and *Agrion splendens* were present mainly in plant fragments hanging down into the water, especially in branches of trees. The first *Gomphid* species, namely *Onychogomphus forcipatus* appeared at Piatra in low number. Near Beclean the dragonfly nymphs were collected from a little branch of the river where after falling aquatic insects stayed behind in little ponds. In these ponds the nymphs of *Gomphus vulgatissimus*, *Agrion splendens* and *Platycnemis pennipes* were very frequent.. The river has an other branch at Beclean in the left bank, which is polluted with communal sewage flowing in it through a little channel. Dragonfly nymphs were not found in this branch but *Orthetrum cancellatum* and *O. albistylum* were collected there as imagoes.

The Someşul Mare and the Someşul Mic join in the United Someş at Dej. The United Someş (17-25, excepting 23) can be characterised by alternating occurrence of bouldery, sandy and gravely substratum. The river gets a large quantity of industrial pollution at Dej. Being sensitive to pollution the Gomphids disappeared downstream the town, although they were present at Piatra and at Beclean in the Someşul Mare. The next sampling site was Letca where *Gomphus vulgatissimus* appeared again but only in low number. It means that the water quality has improved between Dej and Letca but it was still polluted. This self-purification process probably continued between Letca and Someş-Odorhei because *Gomphus vulgatissimus* was quite frequent at the latter station and appeared other two *Gomphid* species (see *Table 1.*). 3 *Gomphid* species was found at 4 sampling sites altogether (17, 20, 22, 23) but all 4 species mentioned by Ambrush et al. (1995) was nowhere found together. *Gomphus flavipes* appeared first at Pomi and it was the most frequent *Gomphid* species at Vetiş. At Sălsig the river was relatively fast flowing with bouldery substratum where I could not find any *Gomphid* nymph. However they might also be present there because an ovipositing female *Onychogomphus forcipatus* was observed.

Beside the river some wetlands were also examined during the expedition. Sampling site (14) was a backwater of the Someşul Mare at Salva with dense macrovegetation (mainly with *Ceratophyllum demersum*). The dragonfly nymphs collected here are typical of still waters and they miss from the river (*Erythromma viridulum, Sympecma fusca, Lestes barbarus, Cordulia aenea, and Sympetrum sanguineum*). Sampling site (23) was a channel near Pomi where marsh vegetation was typical mainly with *Butomus* *umbellatus* and *Iris pseudacorus*. Dragonfly species found there generally grow also in still waters (*Coenagrion puella, Lestes dryas, L. viren vestalis, Anaciaeshna isosceles, Somatochlora metallica, Libellula depressa*).

The checklist of the dragonfly nymphs and adults collected at the sampling sites is presented in Table 1. and 2.

During this short survey the nymphs of 8 dragonfly species were found in the river itself. Being a very important result of the expedition all 4 *Gomphid* species mentioned by Ambrush et al. (1995) was found in the lowland reaches of the river. Likewise the occurrence of *Cordulegaster bidentatus* at the upper Someşul Mare is a remarkable result. Ambrush et al. (1995) also mention the nymphal occurrence of *Sympetrum sanguineum* but normally this species is typical of semistatic standing waters and at most sporadically grow in rivers. The nymphs of this species were not found in the Romanian section of the river. They also caught *Gomphus flavipes*, *Anax imperator* and *Lestes dryas* as imagoes but the latter two species occur generally near still waters. On the other hand they do not mention the larval occurrence of *Orthetrum albistylum* and *Ischnura elegans* in the Hungarian section of the river. The dragonflies typical of Someş are the *Gomphids*, *Platycnemis pennipes* and *Agrion splendens* whose nymphs are frequent in some reaches of the river. In general *Orthetrum albistylum* grow in still waters and its larval occurrence can be expected in reaches where the flow speed of the water decrease almost to zero, therefore silt depositions are formed. *Ischnura elegans* normally can also be found in still waters but this species links to water-plants or plant fragments.

The results of this expedition support that the dragonfly nymphs are sensitive to water pollution, since at sampling sites the river gets a stronger pollution (Dej, Cluj) dragonfly nymphs disappeared entirely or almost entirely and at reaches downstream when water quality improved due to the self-purification of the river they gradually spread again. This is true considering both number of individuals and number of species. Therefore in the lowland reaches of the river the improvement of water quality could be very important.

The checklist of species presented in this paper cannot be considered to be complete for the river and for its surroundings. Because of phenological differences probably other species of dragonflies remain to be found both as larvae and as imagoes.

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Species	Sampling stations																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Platycnemis pennipes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	1	0
Coenagrion puella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ischnura elegans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Sympecma fusca	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Agrion splendens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	1
Aeshna cyanea	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aeshna juncea	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anaciaeshna isosceles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Gomphus vulgatissimus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	1	1
Gomphus flavipes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Onychogomphus forcipatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0
Ophiogomphus cecilia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Cordulia aenea	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Somatochlora metallica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Libellula depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Orthetrum albistylum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Total	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**2**	**1**	**4**	**0**	**1**	**5**	**2**	**2**	**5**	**4**	**4**	**4**

Table 1: Dragonfly larvae collected from the river Someş and nearby still waters

0 = absent 1 = present

Species asterisked (*) are mentioned also in literature

Species	Sampling sites																								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Platycnemis pennipes*	0	0	1	0	0	0	1	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0
Coenagrion puella	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erythromma viridulum	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Ischnura elegans*	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0
Ischnura pumilio	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Lestes dryas*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Lestes barbarus	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Lestes virens vestalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Agrion splendens*	0	0	0	0	0	0	1	1	1	0	0	1	1	0	0	1	0	1	0	0	0	1	0	0	0
Aeshna cyanea	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aeshna juncea	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Onychogomphus forcipatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Cordulegaster bidentatus	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Somatochlora flavomaculata	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Somatochlora metallica	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libellula depressa	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orthetrum albistylum*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Orthetrum cancellatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Sympetrum sanguineum	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	1	0	0	0	1	0	0
Sympetrum meridionale	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Összesen	**1**	**1**	**2**	**0**	**0**	**6**	**6**	**2**	**3**	**1**	**2**	**2**	**2**	**7**	**0**	**6**	**0**	**2**	**1**	**0**	**1**	**3**	**3**	**0**	**0**

Table 2.: Adult dragonflies collected or observed near the river Someş and nearby still waters
0 = absent 1 = present
Species asterisked (*) are mentioned also in literature

The assessment of the bioindicator value of some rheophilic elements of the River Someş/Szamos[1] lotic system

Nicolae Găldean, Gabriela Staicu and Petru Bacalu

Abstract

The analysis of the benthic communities characteristic of the Someş lotic system according to the main taxa (Ephemeroptera, Plecoptera, Trichoptera and fishes) carried out at 27 sampling sites in 1992 and 1996.

The carrying capacity of the river was assessed and some lists of bioindicators specific for this catchment area were proposed.

Keywords: bioindicators, carrying capacity, Ephemeroptera, Plecoptera, Trichoptera and fishes

Introduction

There are two main points to be taken into account:

a. The necessity of permanent monitoring and management of the aquatic resources which must be sustained with a good scientific base. It means a relatively complete knowledge about the taxonomic composition, physico-chemical parameters, structure of the communities, the role of some populations in nutrient cycling.

b. The necessity of comparing the aquatic ecosystems in order to understand their evolution and to predict the environmental impact.

The river Someş is one of the most interesting flow in Romania. It is included within the western hydrographic systems (Gâştescu & coll., 1983).

In 1992 and 1996 two expeditions (Someş/Szamos Expedition) were organised by the Liga Pro Eurpa, Târgu Mureş (Romania) and TiszaKlub of Szolnok (Hungary) to complete researches on the river Someş, from its spring to its mouth.

The river Someş with a hydrographic basin of 15.217 km^2, is formed by the union of 3 main flows, namely of the Someşul Cald, Someşul Rece and Someşul Mare, located in different geological areas. It is interesting that the placing of the Someşul Cald and Someşul Rece within the phoenic winds zone of the Western Carpathians impart the following reduced values, although the discharge basin can be found at an altitude of 1000-1500 m (Ujvary, 1959). This thing provides steadiness to these two ecological systems and contributes to their diversity in species development.

[1] The first name is Romanian, and the second Hungarian

On the other hand, along the lower flow of the Someş, downstream the locality of Jibou, some parts with as pronounced slope can occur, generating the flow acceleration and providing life conditions for some rheophilic species. As a matter of fact, most length of the Someş resembles a submountain, fast flowing river, stirred by the bouldery substratum.

Material and methods

The faunistical analyses took place by a quantitative test (with a Surber benthometer) and a qualitative one (with a hand dredge). In some areas the sampling based on the stratificated random criteria, i.e. different substratum types were selected.

The communities of benthic macroinvertebrates can reflect the main processes of the ecosystems taking into account the existing knowledge (taxonomy, ecology and zoogeography) about the main groups (Plecoptera, Ephemeroptera, Trichoptera and Diptera Chironomidae). We can use the data of dispersal of different groups in an aquatic basin and also we can predict the status of the community and of the system based upon the assessment of the community structure. The anthropogenic influence on lotic ecosystems increases: the energy flux changes by the modification of border vegetation, like the input of alloctonous organic materials and the recycling of nutrients, especially of nitrogen and phosphorus (Hildrew & Giller, 1995).

Results and Discussion

Carrying capacity of the Someş lotic system

Assessing the carrying capacity we must take into account the following criteria:

The activity of a minimum number of populations, which are more adapted to the environmental conditions.

The ecosystem can maintain its functionality based only on 2-3 species that sustain its structure. In some areas of the river Someş just Oligochaeta and some Diptera (Chironomidae) can survive in extreme conditions and they are able to preserve a simplified structure, sufficient for the system.

The special significance of the consumers which are able to use allochtonous trophic resources (some Coleoptera larvae, Trichoptera Limnephilidae, Plecoptera, Leuctridae and some Chironomidae)

The heterogeneity of substrata which induces the localisation of the benthic populations.
-coarse gravel, relatively uniform, with a fine layer of algae
-boulders rinsed by the water current very well, without detritus
-coarse sand without detritus
-coarse sand with detrital deposits with many mayfly larvae (*Siphlonurus)*
-small deposits of mud with many oligochaets and midges.

In the Năsăud area (Someşul Mare) there are some braided sections, which permit the deposition of fine, muddy sediments, inducing the dominance of oligochaets (*Limnodrilus*). On the other hand, in sections with a high water velocity there are numerous Trichoptera (Hydropsychidae).

The riverine vegetation is a main factor for ecosystem and influences the carrying capacity in two ways: directly, as a source of organic fresh material available for macrodecomposers (shredders Crustacea Amphipoda and some Trichoptera) and microdecomposers indirectly, by the shading effect which favours the low temperatures of the water.

The riverine herbaceous vegetation rinsed by the water flow is a shelter for many species mostly in the flooding periods.

The actual distribution of the forests along the Someş reflects the main types of human impacts. The Someşul Mare is protected by mixed forests at the Sant-Rodna section and by deciduous ones at the Năsăud-Beclean section. The Someşul Cald and Someşul Rece flow through deciduous forests. The Someşul Mic and the Someş are more influenced by the deforestation phenomena, mainly in the lower zones.

Between 1910 and 1970 the human pressure was simply estimated by the population growth, correlated with the benthic diversity. In the sectors of the Someşul Mic the growing was significant, from 500-1000 individuals/m^2 up to 2000/m^2. In the sectors of the Someşul Cald and Someşul Rece the values did not change in time and the benthic communities are more diverse than the others one. In the Someş away from Jibou the density became double and this phenomenon, correlated with the industry development induced the decreasing of diversity.

The limits of the carrying capacity

The remarkable diversity in the upper reaches of the Someşul Cald, Someşul Rece and Someşul Mare indicates both favourable abiotic conditions and the complexity of trophic relations. Taking into account the limits of carrying capacity it was possible to appreciate the chances of recovering of the impacted areas.

In our opinion, the upper carrying capacity limit is sustained by the rheophilic species (Ephemeroptera, Plecoptera, Trichoptera, Diptera – Blephariceridae and Pisces-Salmonidae) which use many resources, both autochthonous and allochthonous ones. The medium limit is correlated with the real possibility of restoring the initial conditions because in the sectors of the Someşul Mare (Sanț-Rodna-Năsăud) and the Someşul Mic (away from Cluj) the dominant populations of Hydropsychidae (Trichoptera) and Unionidae (Bivalvia) have a remarkable filtering capacity. The lower limit is induced by the wastes loaded in the water and is sustained by the populations of Chironomidae (Diptera), Oligochaeta, Bryozoa colonies and Hydropsychidae (Trichoptera). The decreasing below this limit can produce a drastic change in the system and a human intervention is necessary to sustain the biological recovering.

The populations of *Hydropsyche pellucidula* (Trichoptera, Hydropsychidae), *Plumatella repens* (Bryozoa) and the Unionidae (Bivalvia) determine the filtering capacity of the benthic communities and ensure specific conditions for settling of other

benthic groups. So, the aggregation of Hydropsychidae larvae on boulders or on argilla permit the forming of an association with Ephemeroptera larvae, many Chironomidae and Isopoda (Crustacea). It must be mentioned that the Hydropsychidae larvae are also dominant in the upper sections of the river, being sustained by loading particles. This situation determines some effects as:
- the covering of the boulders and other surfaces with a fine layer of algae, bacteria and moss
- the accumulation of a fine sediment between the elements of gravel
- the tendency of decreasing of rheophilic populations
- the dominance of filtering collectors
- the consolidation of the association.

The lowest limit is demonstrated by the dominance of Oligochaeta and Chironomidae populations (in the Someşul Mic, downstream Cluj) which can use a quantity of organic matter. In the sector Someşeni (Someşul Mic) this limit is accessible for bacterial populations only.

There are some points do be discussed in order to differentiate the sectors of the river depending on its carrying capacity:

Only the main water-course of the Someş is taken into account; the affluent (small creeks, springs) form a particular unit.

The species characteristic for the upper part of the river have the best bioindicator value.

The actually lotic systems are influenced by the human activity.

The chances of recovering for the impacted zones depend on the stability of affluent (they are reserves of biodiversity).

The bioindicators

The mayflies are considered to be significant in the water qualification but depending on the environmental deterioration their presence may be discussed in different sectors of the rivers. This must be considered with some criteria:
-the population size (isolated individuals are not significant)
-the pollution is not the only phenomenon determining the quality deterioration of the ecosystems
-the assessment of data must be made for a sufficiently long time

In our days the negative phenomena affecting the quality of waters are more and more important. In the Someş watershed there are dams, hydrotechnical buildings, impounds, mining, agriculture. The drought of the last 10 years (as a general phenomenon for Romania) reduced the outputs and contributed to the eutrophication processes resulting an excess of algae, moss and aquatic macrophytes (in the Someşul Mic and in the Someş downstream Jibou) and an increase in water temperatures in summer.

The algal-blooming, which is characteristic of the lenthic ecosystems, has a correspondent in the lotic ones, namely the increasing of population size in Bryophita, aquatic macrophytes (*Potamogeton* species) and Oligochaeta (e.g. *Limnodrilus hoffmeisteri*). These ones are characteristic of the sections Someşeni-Gherla and Dej-Jibou.

Taking into account the faunistical analysis we propose a checklist of species with bioindicator value for the Someş watershed:

Bioindicators of excellent quality
Plecoptera:
Brachyptera risi
Leuctra albida
Leuctra rauscheri
Leuctra quadrimaculata
Amphinemura triangularis
Nemoura fulviceps
Perla marginata
Siphonoperla neglecta
Ephemeroptera:
Siphlonurus lacustris
Siphlonurus aestivalis
Ameletus inopinatus
Baetis alpinus
Baetis sinaicus
Baetis melanonyx
Epeorul sylvicola
Rhithrogena aurantiaca
Trichoptera:
Rhyacophila fasciata
Rhyacophila polonica
Glossosoma boltoni
Philopotamus montanus
Wormaldia occipitalis
Drussus brunneus
Limnephilus griseus
Grammotaulius nigropunctatus
Stenophylax permistus
Beraea pullata
Bioindicators o very good quality
Plecoptera
Tanyopterix nebulosa
Leuctra nigra
Leuctra hippopus
Leuctra inermis
Capnia bifrons
Nemoura cinerea
Nemoura cambrica
Nemurella pictetii
Protonemura intricata
Perla pallida
Isoperla grammatica
Chloroperla tripunctata
Ephemeroptera
Baetis lutheri
Baetis rhodani
Baetis scambus
Rhithrogena semicolorata
Ecdyonurus dispar
Ecdyonurus venosus
Ephemerella mesoleuca
Ephemerella notata
Leptophlebia marginata
Paraleptophlebia submarginata
Ephemera danica
Trichoptera:
Rhyacophila obliterata
Neureclipsis bimaculata
Brachycentrus maculatum
Halesus digitatus
Goera pilosa
Mystacides longicornis
Sericostoma schneideri
Bioindicators of good quality
Ephemeroptera:
Baetis vernus
Baetis fuscatus
Centroptilum luteolum
Heptagenia lateralis
Ephemerella ignita
Caenis macrura
Trichoptera:
Hydropsyche pellucidula
Bioindicators of satisfactory quality
Trichoptera:
Hydropsyche pellucidula
Bioindicators of low quality
Oligochaeta
Diptera Chironomidae

Table 1.

Taking into account the taxa used in this checklist (mainly Ephemeroptera, Plecoptera and Trichoptera) we can observe a clear differentiation of sectors (zones) in the rivers. The mayflies reveal the sustenance capacity of the system for the primary production of algal layer (bioderma) which is maintained at optimum values at least in some sectors.

The competition among the family Baetidae and Heptageniidae induces some changes in the relative abundance of *Baetis vernus, B. rhodani, Rhithrogena semicolorata, Caenis moesta, Ephemerella ignita.*

Some considerations about the relation between the ichthyofauna and the benthic macroinvertebrates

The analysis of the gut content of some fish populations revealed their capacity to control other populations (benthic macroinvertebrates).

Phoxinus phoxinus is abundant in the Someşul Cald, Someşul Rece and Someşul Mic but comparing them each other the significance of their populations is different. The specimen collected in the Someşul Cald (Ic Ponor) used many trophic resources: Chironomidae, Trichoptera (some of them with cases), imagoes of different insects and detritus in the following proportion:

insects larvae	36%
insects imagos	32%
detritus (vegetal origin)	32%

The specimen collected in the Someşul Rece (Blajoaia) consumed Trichoptera (with or without cases), Diptera, insects imagoes, snails *(Radix)* and coarse and fine detritus.

insects larvae	38%
insects imagos	24%
gasteropoda	5%
coarse detritus	18%
fine detritus	15%

In the specimen collected in the Someşul Mic (upstream Cluj) the gut content is dominated by detritus:

very fine detritus	86%
vegetal tissue	7%
chitinous fragments	7%

Here, the boulders and argilla are covered with a thick layer of algae and the population of *Phoxinus phoxinus* uses this resource mainly.

Alburnus alburnus shows the same diversity concerning the trophic resources.

The population from the Someş near Sălsig:

insects imagos	53%
coarse detritus (chitinous fragments and vegetal tissue)	19%
larvae and pupae of trichoptera (*Hydropsyche*)	14%
very fine detritus	14%

The population from the Someş, near Someş Odorhei:

chitinous fragments	39%
fine detritus	23%
very fine detritus	19%
vegetal tissue	19%

The population from the Someşul Mare near Beclean:

very fine detritus	85%
detritus and chitinous fragments	15%

The population from the Someşul Mare near Dej:

very fine detritus	42%
insects imagos	25%
vegetal tissue	8%

Leuciscus cephalus has more or less similar trophic preferences with that of *Alburnus alburnus.* In the specimen collected in the Someşul Cald the gut content is composed by

vegetal tissue	44%
very fine detritus	23%
chitinous fragments	23%
chitinous fragments and detritus	10%

Alburnoides bipunctatus, Someşul Mare near Beclean:

very fine detritus	78%
chitinous fragments	22%

In other species, the low number of collected examples could not permit such estimations. Only the fact must be emphasised that some individuals of *Gobio gobio* used fragments of Bryozoa colonies as a trophic resource.

Conclusions

The Someş can be characterised as a very complex lotic system both from the faunistical and functional point of view. The distribution of the rheophilic elements and the benthic communities reflects either the quality of the river or the state of the watershed. In this way it was possible to establish some characteristic zones:
Someşul Rece and Someşul Cald: very good water quality, high level of biodiversity and absence of human influence
Someşul Mare up to Năsăud: very good water quality and a little influence of the villages
Someşul Mare from Năsăud up to Dej: a good water quality but a significant human influence
Someşul Mic up to Cluj: good water quality, average impact
Someşul Mic downstream Cluj: low water quality, high impact
Someş up to Jibou: average water quality
Someş downstream Jibou: average or good water quality, different types of impact

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Some data concerning the biodiversity of stygofauna in the River Someşul Cald/Meleg Szamos[1] basin

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Abstract

The present study analyses generally and comparatively the community structure of 3 habitats of the Someşul Cald/Meleg-Szamos river basin, belonging to the subterranean realm: springs or emergencies, free basins in caves and interstitial waters (=psammal). The preliminary results comprise the comparative analysis of the biodiversity of faunistical groups treated qualitatively and quantitatively.

Keywords: Someş/Szamos river basin, biodiversity, stygofauna, psammal.

Introduction

As part of the Apuseni Mountains, the Someşul Cald hydrographic basin, a tributary of the Someşul Mic/Kis-Szamos river, covers a large area (around 450 km^2). Its north border is the Crişul Repede/Sebes-Körös basin, the west border is the Crişul Negru/Fekete-Körös basin, the south border is the Arieş/Aranyos basin (it is a tributary of the Mureş/Maros river) and the east border is the Someşul Mic basin. Concerning its upper basin, this covers a large and picturesque area, composed mainly by coniferous forests, also having a great touristic value. In its greatest part, this area was integrated in a project of national park 40 years (M. Bleahu & M. Şerban, 1959).

Till now the entire zone of the Someşul Cald river has not been the subject of any hydrobiological study, except one single work (E. Prunescu-Arion & M.Baltac, 1967), which deals with the area on the whole and treats only some epigeal habitats.

The first investigations on the aquatic subterranean fauna (=stygofauna) took place earlier by the team of Speleological Institute of Cluj, as a part of the international campaign „Biospeologica“, but this study refers exclusively to the fauna of some well known caves (P.A.Chappuis & R.Jeannel, 1951). During this study only Copepods were collected from two caves, namely from Peştera de la Alun and Peştera Zmeilor de la Onceasa.

Since the epigeal streams of the whole Someşul Cald basin are bordered by sand and gravel sediments, which supposedly lodge a remarkable fauna (psammon) in their interstitial waters (psammal), our attention turned to this unexplored habitat since the 1960s.

[1] The first name is Romanian, and the second Hungarian

In this study, we present the preliminary results of a lot of samples collected by C. Pleşa between 1963-1979. These give us an overall view on the biodiversity of the stygofauna.

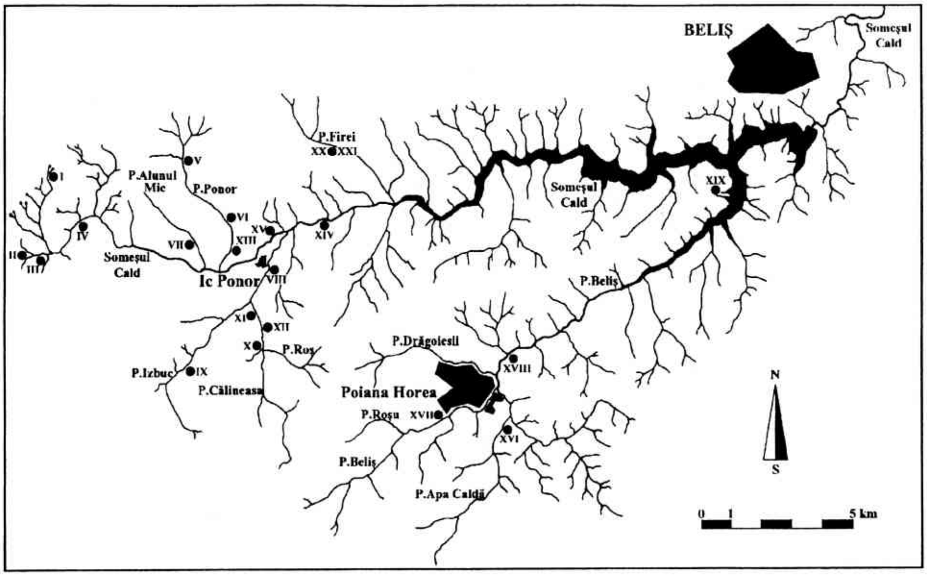


Figure 1. The map of the Someşul Cald/Meleg-Szamos river basin with the sampling sites

Materials and methods

In order to study the stygofauna, we collected material from 3 habitats, namely from springs or emergences (2 samples), from free aquatic basins of caves (3 samples) and from interstitial waters of the sediments deposed in epigeal streams or in cave-streams (19 samples). This last habitat, namely the psammal (only in epigeal streams it is also called *„hyporheic"*) seems to be always the richest habitat in stygofauna and forms with its community *(=psammon)* a real ecosystem for which the name *psammocoen* was suggested (Pleşa, 1995).

The material was collected with a plankton net, fixed in 75-80 % ethyl alcohol, then faunistic groups were sorted in laboratory. For collecting samples from psammal, we made holes in the sand or gravel sediments, which were deposed along the stream borders. The interstitial water was filtered and then fixed. This method is known as „the Karaman-Chappuis procedure".

The investigation area comprises the following more important zones:

-The Someşul Cald springs, bordered in north and west by „Vf .Micău" (1640 m), „Piatra Tâlharului", „Coasta Brăiesei" (1678 m) and „Şaua Cumpănăţelu" (1640 m);

-"Cetatea Rădeasa", „Cheile Someşului Cald" (the so called „Szamos bazár", after an earlier toponymy), the Şomeşul Cald valley upstream Ic Ponor, with its tributaries

(„Alunul Mare“, „Pârâul Porcului“, „Alunul Mic“ and „Pârâul Ponorului);
-The „Călineasa“ area, with „V. Izbucului“, „Pârâul Bătrâna“, „Pârâul Roşu“;
-“Valea Belişului“, between „Poiana Mare“ (=“Poiana Horea“) and its confluence with the Someşului Cald valley. Nowadays, the inferior region of the Belişului Valley is occupied by the „Fântânele“ reservoir, formed in the 1970s.
-“Valea Firei“, an important tributary of the river Someşul Cald.
The sample sites and their location are shown in Figure 1.

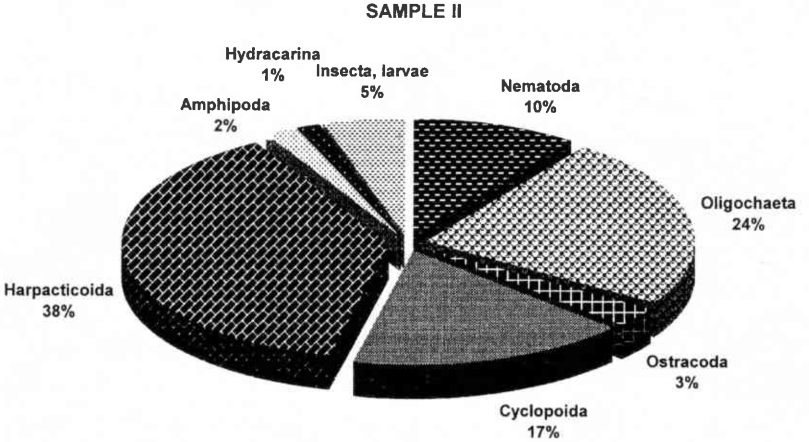
The most important ecological factors, for example the water temperature of each sample, sometimes also of the stream water and only once also the pH was noted. The details concerning the sample sites are presented in Table 1.

Results

As a result of the sample sorting representatives of 10 faunistical groups were identified. The community composition is illustrated in Table 2.

As it can be seen, the most abundant biodiversity is represented in psammal both from the qualitative and quantitative point of view. This habitat provides optimal survival conditions for the groups living here, first of all because the ecological factors are relatively constant in spite of the external seasonal variations. The associated fauna is represented most frequently by Copepods (Cyclopids and Harpacticoids), Oligochetes (particularly Naididae and Pristinidae), insect larvae (mainly Ephemeroptera, Plecoptera and Chironomida) and occasionally Hydracarina.

It has been ascertained that in the psammal the frequency of the faunistical groups differs from sample by sample. Thus, in order to illustrate this fact, we present the percentage distribution of the identified groups in two quantitative samples (Figure 2., 3.).



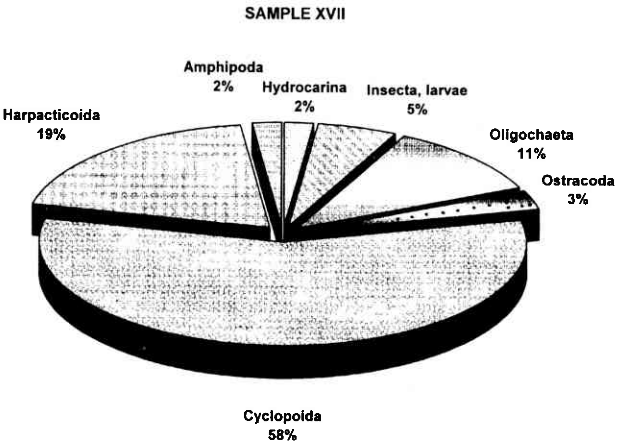


Figure 2., 3. The percentage distribution of the different faunistical groups in two quantitative samples.

Conclusions

Our present study offers an overall view about the living organisms populating the subterranean waters and, especially, the interstitial ones (=psammal) in the Someşul Cald river basin.

In a study of the rhytrofauna in the Someşul Cald river basin E. Prunescu-Arion & M. Baltac (1967) defined three main „zoocoenoses": „that of the mosses, of the periphyton, and the litho-rheophilous fauna". Our own study permitted the enlargement of this ecological spectrum, by the extension of the researches also on the subterranean habitats, which shelter a very interesting and variable stygofauna.

The taxa from each group are going to be identified by specialists. The results will permit a completion of our knowledge concerning the biodiversity of these communities.

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SAMPLE	SAMPLING SITES	DATE	Tw °C in site	Tw °C stream	pH	SEDIMENT STRUCTURE
I	Helocrene spring, on "Cornul Muntelui"	13.09.63	-	-	-	-
II	Psammal, Rădeasa cave	27.07.71	7.2	-	-	gravel
III	Psammal, Someşul Cald valley at Poiana Rădeasa	12.08.71	13.4	-	-	-
IV	Psammal, Someşul Cald gorges, under Moloch cave	27.07.71	-	-	-	-
V	"Peştera Zmeilor" cave from Onceasa, little basin on the clayous bottom	09.07.70	4.0	-	-	-
VI	Psammal, Ponorului stream	09.07.70	-	-	-	sand and gravel
VII	"Peştera de la Alun" cave, little basins and rimstone pools	05.07.70	4.0	-	-	-
VIII	Psammal, "Pârâul Bătrâna" upstream, from Ic Ponor	29.08.67	11.0	-	-	-
IX	Psammal, "Pârâul Izbucului" stream	06.07.68	-	-	-	sand and gravel
Xa	Psammal, "Pârâul Porcului" stream	30.08.67	8.5	-	-	-
Xb	Psammal, Călineasa stream	30.08.67	8.5	-	-	gravel
XI	Psammal, Călineasa stream, downstream from Pârâul Roşu	29.08.67	10.0	-	-	-
XII	Psammal, Călineasa stream	06.07.68	-	-	-	sand and gravel
XIII	Psammal, "Pârâuş Ponor" stream, 3 km upstream from the confluence	09.07.70	15.0	10.0	6.3	-
XIVa	Psammal, Someşului Cald valley, 1,5 km upstream from Ic Ponor	08.07.70	14.5	14.0	-	-
XIVb	Psammal, upstream from XIVth sample	08.07.70	-	-	-	-
XV	Psammal, "Pârâul Şimii" stream	11.07.70	11.0	13.0	-	-
XVI	Psammal, Apa Caldă stream, between Poiana Mare and Şaua Ursoaia	30.08.67	-	-	-	-
XVIIa	Psammal, "Pârâul Beliş" stream, near the bridge	30.08.67	-	-	-	clayous beach
XVIIb	Psammal, "Pârâul Beliş" stream, near the bridge	30.08.67	-	-	-	-
XVIII	Psammal, "Pârâul Beliş" stream, 500 m downstream from Poiana Horea	06.07.68	-	-	-	-
XIX	Psammal, "Pârâul Rece" stream, near Beliş, 200 m upstream from the confluence with Someşul Cald Valley	07.07.70	-	-	-	-
XX	Psammal, "Valea Firei" stream under "Şura Mare" cave	29.08.67	10.0	-	-	fine gravel
XXI	Emergence nr. 1 in "Valea Firei" stream	3-6.09.79	5.2		7.0	-

Table 1. Sampling sites in the Someşul Cald/Meleg-Szamos river basin

SAMPLE	Nematoda	Oligochaeta	Gasteropoda	Ostracoda	Cyclopoida	Harpacticoida	Amphipoda	Hydracarina	Collembola	Insecta, larvae
I		+			+	+	+			
II	+	+		+	+	+	+	+		+
III		+			+	+		+		+
IV		+		+	+	+		+		+
V						+	+			
VI		+		+	+	+	+			+
VII		+			+					
VIII	+	+		+	+	+				+
IX		+		+	+	+		+		+
Xa	+	+		+	+	+	+	+	+	+
Xb	+	+		+	+	+			+	+
XI		+		+	+	+			+	+
XII	+	+		+	+	+		+		+
XIII	+	+		+	+	+				+
XIVa	+	+		+	+	+				+
XIVb		+			+	+				+
XV	+	+			+	+	+	+		+
XVI		+			+	+				+
XVIIa		+				+				+
XVIIb		+		+	+	+	+	+		+
XVIII	+	+		+	+	+		+		+
XIX	+	+			+	+			+	+
XX	+	+		+	+	+	+			+
XXI	+	+	+		+	+		+	+	+

Table 2. The community composition of the samples presented in Table 1.

A study of diving beetles and whirligig beetles in the River Someş (Coleoptera: Dytiscoidea, Gyrinoidea)

Adrian Ruicănescu and István Mathé

Abstract

The authors performed a study of these coleopteran groups in the hydrographic basin of the Someş river. The material has been collected from limnocrenic, ponds, branches with stagnant water and lenthic sections of the Someş river and its affluent (upstream and downstream Ic Ponor, near the river Arinului, from "Trei Iazuri", downstream Salva, downstream Beclean, upstream Rodna Veche, at Someş Odorhei, Pomi and Vetiş). All are situated in Cluj, Bistriţa-Năsăud, Sălaj and Satu-Mare counties. Some data on the habitats were noted, among others their altitude, surface, depth, bottom material, vegetation, transparency and eutrophication, etc.

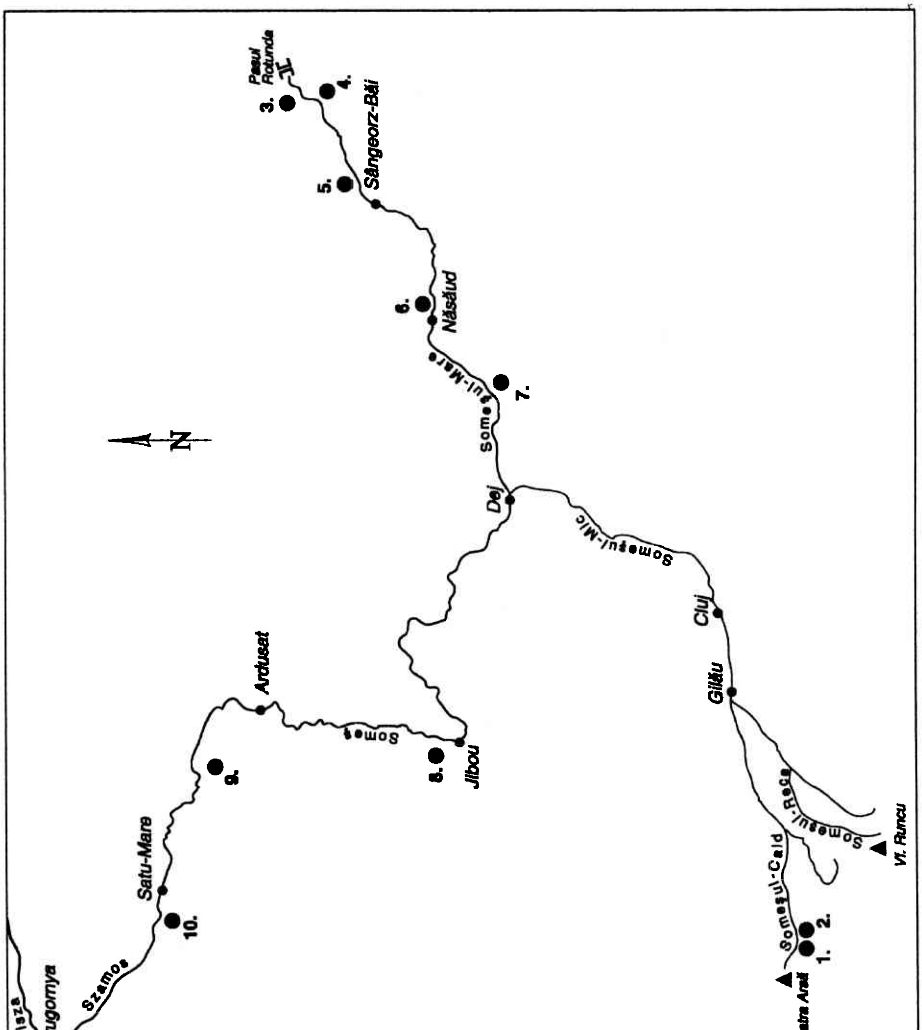
Each species collected and determined during this expedition is presented in this paper, accompanied by some characteristic data, namely their ecological and zoogeographic character, their relative frequency and the number of Dytiscoidea and Gyrinoidea species of different altitude ranges.

Some species were considered to be rare and very rare in the Romanian or Transylvanian fauna, such as Hyphydrus ovatus, Gaurodytes solieri, G. affinis, Hydaticus transversalis, Dytiscus circumflexus and D. dimidiatus.

Keywords: beetles Dyscoidea and Gyrinoidea, River Someş

Materials and methods

The material, consisting of Dytiscoidea and Gyrinoidea specimen collected from aquatic habitats included in the Someş river hydrographic basin, namely from limnocrenes, ponds, branches with stagnant water and lenthic sections of the Someş river and its affluents from the following points: upstream and downstream Ic Ponor, near the river Arinului, from "Trei Iazuri", downstream Salva, downstream Beclean, upstream Rodna Veche, at Someş Odorhei, Pomi and Vetiş. All are situated in Cluj, Bistriţa-Năsăud, Sălaj and Satu-Mare county (see Map).



Results

In the Someş river area 18 species of Dytiscoidea (22.8 %) and 1 species of Gyrinoidea (20 %) has been collected. (see Table)

Abbreviations of all tables: Sp.nr. = number of specimen; Zoogeogr. = zoogeographic character; F. rel. = relative frequency: Ecology: Eh = eremohydatophylous; O-Cn = oreocrenophylous; PoCa = potamocalciphylous; Sh = sciahydatophylous; Ubq = ubiquitous; S-

O-Ca-H-P = silvo-oreo-calci-hydato-potamophylous. Zoogeogr.: Balc-Med = Balkano-Mediterranean; E = European; Hol = Holarctic; I-Med = Irano-Mediterranean; Med = Mediterranean; Mg-E = Maghrebo-European; Mg-Sib-E = Maghrebo-Sibero-European; Pal = Palearctic; Sib-E = Sibero-European. F. rel.: f = frequent > 10 specimen / sample; rf = relative frequent 5-9 specimen / sample; r = 2-5 samples with this species collected till now in Transylvania; fr = very rare 1 single sample with this species collected till now in Transylvania.

The sampling sites were the following ones:

1. Upstream Ic Ponor, on the river Someşul Cald (Cluj county) 1040 m, 02.08.1996

Small water accumulation (limnocrene) situated near Ic Ponor with a length of 2.5 m, width of 2 m and depth of 05 m. Silty and pebbly bottom, without vegetation. The water surface was partially exposed.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Gaurodytes (s. str.) solieri (AUBÉ 1836)	3	O-Cn	E-Mt	600-2000	R
Total: 1 species	3				

2. Downstream Ic Ponor, about. 1200 m (Cluj county) 03.08.1996

Small water accumulation (limnocrene) situated on the river Someşul Cald, with a length of 1 m, width of 0.35 m and depth of 0.03-0.04 m. Silty bottom, without aquatic vegetation, the marsh vegetation consisted of herbaceous plants. The water surface was exposed.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Gaurodytes (s. str.) affinis (PAYKULL 1798)	1	O-Cn	Sib-E	500-1500	R
Total: 1 species	1				

3. Pond near the river Arinului, 900 m (Bistriţa-Năsăud county) 10.08.1996

A pond with a diameter of about 3 m and depth of 0.05-0.1 m, peaty-silty bottom, the swamp being under the way of silting. The aquatic and marsh vegetation consisted of Lemna minor, Alisma plantago-aquatica, Veronica beccabunga, Ferula sadleriana, Callitriche sp.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Hydroporus (s. str.) palustris (LINNÉ 1761)	10	Ubq	Sib-E	0-2000	F
Hydroporus (s. str.) palustris (LINNÉ 1761)	10	Ubq	Sib-E	0-2000	F
Gaurodytes (s. str.) sturmi (GYLLENHAL 1808)	10	S-O-Ca-H-P	E	500-1500	F
Ilybius fuliginosus (FABRICIUS 1792)	5	E-Sh	Hol	200-1000	F
Total: 4 species	35				

4. "Trei Iazuri" (Three Ponds), Confluence of rivers Arinului and Măriei with river Someşul Mare, 900 m (Bistriţa-Năsăud county) 10.08.1996

Three connected ponds with slow flowing water. The surface was about 40×25 m, with a depth of 0.1-0.5 m, and with silty bottom. The aquatic and marsh vegetation was very dense and consisted of Alisma plantago-aquatica, Juncus sp., Typha latifolia, Schoenoplectus sp. The water was relatively transparent.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Platambus maculatus (LINNÉ 1758)	7	PoCa	E	200-1000	F
Ilybius fuliginosus (FABRICIUS 1792)	7	E-Sh	Hol	200-1000	F
Total: 2 species	14				

5. Upstream Rodna Veche, on the river Someşul Mare (Bistriţa-Năsăud county) 900-1000 m, 12.08.1996

Small water accumulation (limnocrene), situated on the river Someşul Mare, 10 km upstream Rodna Veche, near the river Măriei. Its length was 3 m, width was 0.5 m and depth was 0.05-0.1 m, with silty and pebbly bottom. The aquatic vegetation missed. The marsh vegetation consisted of herbaceous plants, which partially invaded in the water. The surface was exposed.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Gaurodytes (s. str.) guttatus (PAYKULL 1798)	4	O-Cn	Pal	600-2000	F
Ilybius fuliginosus (FABRICIUS 1792)	20	E-Sh	Hol	200-1000	F
Gyrinus (s. str.) distinctus AUBÉ 1836	2	Ep	Balc-Med	200-1000	F
Total: 3 species	26				

6. Downstream Salva, 800-900 m (Bistriţa-Năsăud county) 12.08.1996

The stagnant water branch was situated at about 4 km downstream of Salva. The researched segment was 40 m in length, 5 m in width, and 0.1-0.8 m in depth. The bottom was oozy and the silt layer was deep, which shows a great bacterial activity. The water was very eutrophicated. The aquatic and marsh vegetation consisted of Potamogeton pectinatus, Lysimachia vulgaris and Typha latifolia. The surface of the researched segment was exposed.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Laccophilus hyalinus (DE GEER 1774)	2	Eh-Sp	I-Med	0-1500	F
Hyphydrus ovatus (LINNÉ 1761)	4	E-Sh	Mg-Sib-E	0-1000	R
Total: 2 species	6				

7. Downstream Beclean, 800-900 m (Bistrița-Năsăud county) 12.08.1996

It was a slow flowing section of a stream with a length of 50 m, width of 5 m and depth of 0.05-0.5 m. The bottom was oozy (silty) with stones scattered sparsely. The vegetation consisted of Myriophyllum spicatum, Potamogeton crispus, P. pectinatus, Typha latifolia and Schoenoplectus sp. The studied surface was exposed.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Platambus maculatus (LINNÉ 1758)	15	PoCa	E	200-1000	F
Gaurodytes (s. str.) sturmi (GYLLENHAL 1808)	3	S-O-Ca-H-P	E	500-1500	F
Total: 2 species	18				

8. Someş Odorhei (Sălaj county), 200 m, 14.08.1996

Two branches of the river Someş were studied about 3 km upstream Satu Mare. One of them presents a faster water flow. The studied length was 30 m, the width was 3 m and the depth was 10-25 m. The bottom was pebbly. The marsh herbaceous vegetation was typical. The water surface was exposed to the sun rays.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Guignotus pusillus (FABRICIUS 1781)	3	Eh	Med	0-600	F
Rhantus pulverosus STEPHENS 1828	2	Eh	Med	0-1000	F
Dytiscus (Macrodytes) circumflexus FABRICIUS 1801	1	Eh	Mg-E	0-500	FR
Total: 3 species	6				

9. Pomi (Satu-Mare county) 200 m, 15.08.1996

It was a stagnant water channel, with a length of 20 m, width of 1.25 m and depth of 35 cm. The bottom was silty with marsh vegetation consisting of Typha angustifolia, Carex sp., etc. The water was eutrophic with reduced transparency. The water surface was exposed to sun.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Noterus clavicornis DE GEER 1774	5	Eh	Med	0-600	F
Laccophilus hyalinus (DE GEER 1774)	7	Eh-Sp	I-Med	0-1500	F
Ilybius obscurus (MARSHALL 1802)	2	Eh	Hol	0-700	rF
Rhantus pulverosus STEPHENS 1828	3	Eh	Med	0-1000	F
Colymbetes fuscus (LINNÉ 1758)	10	Ubq	I-Med	0-1000	F
Hydaticus transversalis (PONTOPPIDIAN 1763)	2	Eh	Sib-E	0-700	R
Acilius sulcatus (LINNÉ 1758)	3	S-Oh	Sib-E	200-1000	rF
Dytiscus (Macrodytes) dimidiatus BERGSTRÄSSER 1778	4	Eh	Mg-E	0-500	R
Total: 8 species	36				

10. Vetiş, downstream Satu Mare on the joint Someş river, 200 m (Satu Mare county) 17.08.1996

(1)Temporary pool, with a length of 10 m, width of 5 m and maximal depth of 0,5 m. The bottom was silty and pebbly, without vegetation. The surface was exposed.

(2) Temporary pool, with a surface of 5×3 m and depth of 0,5-m. The bottom was black silty (intensive anaerobic activity) with some dispersed pebbles and without specific vegetation. The surface was exposed.

Taxa	Sp.nr	Ecology	Zoogeogr.	Altitude (m)	F rel.
Laccophilus hyalinus (DE GEER 1774)	5	Eh-Sp	I-Med	0-1500	F
Guignotus pusillus (FABRICIUS 1781)	5	Eh	Med	0-600	F
Coelambus impressopunctatus (SCHALLER 1783)	3	Ubq	Hol	0-1000	F
Rhantus pulverosus STEPHENS 1828	4	Eh	Med	0-1000	F
Total: 4 species	17				

We present a brief description of each habitat containing the essential ecological conditions observed and the species list of Dytiscoidea and Gyrinoidea with information on the number of individuals, on their ecological and zoogeographic character, on the number of Dytiscoidea and Gyrinoidea species of different altitude ranges and on the relative frequency of each studied species. The habitats are sorted according to descending altitude.

For defining of the ecological elements, we have introduced the following terms:

1. eremohydatophilous element = species inhabiting usually stagnant waters situated in an open terrain on low altitudes (0-600 m). The surface of ponds is totally or partially exposed to the sun radiation.
2. sciahydatophilous element = species inhabiting usually stagnant waters situated in forests on low altitudes. The surface of ponds is totally or partially shaded by trees.
3. sciapotamophilous element = species inhabiting usually the lenthic (slow running) sections of streams or rivers situated in forests on low altitudes.
4. hydato- or potamocalciphilous element = species inhabiting usually stagnant or slow running waters situated on limestone.
5. oreocrenophilous element = species inhabiting lakes and lymnocrenes on high altitudes (over 800 m)
6. Some species can live in more than one from these habitat types, such as Gaurodytes sturmi that we define like a silvo-oreo-calci-hydato-potamophilous element.
7. ubiquist element = species which can inhabit all of these habitat types.

The greatest number of species was collected at Pomi (8 species). That pond consists of a mosaic of biotopes. It is followed by Vetiş and the river Arinului, (4 species); upstream Rodna Veche and Someş Odorhei (3 species) and "3 Iazuri", downstream Salva and downstream Beclean (2 species) (Figure 1.).

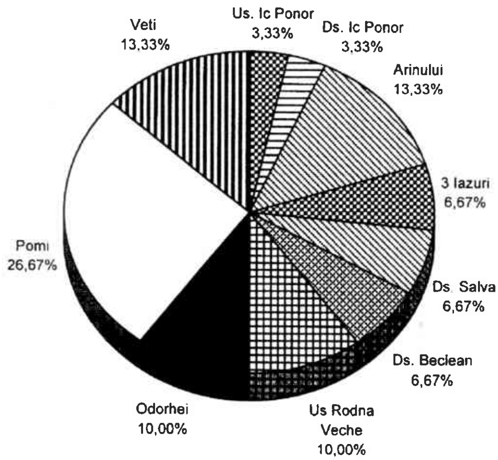


Figure 1. Biodiversity diagram of diving beetles collected on the River Someş

The most common species were Platambus maculatus and Ilybius fuliginosus, both with 22 specimen. The rarest species were Gaurodytes affinis and Dytiscus circumflexus, both with 1 specimen.

In ecological point of view, the eremohidatophilous elements were the most frequent (8 species), followed by oreocrenophilous (3 species), ubiquist and eremo-sciahidatophilous (both with 2 species) (Figure 2.).

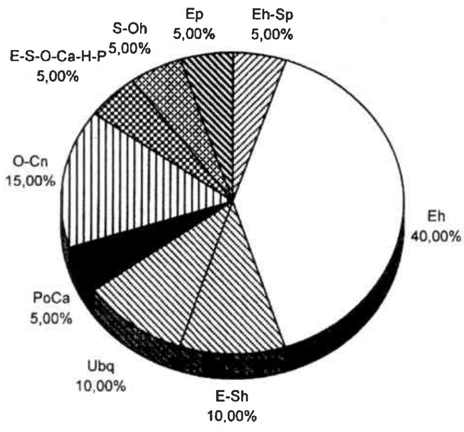


Figure 2. Biological structure of Dyscoidea and Gyrinoidea collected River Someş

In Dytiscoidea and Gyrinoidea collected from the Someş river area a wide range of latitudinal structure exist. The greatest number of species (11) occur in an altitude range of 0-1000 m, followed by an altitude range of 200-1000 m and 500-2000 m (both with 4 species), 0-1500 m and 0-2000 m (both with 3 species) and 0-600 m and 0-700 m (both with 2 species) (Figure 3.).

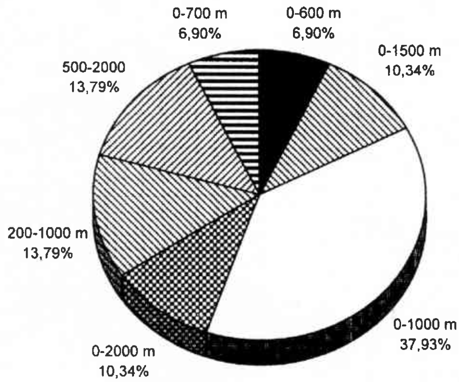


Figure 3. Latitudinal range diagram for Dyscoidea and Gyrinoidea collected from River Someş area

The zoogeographical composition of the Dytiscoidea and Gyrinoidea community was dominated by the Sibero-European elements (4 species), followed by the Mediterranean and Holarctic (both with 3 species), Irano-Mediterranean, European and Maghrebo-European (each with 2 species), Maghrebo-Sibero-European, Palaearctic, Euro-Mountainous and Balkano-Mediterranean (each with 1 species) (Figure 4.).

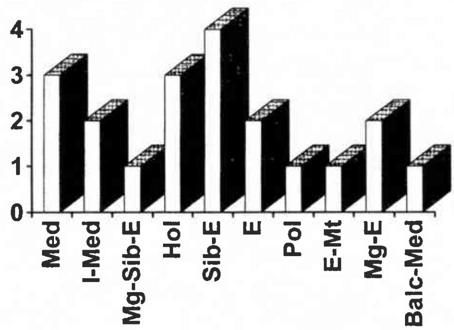


Figure 4. Zoograghical structure of Dyscoidea and Gyrinoidea collected from River Someş area

Discussions

Till now in Transylvania about 79 Dytiscoidea and 5 Gyrinoidea species are known. In the Someş river area 18 species of Dytiscoidea (22.8 %) and 1 species of Gyrinoidea (20 %) has been collected.

The greatest number of species is collected at Pomi and Vetiş, in ponds with diverse habitats.

The most frequent species inhabits waters with a small diversity of species, for example Platambus maculatus inhabits running waters.

The ecological structure of the communities in the Someş river is dominated by the eremohydatophilous elements, like in Dytiscoidea and Gyrinoidea living in Transylvania and Romania.

The zoogeographical structure is dominated by the Sibero-European elements.

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Taxa	Locality, date	Sp.nr	Ecology	Zoogeogr.	Altitude (m)
		Dytiscoidea			
Noterus clavicornis DE GEER 1774	Pomi, 200 m, 15.08.1996	**5**[*]	Eh	Med	0-600
Laccophilus hyalinus (DE GEER 1774)	Pomi, 200 m, 15.08.1996; Salva, 800-900 m12.08.1996; Vetiş (2) 200 m, 17.08.1996	7 2 5 **14**	Eh-Sp	I-Med	0-1500
Hyphydrus ovatus (LINNÉ 1761)	Salva, 800-900 m, 12.08.1996	**4**	E-Sh	Mg-Sib-E	0-1000
Guignotus pusillus (FABRICIUS 1781)	Vetiş (1, 2) 200 m, 17.08.1996; Odorhei (2), 200 m, 14.08.1996	5 3 **8**	Eh	Med	0-600
Coelambus impressopunctatus (SCHALLER 1783)	Vetiş (1) 200 m, 17.08.1996	**3**	Ubq	Hol	0-1000
Hydroporus (s. str.) palustris (LINNÉ 1761)	Arinului river 900 m, 10.08.1996	**10**	Ubq	Sib-E	0-2000
Platambus maculatus (LINNÉ 1758)	downstream "Beclean pe Someş", 800-900 m, 12.08.1996; "Trei Iazuri", 900 m, 10.08.1996	15 7 **22**	PoCa	E	200-1000
Gaurodytes (s. str.) guttatus (PAYKULL 1798)	Rodna Veche, 900-1000 m, 12.08.1996	**4**	O-Cn	Pal	600-2000
Gaurodytes (s. str.) solieri (AUBÉ 1836)	Ic Ponor, 1200 m, 3.08.1996	**3**	O-Cn	E-Mt	600-2000

[*] The total number of specimen was marked with **bold**.

Table: Checklist of Dyscoidea and Gyrinoidea collected from river Someş area (10-17 August, 1996)

Taxa	Locality, date	Sp.nr	Ecology	Zoogeogr.	Altitude (m)
Gaurodytes (s. str.) affinis (PAYKULL 1798)	Ic Ponor, 1200 m, 3.08.1996	**1**	O-Cn	Sib-E	500-1500
Gaurodytes (s. str.) sturmi (GYLLENHAL 1808)	Downstream Beclean pe Someş, 800-900 m, 12.08.1996 Arinului river, 900 m, 10.08.1996	3 10 **13**	E-S-O-Ca-H-P	E	500-1500
Ilybius fuliginosus (FABRICIUS 1792)	Rodna Veche, 900-1000 m, 12.08.1996; Trei Iazuri, 900 m, 10.08.1996; Arinului river, 10.08.1996	20 7 5 **22**	E-Sh	Hol	200-1000
Ilybius obscurus (MARSHALL 1802)	Pomi, 200 m, 15.08.1996	**2**	Eh	Hol	0-700
Rhantus pulverosus STEPHENS 1828	Pomi, 200 m, 15.08.1996; Vetiş (2) 200 m, 17.08.1996; Odorhei (2), 200 m, 14.08.1996	3 4 2 **9**	Eh	Med	0-1000
Colymbetes fuscus (LINNÉ 1758)	Pomi, 200 m, 15.08.1996 (leg. MATHÉ)	**10**	Eh	I-Med	0-1000
Hydaticus transversalis (PONTOPPIDIAN 1763)	Pomi, 200 m, 15.08.1996	**2**	Eh	Sib-E	0-700
Acilius sulcatus (LINNÉ 1758)	Pomi, 200 m, 15.08.1996	**3**	S-Oh	Sib-E	200-1000
Dytiscus (Macrodytes) dimidiatus BERGSTRÄSSER 1778	Pomi, 200 m, 15.08.1996	**4**	Eh	Mg-E	0-500
Dytiscus (Macrodytes) circumflexus FABRICIUS 1801	Odorhei (1), 200 m, 14.08.1996	**1**	Eh	Mg-E	0-500
Gyrinoidea					
Gyrinus (s. str.) distinctus AUBÉ 1836	Rodna Veche (2), 900-1000 m, 12.08.1996	**2**	Ep	Balc-Med	200-1000

Table: Checklist of Dyscoidea and Gyrinoidea collected from river Someş area (10-17 August, 1996)

Occurrence of amphibiocorid bugs, water bugs and ground bugs in the catchment area of the River Someş/Szamos[1]

Attila Kecskés

Abstract

The material was collected at 6 sampling sites along the river Someşul Mare and 7 that of the river Someşul „Unit". We found 25 bug species altogether. We could not collect from the river Someşul Mic, though in the literature 38 species are mentioned. Considering our results and the literature, 21 species are recorded, indicating that the majority of these species can be found in the whole catchment area of the river Someş.

The water bugs (Hydrocorisae), the amphibiocorid bugs (Amphibiocorisae) and ground bugs (Saldidae) are represented in different proportions in stagnant waters and in the rivers. On the riverbanks the *Saldula* species are dominant, while in the river some representatives of the *Gerridae* family are frequent. In the stagnant waters some species of the *Hydrocorisae* suborder are the most common.

Keywords: Heteroptera, River Someş/Szamos

Introduction

There is no literature found referring directly to the water bug, amphibiocorid bug and ground bug fauna living in the Someş valley, but a great amount of data exist about the catchment area of the Someşul Mic. Such data came from localities along Pârâul Fizeş: Geaca (Horváth, G. 1877, 1918; Soós, Á. 1959; Benedek, P. 1970), from the surroundings of Sucutard (Horváth, G. 1918; Soós, Á. 1959; Prunescu-Arion, E., Elian, L. 1962; Benedek, P. 1970), Cătina (Benedek, P. 1970), Sic (Horváth, G. 1918; Soós, Á. 1959; Benedek, P. 1970), or other localities, like Cluj Napoca (Fuss, C. 1862; Horváth, G. 1878), Cojocna (Soós, Á. 1959), Someşeni (Horváth, G. 1877; Soós, Á. 1959; Benedek, P. 1970; Bucşa, C. 1972), Floreşti, Sălicea and the Fânaţele Clujului Natural Reserve (Bucşa, C. 1970, 1972).

The greater part of the data mentioned came from fresh-water lakes or salty lakes and pools. Few data came from the catchment area of the „United" Someş, all of them from the surroundings of Satu Mare (Horváth, G. 1899, 1909; Benedek, P. 1970).

We do not have data about the catchment area of the Someşul Mare.

The material has been collected in sampling sites along the Someşul Mare and the „United" Someş. (Table 1.).

[1] The first name is Romanian, and the second Hungarian

Materials and methods

Because of the life habits of these groups of bugs we could not accomplish a quantitative only a qualitative survey. At every sampling point we tried to take samples proportionally to their frequency. We took the water bug and amphibiocorid bug samples with a pond net from the bottom and the surface of the water and from the leaves of floating plants. The ground bugs were simply caught by wet hands, except the *Macrosaldula* species, which could not be approached so close, and therefore they were caught by net.

The collected material, grouped according to the sampling sites and habitats, was stored in 70 % ethyl alcohol. The bugs were determined under stereomicroscope by their external morphological marks. When needed, we took into consideration genital characteristics as well.

Sampling sites

Someşul Mare:

1. Upstream Rodna Veche:
R1= rill along Maria brook with abundant vegetation, in some places the water is 40 cm deep;
R2= the Éger brook, a typical mountain-brook, with 15-20 sm wide stones on the banks;
S2= pool, 3 m in width and 20-30 cm deep with rich vegetation;
S1= three artificial pools with a surface of about 40x25 m, thick vegetation on the bank.
2. Downstream Rodna Veche:
R= the river is fast-running, there are willows on the bank in some places bending over the water, in other places the bank is stony;
S= pools, with a depth of 5-10 cm and without any vegetation.
3. Ilva brook
R= fast running river, the bank is covered with stones of 25-40 cm in diameter
4. Upstream Salva
R= the river with alternating fast and slow flowing reaches, here and there with roots hanging into the water from the bank; the bank is stony, pebbly or sandy and there are trees and bushes in some places;
S= pool with a surface of 4x7 m and a maximum depth of 40 cm, and without vegetation.
5. Downstream Salva
S= backwater with rich marsh vegetation.
6. Downstream Beclean
R= slow flowing river, rich marsh vegetation.
7. Letca
R= river, slow flow, with stony bank and muddy reaches;
S= pool, with a surface of 3x8 m and a depth of 40 cm, and with a muddy and grassy bank.

8. Someş-Odorhei
R= river, moderately rapid flow, with big stones on the bank;
S= pool, with muddy bottom, with about a surface of 2x4 m and with a depth of 20 cm.
9. The Someş gorges (near Ţicău)
R= slow flowing river, with stony banks and muddy reaches;
S= wallows of 2,5 m width with 5-25 cm depth, far from the river.
10. Sălsig
S= permanent waters with a 1,5 m x 20 m basic area and with a depth of 5-30 cm, rich in vegetation.
11. Near Pomi
R= very slow flowing river, with bushes on the muddy bank.
12. Upstream Satu-Mare
R= slow flowing river, on the banks willows with roots hanging into the water and grass vegetation;
S= pool with a surface of 5x3 m and with a depth of 30 cm, with rough sand and pebbles on the banks.
13. Downstream Satu-Mare
S= pools, with a surface of 6x3 m and with a depth of 20-40 cm, with rough sandy banks.

Results and discussions

In the catchment area of the Someş 40 species were recorded, 38 of them in the Someşul Mic and 3 species in the „united“ Someş.

Along the Someşul Mare and the „united“ Someş 25 species were collected, 21 of which were also found in the Someşul Mic catchment area, while 4 species (*Chartoscirta cocksi*, *Macrosaldula scotica*, *Saldula arenicola* and *Saldula saltatoria*) were not to be found there at all.

The fact that many species can be found in all three river environs mentioned above leads to the conclusion that these bugs are widespread over the whole Someş river system. (Table 2.)

Whether considering the number of species or the number of individuals, we can state that water bugs, amphibiocorid and ground bugs are present in different proportions in the rivers and stagnant waters.

The water bugs in the rivers are represented by the Corixidae and Nepidae families, containing 25 % of the total number of species and a 3,5 % of the total number of individuals. In stagnant waters the Notonectidae, Corixidae, Nepidae and Naucoridae families represent the water bugs. These four families contain 66,7 % of the total number of species and 69,9 % of the total number of individuals.

The Gerridae family in both water types represents amphibiocorid bugs. In rivers only one sample of the Hydrometridae family was taken which represents 37,5 % of the total number species and 61,7 % of the total number of individuals, while in stagnant water these values are 22,2 %, and 25,1 % respectively.

On riverbanks ground bugs represent 37,5 % of the total number of species and 34,8 % of the total number of individuals, while in stagnant water they represent 11,5 % and 5 % respectively.

In rivers and on riverbanks the Gerridae and Saldidae families (Saldula genus) dominate, while stagnant waters show a great dominance of the species of the Hydrocorisae suborder.

Considering the short sampling time compared to the large measurement of the examined area, the investigations need to be completed, therefore these results cannot be generalised. (Figure 1.)

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Species	Someşul Mic	Someşul Unit
Notonecta glauca	Cluj and neighbourhood	
Plea minutissima	Fânaţele Clujului	
Micronecta griseola	Geaca, Sucutard	
Cymatia coleoptrata	Fânaţele Clujului, Geaca, Sucutard	
Cymatia rogenhoferi	Cluj and neighbourhood	
Callicorixa concinna	Sucutard	
Corixa affnis	Sălicea	
Corixa punctata	Cluj and neighbourhood	
Hesperocorixa sahlbergi	Cluj and neighbourhood	
Hesperocorixa linnei	Cluj and neighbourhood, Geaca	
Hesperocorixa parallela	Sălicea	
Sigara semistriata	Sălicea, Geaca	
Sigara falleni	Sălicea, Geaca, Sucutard	
Sigara fossarum	Sucutard	
Sigara lateralis	Sucutard, Cluj and neighbourhood, Geaca	
Sigara striata	Geaca, Sucutard	
Sigara nigrolineata	Sucutard	
Sigara assimilis	Someşeni, Cojocna	
Sigara limitata	Cluj and neighbourhood, Sucutard	
Nepa cinerea	Cluj and neighbourhood	
Ranatra linearis	Cluj and neighbourhood	
Naucoris cimicoides	Cluj and neighbourhood	
Aphelocheirus aestivalis		Satu Mare
Limnoporus rufoscutelatus	Cluj, Someşeni	
Aquarius paludum	Cluj and neighbourhood	
Gerris costae	Sucutard	
Gerris lateralis	Cluj and neighbourhood	
Gerris thoracicus	Sucutard, Geaca	
Gerris lacustris	Cluj and neighbourhood, Sucutard, Geaca	
Gerris gibbifer	Cluj and neighbourhood	
Gerris argentatus	Cluj and neighbourhood, Geaca	Satu Mare
Gerris odontogaster	Cluj and neighbourhood, Geaca	
Microvelia reticulata	Geaca, Sucutard, Cătina	
Mesovelia furcata	Geaca	
Hebrus pussilus	Sucutard	
Hydrometra stagnorum	Sucutard	
Hydrometra gracilenta		Satu Mare
Saldula pilosella	Sucutard, Someşeni	
Saldula pallipes	Sucutard, Someşeni	
Saldula opacula	Sucutard, Sic	

Table 1. Data concerning the bug fauna of the catchment area of the Someş river system (based on Paina, 1975)

Species	Someşul Mare											Someşul Unit											Total
	1				2		3	4		5	6	7		8		9		10	11	12		13	
Hidrocorisae	R_1	S_1	R_2	S_2	R	S	R	R	S	S	R	R	S	R	S	R	S	S	R	R	S	S	
Notonecta glauca										2								2				1	5
Corixa punctata																		1				1	2
Hesperocorixa linnei										4								1					5
Sigara fossarum																		1					1
Sigara falleni										3											6	1	10
Sigara lateralis		1				1			4						10		1				42	33	92
Sigara striata										1	1											2	4
Sigara nigrolineata	1	1				17			1						3		4						27
Sigara limitata															3						1	3	7
Nepa cinerea	2	7			1													2	1				13
Ranatra linearis										2	1												3
Naucoris cimicoides										13								6					19
Amphibiocorisae																							
Limnoporus rufoscutellatus																						1	1
Aquarius paludum			1								1		3	4		18			1	12		6	46
Gerris costae	2																						2
Gerris lateralis	4																						4
Gerris thoracicus					27								1										28
Gerris lacustris	5	28		3	10			17	2	1	9		10	3	3	8		2	1			5	107
Hydrometra stagnorum											1												1
Saldidae																							
Chartoscirta cocksi							1																1
Macrosaldula scotica			5				2																7
Saldula arenicola					6			4				13	1	9		10					6		49
Saldula pallipes								2					4	8		2					1	1	18
Saldula opacula												1				1							2
Saldula saltatoria	1				1		4																6

R= river, S= stagnant water

Table 2. The checklist of the species

R= river

S= stagnant water

Notonecta glauca (Linne) 1758, rC	Aphelocheirus aestivalis (Fabricius) 1794,Ex?
Plea minutissima (Fuessly) 1775, ?	Limnoporus rufoscutellatus (Latreille) 1807, R
Micronecta griseola (Horvath) , ?	Aquarius paludum (Fabricius) 1794, C
Cymatia coleoptrata (Fabricius) 1776, ?	Gerris costae (Herrich-Schaeffer) 1853,R
Cymatia rogenhoferi (Fieber) 1864, ?	Gerris lateralis (Schummel) 1832, R
Callicorixa concinna (Fieber) , ?	Gerris thoracicus (Schummel) 1832, rC
Corixa affinis (Leach) 1818, ?	Gerris lacustris (Linne) 1758, C
Corixa punctata (Illiger) 1807, rC	Gerris gibbifer (Schummel) 1832, ?
Hesperocorixa sahlbergi (Fieber) 1848, ?	Gerris argentatus (Schummel) 1832, ?
Hesperocorixa linnei (Fieber) 1848 , C	Gerris odontogaster (Zetterstedt) 1828, ?
Hesperocorixa parallela (Fieber) , ?	Microvelia reticulata (Burmeister) 1835, ?
Sigara semistriata (Fieber) 1848, ?	Mesovelia furcata(Mulsant et Rey) 1852, ?
Sigara falleni (Fieber) 1848, rC	Hebrus pusillus (Fallen) 1807, ?
Sigara fossarum (Leach) 1818, R	Hydrometra stagnorum (Linne) 1758, R
Sigara lateralis (Leach) 1818, C	Hydrometra gracilenta (Horvath) 1899, Ex?
Sigara striata (Linne) 1758, rC	Chartoscirta cocksi (Curtis) 1835, R
Sigara nigrolineata (Fieber) 1848, C	Macrosaldula scotica (Curtis) 1835, R
Sigara assimilis (Fieber) ?	Saldula pilosella(Thomson) 1871, ?
Sigara limitata (Fieber) 1848, rC	Saldula arenicola (H.Scholtz)1846, C
Nepa cinerea (Linne) 1758, C	Saldula pallipes (Fabricius) 1794, C
Ranatra linearis (Linne) 1758 , R	Saldula opacula (Zetterstedt) 1838, R
Naucoris cimicoides (Linne) 1758, rC	Saldula saltatoria (Linneus) 1758, rC

List of the bug species in the Someş catchment area

? - Species not found in the catchment area, but they have been recorded in the catchment area of the river Someşul Mic, where samples have not been taken during this expedition.

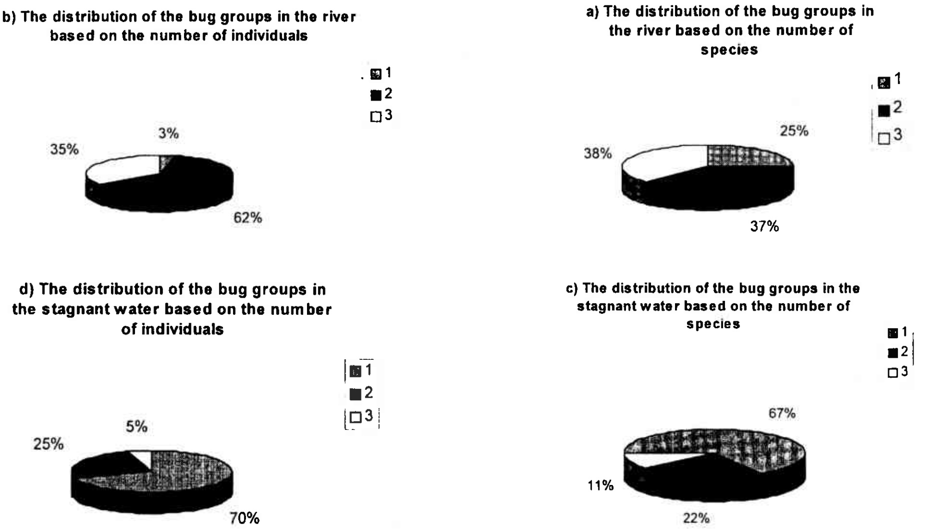

Figure 1. Distribution of the bugs on different water types

1. Hydrocorisae 2. Amphibiocorisae 3. Saldidae

The fish fauna of the River Someş/Szamos[1] basin

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Introduction

The first records of fish species in the drainage area of the River Someş/Szamos are those dealing with the fish fauna of the entire Transylvania (Fridvaldsky, 1767; Benkő, 1778; Bielz, 1853, 1856, 1888) or of Hungary before 1918 (Herman, 1887; Vutskits, 1918). The data presented by these authors are too vague (excepting Vutskits for some species), mentioning the occurrence of the species in some rivers, but not the localities. A single paper is devoted only to the fish fauna of the Someş/Szamos river, but deals only with a restricted stretch of this: that of Jászfalusi (1943) on the fishes present in the Someşul Mic between Gilău and Cluj. More details are provided in the monographs of Bănărescu devoted to the bony fishes (1964) and to the lampreys (1969) of whole Romania and to the paper of Bănărescu and Müller (1960) of the fish fauna of the historical Transylvania. Data about the Hungarian section of the river Szamos were earlier published by Vásárhelyi (1960), and more recently by Harka (1995, 1997). The data mentioned in the publications listed above on the distribution and frequency of the fish species in the Romanian section of the river are now outdated because of the strong modifications of the habitat during the last three decades; it was therefore necessary to make new investigations.

Keywords: fish, River Someş/Szamos

Materials and methods

This paper summarises the results of field studies carried out by the co-authors in 1992 and 1996. In 1992 Nalbant and Ciobanu collected fishes in the upper reaches of the Someşul Mic, the same people and P. Bănărescu in the river Someşul Mic at Cluj, Bănărescu and Nalbant in the Someşul Mare, Bănărescu and Telcean in the Romanian and Hungarian section of the united Someş/Szamos river. The majority of data from Hungary were collected by Harka in 1993 and 1994, when not only the main bed but also a oxbow of the river Someş at Tunyogmatolcs was studied, a oxbow, which is not separated entirely from the river, but is still in connection with it through a sluice. Further information was given from competent people (anglers, fisheries officials and forest guards, etc.), mainly concerning commercially valuable species, which could not be collected with the available nets. Practically all data about the species present in standing water were obtained through verbal communication.

[1] The first name is Romanian, and the second Hungarian

Results

The following fish species are or were once present in the River "united" Someş/Szamos or in its components (Someşul Mare and Someşul Mic, and Someşul Cald and Someşul Rece respectively).

Fam. Petromyzonidae

Eudontomyzon danfordi Regan, 1911.

Cicar; Kárpáti ingola, Tiszai ingola; Carpathian lamprey; Karpathenneunauge.

It was recorded from the upper reach of the Someşul Mic and its tributaries (Chappuis, 1939, 1940), formerly downstream to Cluj, during the 1950s and 1960s downstream only to Gilău; also in the two components of the Someşul Mic (Someşul Cald from Giurcuța de Sus to Gilău) and the tributaries (Rişca and Agârbici) and Someşul Rece from Răcătău to Gilău and from the tributary Căpuş (Bănărescu & Müller, 1960; Bănărescu, 1964). It was not collected in the river Someşul Mic and its tributary during the 1992 and 1996 trips; although according to information from competent local people the species was present in the river.

There are no earlier reports on the occurrence of the Carpathian lamprey in the main channel of the river Someşul Mare, but only from tributaries: Anieş, Cormania and Sălăuța (Bănărescu, 1969, after information from V. Homei). This species was collected in the Someşul Mare at Sângiorz in 1992 and upstream Sângiorz in 1996. It has also been reported from the upper reaches of the river Bistrița ardeleană, being a tributary of the Someşul Mare, and from the Firiza, being a tributary of the united Someş (Bănărescu, 1969). It was also collected from the Hungarian section of the Someş (Vásárhelyi, 1960), but there are not data from the last decades, probably it became extinct (Harka, 1997).

Fam. Acipenseridae

Acipenser ruthenus Linnaeus, 1758.

Cega; Kecsege; Sterlet; Sterlet.

It was recorded from the Someş/Szamos by Bielz (1888). During the 1960s it was considered to be present, in small number, throughout the Romanian section of the united Someş from downstream Dej, being somewhat more abundant in the gorges of Benesat. It lives presently in the lowermost part of the river in the Romanian (information from the Anglers Association of Satu Mare) and in the Hungarian sections, in Hungary in a medium number (Harka, 1995).

Fam. Salmonidae

Salmo trutta fario Linnaeus, 1758.

Păstrăv, Păstrăv-de-munte; Sebes pisztráng; Brown trout; Bachforelle.

It was recorded in the rivers Someşul Cald and Someşul Rece from the headwaters to downstream of their confluence, occasionally reaching the Someşul Mic to Floreşti; the river Someşul Mare downstream to Feldru, occasionally even to Năsăud (Bănărescu and Müller, 1960). It lives also in the tributaries of the Someşul Mare, namely in the brooks Anieş and Cormaia. It has been found in 1992, 1996 and 1997 in the Someşul Cald at Ic-Ponor and upstream, and in the lakes Beliş, Tarnița and Tarnița II; in these lakes the individuals of *S. trutta lacustris* have also been introduced. The brown trout was found in the headwaters of the Someşul Mare and downstream to Şanţ, as well as in the tributary Valea Măriei (in 1996).

Oncorhynchus mykiss (Walbaum, 1792) = *Salmo gairdneri* Richardson, 1836).
Păstrăv curcubeu; Szivárványos pisztráng; Rainbow-trout; Regenbogen Forelle.
The rainbow-trout is a North American species cultivated in fishery farms in the drainage area of the River Someşul Mic, occasionally escaping in rivers.

Salvelinus fontinalis (Mitchill, 1815).
Fântânel, Păstrăv-fântânel; Pataki szaibling; Brook trout; Bachsaibling.
The brook trout, of North American origin, has been introduced, probably before 1916, in three tributaries of the Someşul Mic, namely in the Negruţa, Dumitreasa and Irişoara (Nemeş and Bănărescu, 1954). It lives at least in the former tributary.

Salvelinus sp.
An undetermined species of brook trout, possibly a hybrid, cultivated in fish farms at Gilău, in the drainage area of the Someşul Mic.

*Hucho hucho (*Linnaeus, 1758).
Lostriţa, Galóca; Huchen; Donaulachs.
This species obviously was once present in the Someş rivers but became extinct long ago (it is not mentioned by Bielz in 1853). It has successfully been introduced in the lake Tarniţa on the river Someşul Cald. It was not found in the Hungarian section of the river, but rarely occur at its confluence with the Tisza, therefore its occurrence in the Szamos might be expected (Harka, 1997).

Coregonus sp.
A cisco species was introduced in lake Tarniţa; this could not be determined, specimen having not been available.

Thymallus thymallus (Linnaeus, 1758).
Lipan; Pénzes pér; Grayling; Aesche.
During the 1960s the grayling was distributed in the river Someşul Mare from Rodna Veche to Feldru and in the lower reaches of the tributaries Anieş and Cormaia; in the Someşul Cald from Beliş to the confluence with the Someşul Rece and in the later river from Răcătău to the confluence. Downstream of the confluence of these two rivers, i. e. in the Someşul Mic, it occurred until Gilău or even Floreşti, exceptionally to Cluj (Bănărescu and Müller, 1960; Bănărescu, 1964). In the meantime the species has extended its range to the Someşul Mare with more than 10 km upstream, having been found in 1996 above the village Şanţ, close to the confluence with the tributary Valea Mariei. The species has been found in 1992 at Rodna Veche. It is doubtful whether it still occurs downstream Feldru, as formerly.

In the Someşul Cald the species ranges now from Ic-Ponor to Beliş, being absent downstream this locality and from the lakes. In the Someşul Rece it lives now only upstream of Răcătău and in the damlake „Izvorul Băii". The population from the two components of the Someşul Mic are no more in contact.

Hence the grayling has extended its range upstream and has withdrawn from a part of its range in all rivers.

Fam. Umbridae

*Umbra krameri (*Walbaum, 1792).

Ţigănuş; Lápi póc; Mudminnow; Hundfisch.

A typical inhabitant of standing water and slowly following lowland rivulets, present in the Hungarian section of the Szamos (Someş) river. From the backwater of the Szamos this species was mentioned first by Vásárhelyi (1960), and in 1991 some individuals were collected there again (Harka, 1995).

Fam. Esocidae

Esox lucius Linnaeus, 1758.

Ştiuca; Csuka; Pike; Hecht.

Earlier the pike has been recorded in the river Someşul Mic at Cluj where it was not present in the 1940s (Jászfalusi, 1943). During the 1960s it inhabited this river downstream of Gherla, also the Someşul Mare downstream of Beclean and the entire Romanian section of the united Someş as well as most ponds, oxbows and shallow lakes in the drainage area of the river Someş. It is probably became extinct from the main channel of the Someşul Mic, but survives in the other parts of its former range, being more frequent in ponds and shallow lakes: Zaul-de-Câmpie, Geaca, Ţaga, Tăureni, Sic, Sântejude, Săcălia („lacul cu ştiuci / The Lake with Pikes"). In the Hungarian section of the Szamos it lives in medium number, but in the backwater at Tunyogmatolcs it is frequent (Harka, 1995).

Fam. Anguillidae

Anguilla anguilla (Linnaeus, 1758).

Anghila; Angolna; Eel; Aal.

The specimen of eel ascend occasionally from the Tisza in the Hungarian section of the Szamos river (Harka, 1997), but till now the species has not been recorded in the Romanian section. The eel cannot be considered to be native, since most individuals have been introduced, as young, from Western Europe in the German section of the Danube from where they dispersed in various directions.

Fam. Ciprinidae

Rutilus rutilus (Linnaeus, 1758)

Babuşca; Bodorka; Roach; Plötze.

It was recorded by earlier authors from the River Someşul Mic near Cluj, where this species was not present during the early 1940s (Jászfalusi, 1943) and also now it is absent; reported by Herman (1887) and Vutskits (1918) from the ponds Zaul-de-Câmpie and Geaca in the drainage area of the same river, in which the species is presently absent (Bănărescu & Müller, 1960), however being present in the ponds Tăureni and Ţaga (Müller, 1956). It is probably absent from the Someşul Mare. It was recorded by Bănărescu (1964) from the "united" Someş downstream Dej but there is no evidence of its occurrence upstream Sălsig. In the 1992 and 1996 trips it was collected at Sălsig and

Pomi (in 1992), and it also was present throughout the Hungarian section of the river. In Hungary it is frequent only in the backwaters, but it is rare in the river (Harka, 1995).

The validity of the subspecies *R. rutilus carpathorossicus*, to which all populations from Danube basin were ascribed, is no more accepted (Holik and Skorepa, 1971).

Rutilus pigus (Lacépéde, 1804)

Babuşca de Tur; Leánykoncér; - ; Frauennerflig.

It is not reported from the River Someş/Szamos yet, neither in Romania nor in Hungary, but it is present in the river Tisza at the confluence with the Szamos (Harka, 1997). It may occasionally ascent the latter river.

Chondrostoma nasus (Linnaeus, 1758)

Scobar, Poduţ; Paduc; Nose; Nase.

Formerly (during the 1950s to 1970s) the nose was the most abundant fish species in the Someşul Mare from Ilva Mică and in the Someşul Mic downstream Gilău; also in the united Someş river, being the most abundant species down to the confluence with the river Lăpuş and present also between this confluence and the Hungarian border. Specimen from these localities are present in the collections. It is still present in the same sections, but extinct in the polluted section of the Someşul Mic downstream Cluj and in the Someşul Mare at Căşei. It was collected during the 1992 and 1996 trips in the Someşul Mic at Cluj, in the Someşul Mare at Dej and in all localities on the "united" Someş downstream Someş-Odorhei. It is also present and frequent in the Hungarian section of the Szamos river excepting the backwater at Tunyogmatolcs (Harka, 1995).

Leuciscus cephalus (Linnaeus, 1758)

Clean; Domolykó; Chub; Döbel.

It was recorded earlier from the lower sections of the rivers Someşul Cald and Someşul Rece and the whole reach of the Someşul Mic down to their confluence, from its tributaries (Căpuş, Luna, Gârbău, Nadăş, Gădălin) and from the Someşul Mare downstream of Sângiorz-Băi (Jászfalusi, 1943; Bănărescu & Müller, 1960; Bănărescu 1964). Unlike most others, this species favoured the hydrotechnical constructions and it retained its range (being absent only from the strongly polluted section of the river Someşul Mic downstream of Gherla). It has even extended its range in both components of the river Someşul Mic upstream, having colonised the lakes Tarniţa and Beliş on the Someşul Cald, ascending occasionally the river as far upstream as Ic-Ponor. (information from competent local people, 1997). It was collected in 1992 in the Someşul Rece upstream of Gilău, in 1996 in lake Tarniţa, in both years at Cluj-Mănăştur, then in the river Someşul Mare at Salva, Piatra, Beclean, Dej, in the "united" Someş at Căşei (in moderately polluted water), Someş-Odorhei, Ţicău, Sălsig, Pomi and Vetiş. It is present and frequent throughout the Hungarian section of the river Szamos, but it is rare in backwaters (Harka, 1995).

Leuciscus leuciscus (Linnaeus, 1758)

Clean mic; Nyúldomolykó; Dace; Hasel

It was reported by Jászfalusi (1943), Bănărescu and Müller (1960) and Bănărescu (1964) from the river Someşul Mic between Floreşti and Gherla and its tributary Valea

Someşenilor. During the 1940s and early 1950s it was rather frequent in this river, but now it seems to have become totally extinct because it was not found in 1992 and 1996. However according to some information it may be present in lake Tarniţa on the river Someşul Cald. It was never recorded from the Someşul Mare (it was however probably once present in this river, too) and from the "united" Someş/Szamos in either Romania or Hungary.

Leuciscus idus (Linnaeus, 1758)

Văduviţa; Jászkeszeg, Ónosjász; Ide, orfe; Aland, Nerfling.

It was vaguely reported from the River Someş/Szamos by Bielz (1888) and Vutskits (1918) without specification of locality and recorded by Bănărescu (1964) from the Romanian section of the Someş between the confluence with the tributary Lăpuş and Satu Mare, but only on the base of information from local people. It was not found during the 1992 and 1996 trips. The species is recorded from the Hungarian section of the River Szamos, but only one specimen was collected at Tunyogmatolcs (Harka, 1995).

Scardinius erythrophthalmus (Linnaeus, 1758)

Roşioara; Vörösszárnnyú keszeg; Bodorka; Rudd; Rotfeder

It is present in the shallow lakes and ponds in the drainage area of the River Someşul Mic at Sic, Geaca, Ţaga, Zaul-de-Câmpie and Tăureni (Müller, 1956). Once it was collected in the Someşul Mare at Beclean (Bănărescu, 1954), but being an inhabitant of standing waters, it occur only occasionally in rivers. It was not collected during the 1992 and 1996 trips. It was recorded from the Hungarian reach of the Szamos, but only from backwaters where it is a rare species (Harka, 1995).

Alburnus alburnus (Linnaeus, 1758)

Obleţ; Küsz; Bleak; Ukelei

It was recorded in the river Someşul Mic downstream of Gilău and in its tributaries (Nadăş and Căpuş), in the Someşul Mare downstream of Beclean and in the entire Romanian section of the "united" Someş (Jászfalusi, 1943; Bănărescu and Müller, 1960; Bănărescu, 1964). It has not been collected during the 1992 and 1996 trips in the River Someşul Mic but it has been found in the Someşul Mare at Dej and in the "united" Someş in all sites downstream of Căşei. It is very frequent throughout the Hungarian section of the Szamos, just like in backwaters (Harka, 1995). According to information from anglers, this species is present in the pond Chinteni (drainage area of the Someşul Mic), probably in the other ponds and shallow lakes in the same drainage area, however being absent from the lake Tarniţa, where other lowland species are present.

Alburnoides bipunctatus (Bloch, 1782)

Latiţa, Beldiţa; Sujtásos küsz; - ; Schneider

It was recorded from the lower reaches of both components of the river Someşul Mic (Someşul Cald and Someşul Rece) and from the entire section of this river, downwards to its confluence; also from the tributaries (Căpuş, Luna, Gârbău, Nadăş and Gădălin); from the Someşul Mare from upstream of Feldru to its confluence at Dej and from most of the Romanian section of the united Someş, downstream almost to Satu Mare

(Jászfalusi, 1943; Bănărescu and Müller, 1960; Bănărescu, 1964). It was found in 1992 in the lower reaches of the Someşul Rece and in the Someşul Mic at Cluj; became extinct downstream of this town. In 1992 and 1996 it was found in the river Someşul Mare at Sângiorz (and in the tributary Ilva), at Salva, Piatra, Beclean and Dej. It was absent from the polluted section of the united Someş at Căşei, but it was present downstream, at Letca, Someş-Odorhei, Ţicău, Sălsig and Pomi and absent downstream (at Păuleşti and Vetiş) and from the Hungarian section of the river (Harka, 1997).

Blicca bjoerkna (Linnaeus, 1758)

Batca; Karikakeszeg; White bream; Güster

The species has been vaguely recorded from the Romanian stretch of the Someş/Szamos river at Satu-Mare (Bănărescu, 1964), however this species has not been found in Romania during the 1992 and 1996 trips. In Hungary it is present in medium number both in the river and in its backeater (Harka, 1995).

Abramis brama (Linnaeus, 1758)

Plătica; Dévérkeszeg; Bream; Common bream; Brachsen; Blei

Formerly it was present in the River Someşul Mic at Gherla and downstream, now it became extinct and present in the ponds and shallow lakes in the drainage area of the river at Geaca, Ţaga, Sântejude, Tăureni and Zaul-de-Câmpie (Herman, 1887; Bielz, 1888; Bănărescu and Müller, 1960). According to information from the association of anglers in Cluj, the species lives in these ponds. It is absent from the Someşul Mare, but (after information from competent people) it inhabits the entire Romanian stretch of the united Someş, even the polluted section downstream of Dej and Căşei. It has not been collected in 1992 and 1996. It is present in medium number in the Hungarian stretch, and it is frequent in the backwater at Tunyogmatolcs (Harka, 1995).

Abramis sapa (Pallas, 1811)

Cosac-cârn; Bagolykeszeg; White-eyed bream; Zobel

This species has not been recorded earlier from the Romanian stretch of the rivers. It was collected only in 1992 from in the "united" Someş at Sălsig, Pomi, Păuleşti and Vetiş. It is present in the Hungarian stretch, being the most frequent Abramis species, but it was not found in the backwater at Tunyogmatolcs (Harka, 1995).

Abramis ballerus (Linnaeus, 1758)

Cosac-cu-bot ascuţit; Laposkeszeg; Pointed-snout bream; Zope

This species has not been recorded from the Romanian reach of the River Someş/Szamos (where it may occasionally ascend in some years) and was not collected either in 1992 and 1996. It has been found in the Hungarian stretch , but only in very low number. One specimen was caught in the backwater at Tunyogmatolcs (Harka, 1995).

Vimba vimba (Linnaeus, 1758)

Morunaş; Évakeszeg, Szilvaorrú keszeg; Vimba-bream; Zahrte, Russnase

The species is a rather recent intruder in the Transylvanian reach of the Someş river, having not been mentioned by Bielz (1853, 1888) and Herman (1887). It was identified in 1948 (specimen from the united Someş at Ileanda, in the fish-marked of Cluj), than by Pojoga (1965) in the Someşul Mic at Gherla but it became extinct from this river. In addition it was collected in the "united" Someş at Jibou in 1983 and during the 1992 and 1996 trips in all localities between Someş-Odorhei and Vetiş. It also inhabits the Hungarian reach of Szamos being frequent at Csenger and present in medium number downstream (Harka, 1995).

Pelecus cultratus (Linnaeus, 1758)
Săbiţa; Garda; -; Ziege
It was never recorded or found in the Romanian reach of the River Someş/Szamos, but occasionally some specimen ascend from the Tisza in its lower reaches in Hungary. In 1993 one specimen was collected at Olcsvaapáti (Harka, 1995).

Aspius aspius (Linnaeus, 1758)
Avat; Ragadozó őn; Balin; -; Rapfen
It was recorded in the Romanian reach of the "united" Someş from downstream Dej. This species was found in 1992 and 1996 also in the Someşul Mare on a short distance upstream of Dej; in the "united" Someş (Romanian reach) it has been collected only at Pomi, Păuleşti and Vetiş but is evidently present on the entire stretch between Jibou and Pomi, possibly in smaller number. It is also present in the Hungarian reach and in the backwater at Tunyogmatolcs in medium number (Harka, 1995).

Leucaspius delineatus (Heckel, 1843)
Fufa; Kurta baing; -; Moderlieschen
This species is mainly an inhabitant of standing waters. In the Romanian area of the Someş basin there are earlier records only from the confluence of the river Lăpuş with the Someş and from lake Geaca but surely it is more widely distributed in ponds and shallow lakes. In Hungary it has big populations in newly established shallow lakes and in channels with stagnant water, but some individuals were found in rivers of various measurement, even from their fast flowing reaches (Györe, Sallai, Csikai, 1995 Harka, Györe, Sallai, Wilhelm, 1998). In the Hungarian section of the Szamos it was not recorded earlier, the first individuals were collected in 1994 at Tunyogmatolcs (Harka, 1995).

Phoxinus phoxinus (Linnaeus, 1758)
Boiştean; Fürge cselle; Minnow; Elritze
It inhabits mainly mountain brooks and rivers. It was recorded from the upper reaches of the components and tributary of the river Someşul Mic downstream to Gherla and in the Someşul Mare to below Năsăud. It was found during the 1992 and 1996 expeditions in the Someşul Cald at Ic-Ponor and in the lake Tarniţa, in the Someşul Rece at Răcătău and Gilău, in the Someşul Mic at Cluj-Mănăştur. This species became extinct downstream of Cluj but has continuous distribution upstream this town. In the Someşul Mare it has been collected at Sângiorz-Băi, Salva, Piatra and the tributary Ilva and it is absent at Beclean and downstream as well as in the united Someş.

Hypophthalmichthys (s.str.) molitrix (Valenciennes, 1844)
Sânger; Fehér busa; Silver carp; Silberkarpfen

Hypophthalmichthys (Aristichthyes) nobilis (Richardson, 1845)

Novac; Pettyes busa; Bighead carp; Marmorkarpfen

These two species are of East Asian origin and cultivated in fish farms in Romania and Hungary as well. They occasionally escape in natural waters and some specimen were found in the River Szamos in Hungary (Harka,1997).

Rhodeus sericeus amarus (Bloch, 1782)

Boarța; Szivárványos ökle; Bitterling; Bitterling

It was recorded by earlier authors in the river Someşul Mic at Cluj where the species is no more present since the 1940s (Jászfalusi, 1943; Bănărescu and Müller, 1960). During the late 1940s it was present in this river downstream of Gherla (Bănărescu and Müller, 1960), where this species was not found in 1992 and 1996, but may still survive. It was recorded from the Someşul Mare at Beclean and downstream and in the shallow lakes Zaul-de-Câmpie, Țaga and Tăureni in the drainage area of the Someşul Mic (Bănărescu and Müller, 1960; Bănărescu, 1964). This species was found in 1992 and 1996 in the Someşul Mare at Beclean and downstream and in the Romanian stretch of the "united" Someş/Szamos at Someş-Odorhei, Sălsig, Țicău, Pomi, Păuleşti and Vetiş, but nowhere in great quantities. In the Hungarian reach of the river it was rather rare in 1993 and in 1994, since only three individuals was caught (one at Csenger, two at Olcsvaapáti), the result being very poor in comparision with other similar rivers. The reason for this is probably that the heavy water pollutions occured previously exterminated the shells indispensable for the reproduction of this ostracophil species. At the same time about 500 individuals were collected from the backwater at Tunyogmatolcs, where the shells are abundant (Harka, 1995).

Pseudorasbora parva (Schlegel, 1842)

Murgoi-bălțat; Razbóra; Pseudokeilfleckbarbe; Blaubandbarbling

This small-sized fish of East Asian origin is now widely distributed in Romania, Hungary and most other European countries, being abundant mainly in small lowland rivers. It is rare in the Someş/Szamos river and its two components in Romania, since no specimen have been found during the 1992 and 1996 expeditions, but specimen were collected in the lake Tarnița on the River Someşul Cald, at a rather high altitude; possibly the species has been introduced there by anglers. *P. parva* is present in low number in the Hungarian reach of the River Szamos, but it can be found in medium number in the backwater (Harka, 1995).

Gobio gobio (Linnaeus, 1758)

Porcuşor comun; Fenékjáró küllő; Common gudgeon; Gemeiner Gründling

The species was recorded earlier in the River Someşul Mare from upstream of Nepos to its confluence, in the Someşul Mic from upstream of Gilău (i.e. also in the lower stretch of its both components) and in the tributaries and in the entire Romanian stretch of the "united" Someş The species has extended its range upstream in both components of the Someşul Mic, Someşul Rece and Someşul Cald, in the later as far as the lake Tarnița. It was collected in 1992 in the River Someşul Rece, in 1996 in the lake Tarnița and at Cluj-Mănăştur, being absent in the strongly polluted stretch downstream of Cluj, but present again in the less polluted section downstream of Gherla. It has also been found in the river Someşul Mare at Salva, Piatra, Beclean and Dej and in the united Someş between Căşei (near Dej) and Vetiş (Hungarian frontier), becoming gradually more rare downstream. It is rare in the Hungarian reach of the river, being found only at Tunyogmatolcs, where it is present also in the backwater (Harka, 1995). In the Hungarian rivers this species became rare in the last two decades, being replaced by a relative species (*Gobio albipinnatus*), especially in the Great Hungarian Plain (Harka, 1996).

Gobio uranoscopus frici Vladykov, 1925

Porcuşor-de-vas; Felpillantó küllő; Stone-gudgeon; Streingressling

This species was vaguely recorded from the Someşul Mare (Nagy Szamos) at Beclean (Vutskits, 1918). The first sure document about its occurrence in this river is the finding of a specimen at Năsăud by T. Ceuca in 1946 (Bănărescu, 1954). Later it was recorded in the same river at Nepos and Beclean. In 1992 and 1996 it was found at Salva, Piatra and Beclean. It was not mentioned in the monograph of Jászfalusi (1943) of the fishes of the Someşul Mic, but it was found in this river upstream from Cluj in 1955 and 1992 at Cluj-Mănăştur. It is absent from the lower stretch of the Someşul Mare and from the entire Romanian and Hungarian reach of the "united" Someş/Szamos (Harka, 1997).

Gobio (Romanogobio) albipinnatus vladykovi Fang, 1943

Porcuşor-de-şes; Halványfoltú küllő; Whitefin gudgeon; Weisflossen Gründling

This species was found in the River Someş at Satu Mare. During the 1940s to the early 1950s it was absent or rare in the middle reaches of the "united" Someş and in the lower section of the Someşul Mare. It ascended later upstream, having been found in 1983 in the Someşul Mare at Dej and in 1992 and 1996 in the same locality and in the entire Romanian reach of the "united" Someş, being abundant at Letca, rare at Someş-Odorhei and again abundant further downstream. It is very abundant in the Hungarian reach of the River Szamos, and not rare in the backwater at Tunyogmatolcs (Harka, 1995).

Gobio kessleri Dybowski, 1862

Porcuşor-de-nisip; Homoki küllő; Sand-gudgeon; Sandgressling

This species has been found within the drainage area of the River Someş first from the Someşul Mare at Dej in 1948, having been later recorded from the entire stretch of the "united" Someş in Romania. It was found during the 1992 and 1996 trips in the Someşul Mare at Dej and in all sites on the "united" Someş downstream from Căşei, being very abundant at Someş-Odorhei and becoming gradually more rare downstream. In the Hungarian section it was found at Csenger, Rápolt and Olcsvaapáti, but only in low number (Harka, 1995). It has never been recorded from the Someşul Mic and now is surely absent from this river.

Tinca tinca (Linnaeus, 1758)

Lin; Compó; Tench; Schleie

The tench is a typical inhabitant of standing waters, being only exceptionally present in rivers. It was reported from the shallow lakes Zaul-de-Câmpie, Ţaga, Geaca, Bujorul in the drainage area of the river Someşul Mic (Bănărescu and Müller, 1960; Bănărescu, 1964). There are no recent information concerning its occurrence and abundance in this lakes. The species has not been found during the 1992 and 1996 expeditions. It was recorded in the Hungarian reach of the River Szamos, in the backwater at Tunyogmatolcs (Harka, 1995).

Ctenopharyngodon idella (Valenciennes, 1843)

Cosaş; Amur; Grasscarp; Grasskarpfen

An East Asian species, cultivated in fishery farms and occasionally it is found in natural waters. It is rare in the Hungarian reach of the Szamos, but is frequent in the backwater at Tunyogmatolcs (Harka, 1995).

Barbus barbus (Linnaeus, 1758)

Mreana; Márna; Barbel; Barbe

It was recorded in the River Someşul Mic from Gilău to Dej, in Someşul Mare from Nepos to Dej and throughout the Romanian stretch of the united Someş river (Jászfalusi, 1943; Bănărescu & Müller, 1960; Bănărescu, 1964). The species has not been found in 1992 and 1996 in the Someşul Mic, but it probably lives upstream of Cluj. It was found in the Someşul Mare at Beclean and Dej throughout the Romanian stretch of the united Someş. It is frequent in the whole stretch of the Szamos in Hungary, being caught in the greatest number at Csenger. Rarely some specimen coming from the river can occur in the backwater at Tunyogmatolcs (Harka, 1995).

Barbus peloponnesius petenyi Heckel, 1847

Moioaga, Mreana vânătă; Magyar márna, Petényi-márna; Balcanic Barbe; Semling, Afterbarbe

It was recorded from the lower reaches of the rivers Someşul Cald and Someşul Rece, from the Someşul Mic between Gilău and Apahida and its tributaries (Căpuş, Gârbău, Nadăş), from the Someşul mare from upstream of Rodna-Veche to Beclean, in small number also at Dej, sporadically also in the "united" Someş (Jászfalusi, 1943; Bănărescu & Müller, 1960; Bănărescu, 1964). It has extended its range in the river Someşul Cald far upstream, but became extinct in the Someşul Mic downstream of Cluj. It was found in 1992 and 1996 in the River Someşul Cald at Ic-Ponor and in the lake Tarniţa (here in great number), in the lower reach of the Someşul Rece, in the Someşul Mic at Cluj-Mănăştur, in the Someşul Mare at Salva, Piatra, Beclean and Dej and in the tributary Ilva and in the "united" Someş at Someş-Odorhei, in 1992 and 1996. It is missing from the Hungarian reach of the river (Harka, 1997).

Cyprinus carpio Linnaeus, 1758
Crap; Ponty; Carp; Karpfen
The carp inhabits mainly standing waters and the deeper sections of lowland rivers. It was reported from the River Someşul Mic at Apahida and downstream, from the entire Romanian stretch of the "united" Someş and from all ponds and shallow lakes in the drainage area of the Someşul Mic. It became extinct from the main channel of the Someşul Mic which is polluted. It is present in the ponds and lakes of Ţaga, Geaca, Tăureni, Chinteni, Sic and Bujor. It is absent from the main channel of the Someşul Mare, but, according to oral information, it is present in the entire Romanian reach of the united Someş. Fishes were collected in 1992 and 1996. It also inhabits the Hungarian reach of the Szamos and it is frequent in the backwater at Tunyogmatolcs (Harka, 1995).

Carassius carassius (Linnaeus, 1758)
Caracuda; Kárász; Crucian carp; Karausche
The crucian carp is an almost exclusive inhabitant of standing waters. Formerly it was widely distributed in all ponds and shallow lakes throughout the drainage area of the Someş/Szamos, but since the 1950s it underwent a strong numerical decline in the entire basin of the middle and lower Danube basin. According to information from the Anglers Association of Cluj, it is still present, in small number, in the shallow lake Săcălaia („Lacul stiucilor") and in small ponds close to the River Someşul Mic at Floreşti and Cluj. In Hungary, at the end of the 1980s fishermen caught some specimen from the backwater of Tunyogmatolcs, but it was not found in the last few years (Harka, 1995). Because of this drastic decrease, which is caused by the overpopulation of the concurrent *Carassius auratus*, this species would be protected.

Carassius auratus gibelio (Bloch, 1783)
Caras; Ezüstkárász; German carp; Giebel
This is an exotic species of eastern Asian origin, which was introduced with fry of carp in the drainage area of the Someş/Szamos river during the early 1950s and has replaces everywhere the native crucian carp. It is present in all lakes and ponds in the catchment area of the Someş and in the lower reach of this river, both in Romania and in Hungary.

Family Cobitidae
Orthrias barbatulus (Linnaeus, 1758)
Molan, Grindel; Kövicsík; Stoneloach; Schmerle
It was recorded in the lower reaches of the rivers Someşul Rece and Someşul Cald, from the Someşul Mic downstream Apahida, from its tributaries Căpuş, Gârbău, Luna, Nadăş and Valea Chintăului and from the Someşul Mare, from upstream of Sângiorz to Dej (Jászfalusi, 1943; Bănărescu and Müller, 1960; Bănărescu, 1964). Single isolated individuals have also been collected in the "united" Someş at Apa and Buşag. In 1992 and 1996 it has been collected in the rivers Someşul Cald between Ic-Ponor and Doda Pili, Someşul Rece (lower reach), Someşul Mic at Cluj-Mănăştur (being extinct farther downstream), Someşul Mare at Rodna Veche, Sângiorz, Salva, Piatra; one specimen was found in the "united" Someş at Sălsig.

Misgurnus fossilis (Linnaeus, 1758)

Ţipar; Réticsík; Mud loach; Schlampeitzger

This species lives almost exclusively in standing waters. It was earlier recorded in the river Someşul Mic at Cluj, where it was not present even in the early 1940s (Jászfalusi, 1943). Later it was recorded in ponds at Someşeni and in an oxbow of the River Someşul Mic at Apahida and vaguely, in ponds within the drainage area of the "united" Someş downstream of Ulmeni-Sălaj (Bănărescu and Müller, 1960; Bănărescu, 1964). There are no recent data about its occurrence in the Romanian section of the Someş. According to information, it has been present in ponds at Săcălaia („Lacul cu ştiuci") and Chinteni where it became extinct. There are no recent data about its occurrence (or extinction) in the Romanian area of the "united" Someş drainage area. It is recorded from the Hungarian stretch of the Szamos river. In the autumn 1991 some individuals were caught by fishermen from a backwater of the river at Ököritófülpösnél (Harka, 1995).

Sabanejewia aurata (Filippi, 1865).

Câra; Törpecsík; Balcan spined loach; Balkan Steinbeisser.

It was recorded in the River Someşul Mare from Nepos to Dej, in the lower reaches of the rivers Someşul Cald and Someşul Rece, in the Someşul Mic from Gilău to Dej and its tributaries Căpuş and Gârbău and in the entire Romanian stretch of the "united" Someş from downstream Dej and in the tributary Lăpuş at its confluence (Bănărescu and Müller, 1960; Bănărescu, 1964). It became extinct from the Someşul Mic downstream of Cluj, has no more been found in the lower reaches of the Someşul Cald and Someşul Rece. It was found, in 1992 and 1996 in the river Someşul Mic at Cluj-Mănăştur, in the Someşul Mare at Sângiorz-Băi, Salva, Piatra, Beclean and Dej, in the "united" Someş at Letca, Someş-Odorhei, Sălsig, Pomi, Păuleşti and Vetiş, and in Hungary, at the confluence of the Szamos river with the Tisza. This species is also recorded in the whole Hungarian stretch of the Szamos, being present in relatively great number at Csenger and Kérsemjén (Harka, 1995). The populations of the Someşul Mare, Someşul Mic and the "united" Someş upstream of Pomi are typical *S. aurata balcanica* Karaman, 1922, those from Pomi, Păuleşti and Vetiş (and surely those from the Hungarian reach, too) are intergrades between the subspecies *balcanica* and *bulgarica*, while those from the Tisza at the confluence with the Szamos can be considered as typical *S. aurata bulgarica* (Drensky, 1928).

Cobitis taenia danubialis Băcescu, 1993.

Zvârluga; Vágócsík; Spined loach; Steinbeisser.

The Spined loach has been recorded in the river Someşul Mic at Cluj and downstream to the confluence with the Someşul Mare, in the tributaries Nadăş and Gădălin and in the nearby ponds and in the "united" Someş from Apa (confluence with the river Lăpuş) to the Hungarian border (Jászfalusi, 1943; Bănărescu and Müller, 1960, Bănărescu, 1964). This species has been found during the 1992 and 1996 expeditions in the river Someşul Mic at Cluj-Mănăştur, being absent in the strongly polluted stretch downstream of the town, but present again in the polluted stretch downstream of Gherla (and probably farther downstream, too) and in the united Someş only at Pomi. It probably occurs also at Păuleşti and Vetiş but in small numbers. It is also present in the Hungarian reach of the Szamos, and in the backwater at Tunyogmatolcs (Harka, 1995), but seems to be absent from the Someşul Mare.

Fam. Siluridae

Silurus glanis Linnaeus, 1758

Somn; Harcsa; Wels; Wels.

There are earlier records of the wels in the River Someşul Mic near its confluence, where it may have become extinct. In the Someşul Mare it was present until the 1950s only at Beclean and downstream it was absent at Năsăud, where the Romanian vernacular name "*somn*" was used for *Lota lota*. It ascended later also at Năsăud (information from Prof. T. Ceuca). It has been found in 1996 in the Someşul Mare at Beclean and in 1992 in the "united" Someş at Sălsig. It is present in the Hungarian reach of the Szamos in medium number and occur in the bakwater at Tunyogmatolcs (Harka, 1995).

Fam. Ictaluridae

Ictalurus nebulosus (Le Sueur, 1818).

Somn pitic, Somn american; Törpeharcsa; Brown bullhead, Catfish; Zwergwels.

An introduced North American species, vaguely recorded in the Romanian stretch of the River Someş/Szamos and in adjacent ponds from Dej to Satu Mare (Bănărescu, 1964). Vásárhelyi (1960) mentioned this species to be frequent in the Hungarian reaches of the river, but more recently it was found only at Olcsvaapáti in 1992 (Harka, 1995). It was also found in 1996 in a channel connected with the river at Pomi.

Fam. Gadidae

Lota lota (Linnaeus, 1758)

Mihalţ; Menyhal; Burbot; Quappe.

It was recorded earlier in the Someşul Mic at Cluj where it was not present during the 1940s (Jászfalusi, 1943). It was also recorded in the Someşul Mare at Năsăud and downstream and throughout the Romanian reach of the River Someş/Szamos (Bănărescu, 1964). It is also present in the Hungarian reach (Harka, 1995), but it was not found in 1992 and 1996.

Fam. Cottidae

Cottus gobio Linnaeus, 1758.

Zglăvoc; Botos kölönte; Bullhead, Sculpin; Groppe.

It was recorded from the rivers Someşul Cald and Someşul Rece downstream of their confluence, from the Someşul Mic downstream to Floreşti and from the Someşul Mare between Şanţ and Nepos, reaching exceptionally downstream to Năsăud (Bănărescu and Müller 1960, Bănărescu, 1964). It was found in 1992, 1996 and 1997 in the River Someşul Cald at Ic Ponor and Doda Pili, in the Someşul Rece at Blăjoaia and Răcătău, in the Someşul Mare from the headwaters to Sângiorz and in its tributaries (Valea Măriei, Ilva and Anieş).

Fam. Centrarchidae

Lepomis gibbosus (Linnaeus, 1758)

Biban-soare; Naphal; Sunfish, Pumpkinseed; Sonnenbarsch.

This is an introduced North American species and it was not recorded earlier from the drainage area of the River Someş in Romania. A few specimen were found in 1996 in a channel connected with the Someş at Pomi. The species is present in the Hungarian reach of the Szamos river, three individuals were collected at Tunyogmatolcs (Harka, 1995).

Fam Percidae

Perca fluviatilis Linnaeus, 1758

Biban; Süger; Perch; Barsch.

The perch has been recorded from the ponds and lakes of Apahida, Sic, Geaca, Ţaga, Zaul-de-Câmpie, Tăureni and Bujor in the drainage area of the river Someşul Mic, in the same river downstream of Apahida and also in the Romanian reach of the "united" Someş and adjacent ponds (Bănărescu, 1964). It has extended its range far upstream, especially in the Someşul Mic and Someşul Cald. It has been found in 1996 in the river Someşul Mic at Cluj and in the lake Tarniţa on the Someşul Cald. It was not found in the River Someşul Mare (according to oral information it is present as far upstream as Năsăud) and in the "united" Someş (it is present, but rare). It also lives in the Hungarian reach, being frequent in the backwater at Tunyogmatolcs, but more rare in the river (Harka, 1995).

Gymnocephalus cernuus (Linnaeus, 1758)

Ghiborţ; Vágódurbincs; Ruffe; Kaulbarsch.

It was recorded by Bielz (1888) from the River Someş in historical Transylvania (i.e. upstream of the confluence with the River Lăpuş) without other indication. According to information from competent people, the species is present in the shallow lake Săcălia („Lacul cu ştiuci"), in the drainage area of the Someşul Mic, probably in other standing waters of the same drainage, too. A specimen has been seen in a pond near Cluj by M. Ciobanu. This species has not been collected in the main channel of the Someşul Mare or of the "united" Someş in 1992 and 1996, since it inhabits mainly standing waters. It lives in the Hungarian reach of River Szamos (Harka, 1997).

Gymnocephalus baloni Holik et Hensel, 1974

Ghiborţ-de-râu; Széles durbincs; Balon's ruffe; Flusskaulbarsch.

This species has been confounded until recently with *G. cernuus*, with which it shares much similarity and is probably closely related, but differs biologically, being an inhabitant of lowland rivers, like *G. schraetser*. It is surely present in the lower part of the Romanian reach of River Someş/Szamos, but it has not been found there yet. It is present in the Hungarian reach, one specimen was collected at Olcsvaapáti in 1994 (Harka, 1995).

Gymnocephalus schraetser (Linnaeus, 1758)

Răspăr; Selymes durbincs; Yellow pope; Schraetser.

The species was recorded from the lower Romanian stretch of the River Someş/Szamos (Bănărescu, 1964) where it lives (information from competent people). It was not found in 1992 and 1996. It is present in the Hungarian reatch, being frequent everywhere excepting the backwater at Tunyogmatolcs, where it was missing (Harka, 1995).

Stizostedion lucioperca (Linnaeus, 1758)

Şalău; Süllő; Pikeperch; Zander, Schill.

It was reported from the shallow lake Ţaga in the drainage area of the river Someşul Mic and from the lower part of the Romanian stretch of the Someş near Satu Mare (Bănărescu, 1964). It is present also in the shallow lake Chinteni, being in the drainage area of the Someşul Mic. Numerous specimen have been seen by fishermen in the "united" Someş at Pomi and downstream in 1992. The species is present in the Hungarian reach of the River Szamos, being frequent in the river, but rarer in the backwater at Tunyogmatolcs (Harka, 1995).

Stizostedion volgense (Gmelin, 1788).

Şalău-vărgat; Kősüllő; - ; Wolgazander.

The species has never been recorded or found in the Romanian stretch of the River Someş and in other rivers of Romania, excepting the Danube. It was found in the Hungarian stretch of the River Szamos (Harka, 1997).

Zingel streber (Siebold, 1863)

Fusar, Fusar mic; Német bucó; - ; Streber.

The species has been recorded once in the River Someşul Mic downstream of Cluj (Nemeş, 1961) where it is now extinct. It has not been recorded from the Someşul Mare were it may occur. Bănărescu (1964) mentions its occurrence in the Romanian reach of the "united" Someş. Actually its specimen have been collected only at Satu Mare during the early 1960s, but not during the expeditions in 1992 and 1996. According to oral information, some species were rarely caught by anglers in the Hungarian reach of the river, but it was not found in 1993 and 1994. However it was collected in the Tisza upstream and downstream its confluence with the Szamos, therefore this species is almost surely occur in the lowest section of the (Harka, 1995).

Zingel zingel (Linnaeus, 1758)

Fusar-mare, Pietrar; Magyar bucó, Nagy bucó; - ; Zingel.

This species was recorded in the River Someşul Mic downstream of Cluj (Jászfalusi, 1943) were it is now extinct. It was also recorded in the Someşul Mare downstream of Beclean and in the Romanian stretch of the "united" Someş (Bănărescu and Müller, 1960; Bănărescu, 1964). However in scientific collections there are only specimen collected at Satu Mare in 1961. The species has not been found in 1992 and 1996. It may became totally extinct from the Romanian reach of the River Someş/Szamos. It is recorded in the Hungarian reach at Olcsvaapáti and at Tunyogmatolcs in 1993 and 1994 (Harka, 1995).

Summary

The total number of fish species present in the basin of the river Someş/Szamos is 62; 49 of them are native, 13 introduced (including *Anguila anguila* and *Hucho hucho,* which has been re-introduced). The 49 native species belong to the following biogeographic categories:

- endemic to the Danube basin: *Eudontomyzon danfordi, Rutilus pigus, Gymnocephalus schraetser*;
- centering in the Danube basin, also present in a few neighbouring basins (mainly the Nistru and the Vardar): *Umbra krameri, Gobio uranoscopus, G. kessleri, Barbus peloponnesius,* both *Zingel* species;
- true (primary) freshwater species present mainly or exclusively in the Ponto-Caspian or Aralo-Caspo-Pontic areas: *Abramis sapa, Gobio albipinnatus, Sabanejewia aurata, Gymnocephalus baloni, Stizostedion volgense*;
- more widely distributed: 14 species are central European, 6 have wide European or West-Palearctic ranges, 10 are Euro-Siberian, 2 Palearctic and 3 are Holarctic in distribution.

The anthropogenic impact has strongly modified the fish fauna in the River Someşul Mic. The construction of lakes like Tarniţa has enabled the upstream dispersal of many lowland species and determined a numerical decline of *Eudontomyzon danfordi* and *Thymallus thymallus* but has made possible the reintroductions of the formerly extinct *Hucho hucho*. The strong pollution of the river with industrial and urban wastes determined the almost total extinction of the fish fauna downstream of the town Cluj.

On the contrary the river Someşul Mare has been affected only slightly by the human activity. Life conditions remained good and the fish fauna is rich. Downstream the confluence of rivers the fish fauna is impoverished on a short reach (apparently less than 25 km.), but becomes quite rich further downstream, especially in the reach Someş-Odorhei - Benesat (the so-called „Benesat gorges“), where certain typical oxyphilic species - *Alburnoides bipunctatus, Barbus peloponnesius* and especially *Gobio kessleri* - are abundant.

A single species seems to have become extinct, namely *Leuciscus leuciscus* (formerly recorded only from the Someşul Mic). *Acipenser ruthenus* became extinct from the middle reach of the River Someş, but survives in the lower reach. Some species also underwent a numerical decline, such as *Eudontomyzon danfordi*, *Thymallus thymallus* (only in the Someşul Mic), *Chondrostoma nasus*, *Barbus barbus,* possibly *Gobio kessleri* and especially both *Zingel* species among inhabitants of running waters, and *Misgurnus fossilis, Tinca tinca* and especially *Carassius carassius* among stagnant waters inhabitants. The rheophilic and oxyphilic species retaining their abundance are *Salmo trutta fario, Phoxinus phoxinus, Alburnoides bipunctatus, Barbus peloponnesius, Orthrias barbatulus, Leuciscus cephalus* and *Gobio uranoscopus,* while *Alburnus alburnus, Aspius aspius, Gobio albipinnatus* and *Perca fluviatilis* became more abundant and partially extended their ranges, especially upstream.

In Table we proposed Red List of the Fish fauna of the R. Someş is shown.

Species	Someşul Mic	Someşul Mare	Someşul Unit	Observations
Eudontomyzon danfordi	V	V	-	
Acipenser ruthenus	-	-	R	
Salmo trutta fario	C	C	-	
Thymallus thymallus	V	RC	-	
Esox lucius	-	RC	RC	
Umbra krameri	-	-	V	
Rutilus rutilus	-	-	R	
Leuciscus cephalus	C	C	C	
Leuciscus leuciscus	Ex	-	?	not cited
Leuciscus idus	-	-	R	
Aspius aspius	-	C	C	
Chondrostoma nasus	R	C	C	
Alburnus alburnus	C	C	C	
Alburnoides bipunctatus	C	C	C	
Blicca bjoerkna	-	-	R	
Abramis brama	Ex	-	C	
Abramis sapa	-	-	RC	
Abramis ballerus	-	-	R	
Vimba vimba	Ex	C	RC	
Phoxinus phoxinus	C	C	-	
Rhodeus sericeus	?	C	C	not cited
Gobio gobio	C	C	RC	
Gobio uranoscopus frici	R	C	-	
Gobio albipinnatus vladykovi	-	RC	C	
Gobio kessleri	-	C	C	
Barbus barbus	RC	C	RC	
Barbus peloponnesius petenyi	C	C	R	
Cyprinus carpio	-	-	RC	
Carassius carassius	Ex?	-	R	
Orthrias barbatulus	C	C	R	
Cobitis taenia danubialis	.R	R	C	
Sabanejewia aurata balcanica	C	C	C	
Silurus glanis	-	RC	RC	
Lota lota	-	Ex	R	
Cottus gobio	C	C	-	
Perca fluviatilis	C	RC	C	
Gymnocephalus cernuus	R	-	R	
Gymnocephalus baloni	-	-	R	
Gymnocephalus schraetzer	-	-	RC	
Stizostedion lucioperca	-	-	C	
Stizostedion volgense	-	-	R	
Zingel streber	Ex	-	V	
Zingel zingel	-	Ex	V	

Table 1. Recommended Red List

Ex: extinct; E: endangered; V: vulnerable; C: common; ?: uncertain

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Bioaccumulation of certain toxic metals by fish and unionidae shells in River Someş/Szamos[1]

Andrei Sárkány-Kiss and Kunigunda Macalik

Abstract

Thsis study presents the occurrence of certain toxic metals (Al, Cu, Zn, Pb, Mn) in *Unio crassus* and *Leuciscus cephalus* species in the „united" Someş/Szamos river.

Keywords: Someş/Szamos rivers, pisces, mollusc, toxic metals

Introduction

The heavy metal content of organisms shows the degree of pollution of the water.

As a result of the research in the river Criş/Körös. Valleys we discussed in some previous papers A. Sákány-Kiss et al., 1997/a, b the role of the fish and shells in the bioaccumulation of certain heavy metals. Based on this research we concluded - especially in the case of shells -, that populations with an apparently good vitality have a high degree of heavy metal content. So high that it can cause the extinction of these populations. Therefore we believe that the survey of a river must also include analysis of heavy metal content in organisms.

Unfortunately in the case of river Someş/Szamos we had the possibility to examine the metal content of only a few samples of shells and fish.

Materials and methods

Taking into consideration the fact that the Someşul Mic and Someşul Mare rivers are very polluted, they do not contain significant shell populations. This is the resason why we collected shells for examination only from the middle section (Sălsig - Păuleşti) of the „united" Someş. First of all we have examined the *Unio crasus* species, the specimens of wich we have found in every sampling site.

Exception being only the Sălsig sampling site, where the low abundance of shell populations did not permit us to collect more specimens of one species, so this sample is a mixed one: *Unio crassus - Anodonta cygnea.* In the case of shells we have determine separately the metal content of muscle and gills.

[1] The first name is Romanian, and the second Hungarian

As for fish we have examined a single species - *Leuciscus cephalus* - in the „united" Someş. This species was easy to capture in every sampling site, and the other reason why we have opted for it is, that it is a predator, and this fact predestinates this species to the high metal content Svobodová and Hajtmánek 1985.

The fish were eviscerated and cleaned the same way as it is done for human consumption. The material prepared in this way was dried at 100 oC in the site. Therefore our results are related to dry material.

The determinations of the metal-content were performed in the labs of the Department of Inorganic and Analytical Chemistry of Kossuth Lajos University, Debrecen, Hungary using inductively coupled plasma atomic emission spectrometry method.

Results and discussion

The shell samples show that metal content of the gills is higher than that of the muscles in every case. The results (especially the high copper content of the Păuleşti sampling site) shown in Figure1. and Table 1. show that the residual water resulting from non-ferrous metal extraction and processing is damaging the living organisms of the Someş/Szamos. We couldn't take samples from the Pomi sampling site right after the confluence with Lăpuş river which is the most polluted sector as there are no shells living there.

In spite the fact that Pomi is at a distance of 80 km from Baia Mare and most of the heavy metals settle in the sediment, the high zinc content of shells indicates the polluting effect of residual waters coming from the industrial establishment of Baia-Mare.

In every sample (especially in the gills) the mangan content is high, which has to do with the local geological conditions. We decided to measure the mangan content as well, because according to Serfőző et al. 1995 the bioaccumulation of this metal can offer protection against the toxic effects of heavy metals.

Table 1. Metal content of shells in the "united" Someş river

Sampling Sites	Al	Cu	Pb	Zn	Mn
	(mg / kg weight)				
Someş-Odorhei Uc-Ac; I	9.5	2.5	2.5	68.5	180.5
Someş-Odorhei Uc-Ac; K	28	2.5	< 2,71	272	3750.5
Ţicău Uc; I	10	2	0.5	82.5	125.5
Ţicău Uc; K	150	6.5	3.5	312.5	5787
Sălsig Uc; I	0.5	2.5	0	89.5	60.5
Sălsig Uc; K	61.5	6.5	0.5	259 5	4567
Păuleşti Uc; I	2.5	20	<1,18	137.5	381
Păuleşti Uc, K	55.5	288	<1,22	913.5	4790.5

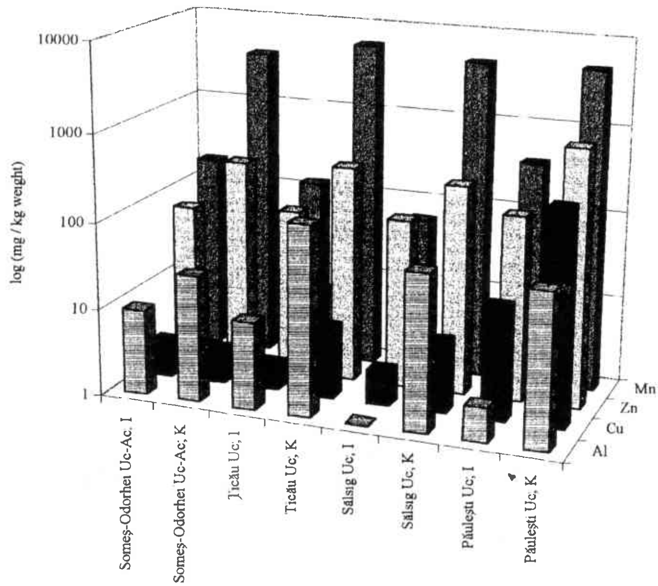

Figure 1.

The higher copper, zinc and aluminium content of fish in the lower portions of the river (Table 2., Figure 2. and 3.) also indicate the polluting effect of the industrial establishments to be found along the river. However, the degree of bioaccumulation is significantly lower in fish than in shells as they are more mobile organisms. In addition this mobility of fish also makes it more difficult to determine the degree of pollution of a certain sector.

Table 2. Metal content of *Leuciscus cephalus* in the "united" Someş river

Sampling Sites	Cu	Mn	Zn	Al
	(mg / kg weight)			
Ţicău	2	1.5	82	0
Sălsig	7.5	9	92.5	13.5
Pomi	4.5	46	86.5	138.5
Păuleşti	8	73	103	120.5

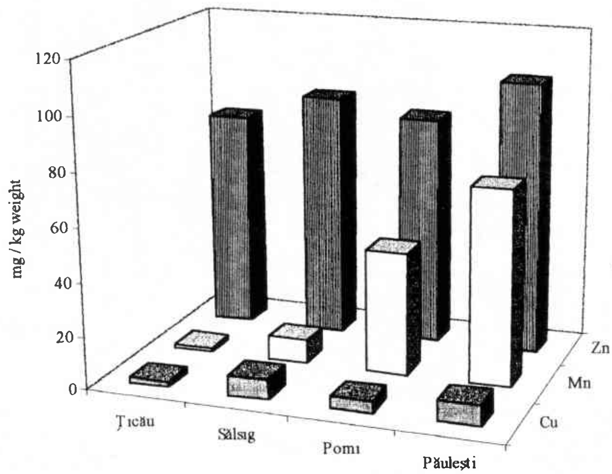

Fig. 2. Cu, Mn and Zn content of *Leuciscus cephalus* in the "united" Someş river

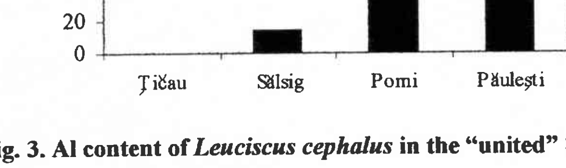

Fig. 3. Al content of *Leuciscus cephalus* in the "united" Someş river

Acknowledgements to Mihály Braun from the Department of Inorganic and Analytical Chemistry of Kossuth Lajos University for determinations.

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Contribution to the mollusc community of Someşul Cald/Meleg Szamos[1] gorges

Károly Bába and Andrei Sárkány-Kiss

Abstract

There were no earlier published data found about the snail fauna of Someşul Cald/Meleg Szamos. The authors found 9 snail species during an occasional examination in 1992. In 1996, 26 species of 10 square samples were identified. Comparing the results of these two examinations, it was concluded that at present 29 species are known in the investigated area.

Keywords: Gastropoda, Someşul Cald gorges.

Introduction

The malacofauna of the West Carpathians has very sporadically been investigated. In this respect significant data can be found in the works of Kobelt, E.A. (1867), Clessin, S. (1887), Kimakowicz, M. (1883, 1890), Csiki, E. (1906), Wagner (1942), Soós, L. (1943) and Grossu, AL. (1956, 1981, 1983, 1987, 1993). These authors performed malacological studies in Transylvania. Examining attentively the works of them can nothing be found referring to the malacofauna of Someşul Cald. During the study in 1992 Bába and Sárkány (former paper of this volume) mentioned 9 species from the Someşul Cald gorges.

Materials and methods

In July 1996 the upper valley of Someşul Cald gorges (Bazarul Someşului) was studied. In contrast to our study in 1992 (former paper also in this volume), this qualitative and quantitative malacological research refers only to the gorges of Someşul. The examined section is between 900-1200 m above the sea level. The geological layer is formed mainly of limestone. The malacological samples were collected from the following plant communities: *Thymo-comosi-Seslerietum rigidae* (Zólyomi, 1939) Pop et Hodişan, 1985; *Seseli gracile-Festucetum pallentis* (Soó, 1959) Coldea 1991, *Pulmonario-coloro-Abieti-Fagietum silvaticae.* The first two nonforest plant communities were analysed together, while the forest community was analysed

[1] The first name is Romanian, and the second Hungarian

separately (Table 1.). The 10 sampling squares, each of 25x25 cm, were taken at random from both sides of the gorges. The malacological material was selected from the 5 cm deep soil samples with a stereomicroscope.

		1		2	
No.	Species	a	b	a	b
1.	*Acicula banatica* (Rossmässler, 1842)	-	3	3	1
2.	*Carychium minimum* (O.F.Müller, 1774)	10	16	-	-
3.	*Pyramidula rupestris* (Draparnaud, 1801)	10	49	7	26
4.	*Vestigo pygmaea* (Draparnaud, 1838)	-	2	-	2
5.	*Vestigo alpestris* Alder, 1838	4	-	-	-
6.	*Chondrina clienta* (Westerlund, 1883)	1	7	-	1
7.	*Pupilla bigranata* (Rossmässler, 1838)	9	13	2	2
8.	*Ena obscura* (O.F.Müller, 1774)	-	2	-	5
9.	*Punctum pygmaeum* (Draparnaud, 1801)	-	-	1	-
10.	*Vitrina pellucida* (O.F.Müller, 1774)	3	10	3	5
11.	*Phenicolimax annularis* (Studer, 1820)	-	1	-	-
12.	*Vitrea subrimata* (Reinhardt, 1871)	-	6	1	4
13.	*Aegopinella pura (Alder, 1830)*	1	5	2	1
14.	*Oxychilus glaber* (Rossmässler, 1835)	1	-	-	-
15.	*Euconulus fulvus* (O.F.Müller, 1774)	4	3	-	-
16.	*Cochlodina laminata* (Montagu, 1803)	-	2	-	-
17.	*Cochlodina marisii* (A.Schmidt, 1857)	19	-	-	-
18.	*Ruthenica filograna* (Rossmässler, 1836)	5	-	-	-
19.	*Laciniaria plicata* (Draparnaud, 1801)	1	-	-	-
20.	*Pseudalinda stabilis* (L.Pfeiffer, 1847)	2	4	-	2
21.	*Bulgarica vetusta* (Rossmässler, 1836)	9	24	6	24
22.	*Bradybaena fruticum* (O.F.Müller, 1774)	2	-	2	1
23.	*Perforatella vicina* (Rossmässler, 1842)	1	5	-	1
24.	*Hygromia transsylvanica* (Westerlund, 1876)	1	-	-	-
25.	*Chilostoma banaticum* (Rossmässler, 1836)	1	13	3	6
26.	*Isognomostoma isognomostoma* (Schr. 1784)	-	1	-	1
27.	*Helix pomatia* Linne, 1758	1	-	-	-
Number of individuals		85	166	30	82
Number of species		26		16	
Percentage of dead individuals		66,13		73,21	

Table 1. Snail fauna of Someşul Cald / Meleg Szamos gorges
1= *Thymo-comosi-Seslerietum rigidae* (Zólyomi, 1939)
Pop et Hodişan, 1985; *Seseli gracile-Festucetum pallentis* (Soó, 1959)
Coldea 1991; 2 = *Pulmonario-coloro-Abieti-Fagietum silvaticae*;
a = living individuals; b = dead individuals.

Discussion

363 individuals of 27 species were found in 10 examined samples. The number of species is relatively large in the two nonforest communities (*Thymo-comosi-Seslerietum rigidae* (Zólyomi, 1939) Pop et Hodişan, 1985; *Seseli gracile-Festucetum pallentis* (Soó, 1959) Coldea 1991, where we identified 85 living and 166 dead individuals belonging to 26 species. Comparing to the forest community one single species, the *Punctum pygmaeum* is missing from these nonforest communities. This hygrophyte species is very frequent on the banks of mountain brooks, although it was mentioned in few places (Grossu, 1983). Probably because of its small size it can rather be identified from soil samples. The larger number of rock-grass species is due to the fact that more variable habitats are found on the narrow gorges of Someş. In the plant community *Pulmonario-coloro-Abieti-Fagietum silvaticae* 30 living and 89 dead individuals of 16 species were found.

The numbers above point to a high percentage of dead individuals. We believe that this is not a consequence of some disturbing factor but it can be due to two particular circumstances. The soil formed on the limestone rock gets dry relatively quickly after rain and thus the snail shells preserve their characteristic structures. The vegetation covering the soil protects the empty snail shells from the current of waters running down. Otherwise the limestone would swallow up the precipitation and the water could not run on the surface. In this way the accumulation of empty shells is possible.

During the Someş expedition organised in 1992 the authors once identified 9 species in the gorges by occasional examination. They did not find *Balea stabilis* (L.Pfeiffer, 1847) and *Ena montana* (Draparnaud, 1801) in 10 quantitative samples. So far, altogether 29 species were found in this place. At the same time this finding warns that more samples are needed in order to reveal the total number of snail species living in such an area with mosaic habitats.

The fauna of the limestone-gorges of Someşul Cald is of nearly the same character as other limestone-gorges of the Western Carpathians (Bába, Sárkány, 1998), but it is the most possible that more intense searching will point to the existence of other Transylvanian endemic snails besides *Cochlodina marisii.*

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Terrestrial snail fauna in the Someş/Szamos[1] River Valley from the spring region to the inflow into the river Tisza

Károly Bába and Andrei Sárkány-Kiss

Abstract

The sampling sites included montane and lowland riparian plant communities of early or advanced successional stages as well as forests of hilly region, which often extend_to riverbanks. The plant communities differ from each other by the composition of their snail assemblages, as it is proved by the results of cluster and principal component analyses. It was concluded, that ubiquitous and continental species (*Bradybaena, Deroceras rodnae, Succinea putris, Helix lutescens*) dominate among snails transported by the Someş/Szamos over long distances. Species of narrow ecological tolerance range can be found in the riparian vegetation of the Someş/Szamos Valley and also of minor watercourses arriving from neighbouring hills and mountains. The fauna dispersal from the spring region is hampered by water reservoirs, shrinkage of forest habitats to single row of trees along the river and the lack of riparian gallery forests in the flood area. The biotopes are subjected to the strongest human impact resulted from the forest management, or logging the flood plain into agricultural fields. The garbage disposal in/or near the riparian vegetation also cause major disturbances for the snail assemblages.

Keywords: Gastropoda, human impact, Someş/Szamos River Valley

Introduction

A scientific expedition was organised in the valley of river Someş/Szamos between 1-18. 06. 1992 with the aim of assessing the current biotic status of the river. During the field investigations special attention was paid to the influence of human activities on the microflora and invertebrate fauna of the river, and on its natural self-purification. It was also followed how the prevailing water quality and the environmental conditions affects the capacity of the river for transporting fauna elements along its course. This process is decisive in settling of montane invertebrates (e.g. snails) of more or less narrow ecological tolerance range in plant communities on the Great Hungarian Plain, even far beyond the borders of Romania. The invertebrate fauna populating the environs of the river Szamos were studied by Erdős (1935) and by Bába (1968-69, 1970, 1972, 1973, 1974, 1975, 1977, 1978, 1979, 1980-81, 1983 a, b, 1986, 1991, 1992 a), studying beetles and snails respectively.

[1] The first name is Romanian, and the second Hungarian

Materials and methods

Sixteen major sampling sites were appointed for the expedition, but not all of them were appropriate for collecting snails. Snail data were gathered from further localities (1b, 16, 1a, 19-25) during rest periods. Mostly the quadrate method (with plots of 10x25x25 cm) was used for sampling snail assemblages, but on sites 19-25 snails were collected by thinning. For comparison, two additional localities (17-18 quadrates) situated close to the country borders were also analysed. The sampling sites, the snail species found and several calculated parameters are listed in Table. The field data (from both quadrates and thinning) were analysed by ecological and zoogeographical techniques.

During the data analysis we focused on two main points, namely on the dispersal ability of species and on the ecological status of snail assemblages in plant communities studied by the quadrate method.

An area-analytical zoogeographical technique (Bába, 1982) was used to study the dispersal characteristics of snail species.

The following fauna groups were distinguished: climatically continental groups: 1. Siberian-Asian (1.1. East Siberian, 1.2. West Siberian, 1.3 Euro-Siberian, 1.4. Holarctic), 3. Kaspi-Sarmatian, 4. Ponto-Pannonic, 9.5. Daco-Podolian, 10.1. Boreo-alpine; climatically subatlantic groups: 2.1. Central Asian xeromontane, 5. Ponto-Mediterranean (5.2.1. *Quercion frainetto,* 5.2.2. *Fagion illyricum-moesiacum*), 6. Adriato-Mediterranean, 7. Atlanto-Mediterranean, 8. Holomediterranean, 9. Central European montane (9.1. Carpathian, 9.2. Carpatho-Sudetian, 9.3. Carpatho-Baltic, 9.4. Alpo-Carpathian), 10.2. Boreo-montane.

The species distribution data reported by Grossu (1981, 1983, 1987), Soós (1943) and Lozek (1964) were also considered in *Argna bielzi, Carpathica calophana, Cochlodina marisi, Balea stabilis, Vestia elata, Vestia gulo* and *Trichia bielzi* in groups 9.1. or 9.2.. The occurrence of *Vitrea transsylvanica* and *Balea fallax* in Bulgaria (Serafim-Liharev, 1975) justified to put them into the group 5.2.2.

In order to observe changes in the structural composition of snail assemblages the following variables were used: abundance (A/m^2), species density (mean number of species in ten quadrates), percentage proportion of juvenile individuals, percentage of mortality, Shannon-Wiener diversity (H') and the habitat typology system of Lozek (1964-65) and Lisicky (1991). Following the notation of Lozek, four major groups were distinguished, namely the forest dwellers (W, amalgamating Lozek's W, Wh and Wm groups), bush forest dwellers (BW, comprising Lozek's SW, OW, WS, WM, M and Wf groups), riparian species (RU, including Lozek's H and P groups), and steppe dwellers (S, created from the groups of O, X, Sf and S).

The ecological groups obtained by the block clustering method of Feoli & Orlóczi (1979) (Bába & Podani, 1992b) were used in accordance with the data of Grossu (1981, 1983, 1987), Soós (1943), Lisicky (1991) and Kerney et al. (1983) for the zoogeographical group assignments of species listed before. Five categories were recognised: 1. hydrophilous montane-submontane species, 2. subhydrophilous species, 3. riparian hydrophilous species, 4. mesophilous-mesoxerophilous elements, 5. ubiquitarian components.

The relationships among snail assemblages were analysed by the Sokal-Michener group average clustering method and by Principal Coordinates Analysis (PRINCOOR, Podani 1988).

The characteristics used for the analysis of structural composition of snail assemblages are listed in Table.

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Sampling sites and plant communities

The sampling sites listed in Table 1. are of two types depending on the sampling technique used (thinning or quadrate method), which is reflected also in their numbering. For each plant community the altitude above sea-level, annual precipitation (Tufescu, 1965) and magnitude of river fall (m/km) are given in this order. The numbers signing sites were inappropriate for snail collection are omitted.

Gilău Mountains; Someşul Cald

1.a. Cliffs above the spring Bazarul-Someşului, 03. 06. 1992 (thinning) by Gheoca V., 1250-1300 m a.s.l. 1.b. Ic Ponor, 150 m downstream of the spring, a *Petasitetum albae* (Klika, 1954) stand of about 20 cm height (1200 m a.s.l., limestone bedrock, 1500 mm, 5 m/km). 19/1. On site 1.b. thinning from rocks along a path escorting the creek. 20/1. In the creek wave area in the neighbourhood of the „Rumen Ars" forester's lodge. 1.c.2,5 km downstream of 1.b., in a primordial stand of *Alnetum incanae-Petasitetum albae* (*Rumex obtusifolius, Caltha pelta, Salix eleagnos, Salix caprea*; about 1100 m a.s.l., metamorphic rocks, biotitic paragneis, 1500 mm, 5 m/km).

Muntele Mare: Someşul Rece

2. Blăjoaia, 04. 06. 1992. Due to deforestation and heavy grazing by sheep, the soil is substantially acidified, on which peat bogs and swamps of *Sphagnetalia Pawlowski, 1928*, and *Nardetalia Passarage, 1949* plant communities developed. Especially the *Polytrichum juncetum* plant community forms large stands (1350 m a.s.l., granite, 1200 mm). According to measurements on the site, the soil pH was 5,5 on the bank of the stream. 21/2: Near the water reservoir at the confluence of the two Someş/Szamos branches upstream Gilău. 05. 06. 1992. On the bank in a *Querco petreae Carpinetum* stand.

Someşul Mic.

3. Upstream Cluj, 07. 06. 1992. *Salicetum albae fragilis* Isser 1926 (*Galium aparine, Urtica dioica, Rubus sp.,* some *Agrostis stolonifera, Aegopodium podagraria*; disturbed site, 350 m a.s.l., sand, silt, Eocene marl and sandstone, 700 mm, 3m/km).

4. Downstream Cluj, 07. 06. 1992. *Salicetum albae fragilis* Isser 1926 (*Galium aparine, Rubus sp., Urtica dioica,* some *Aegopodium podagraria*; disturbed site, 330 m a.s.l., sand on Sarmatian marl, silt, 700 mm, 1,7 m/km).

5. Downstream Gherla, 22/5 upstream the village Nima, 08. 06. 1992. Thinning in tall vegetation along the stream.

Rodna Mountains: Someşul Mare River

6.a. 500 m downstream of the spring, upstream Valea Mare, 08. 06. 1992, initial phase of *Petasitetum kablikiana* Paul et. Wales (1936) 1946 (Coldea 1990), 900 m a.s.l., gneiss, 1400 mm, 5 m/km.

6.b. Downstream of Valea Mare, before Arieş. 09. 06. 1992, *Petasitetum kablikiana* Paul et. Wales (1936) 1946 (Coldea, 1990) (*Athyrium filix-femina, Rumex obtusus, Abieto-Fagetum* zone, 700 m a.s.l., gneiss, 1400 mm, 5 m/km).

7. Downstream Sângeorgi Băi, 09. 06. 1992. Primordial stand of *Telekio-Alnetum incanae* Coldea, 1990, with *Aegopodium podagraria, Mentha aquatica, Athyrium filix-femina.* In a narrow strip along the bank of the stream close to a plough-land, 480 m a.s.l., sandy silt, 1000 mm, 4,5 m/km.

Someş/Szamos

9. Downstream Beclean, 10. 06. 1992. *Salicetum albae-fragilis* Isser 1926. Single row of trees on a steep bank (*Galium aparine, Rubus sp., Scrophularia nodosa*), near a cornfield, 250 m a.s.l., clay on volcanic bedrock, 800 mm, 2 m/km. 23/9 Downstream Beclean, 10. 06. 1992.

10. Căşeiu, 10. 06. 1992. *Salicetum albae-fragilis* Isser, 1926, consotiation *Populus nigra / Urtica dioica*, mass occurrence of the adventive *Helianthetum decapitatus.* Single row of trees among agricultural fields, 225 m a.s.l., marl and clay on sandstone bedrock, 700 mm, 1,5 m/km.

12. Sălsig. 24/12 Benesat, 11. 06. 1992. Upstream of Sălsig at a railway viaduct, 70 m away from the river on the edge of a *Querco petreae-Carpinetum* Soó 1957 stand. Thinning, 164 m a.s.l., gravely soil, 700 mm, 1 m/km.

13. Pomi, 11. 06. 1992. *Quercetum petreae-Carpinetum* Soó 1957 stand extending down to the riverbank. Hilly region in the environs of Gutin Mountains. A small creek reaches the Someş/Szamos in the neighbourhood of the sampling site at Pomi (*Lamium galeobdolon, Chrysantemum corymbosum, Echinocystis echinata*). 142 m a.s.l., sandy clay on andesite bedrock, 800 mm, 1 m/km. 25/12. A forest stand owned by the village Agrişu de Jos in the environs of Fersig-Mireşu-Mare. Canals go through and around the oak forest. Collection by thinning.

14. Upstream Satu Mare, 12. 06. 1992. *Salicetum albae-fragilis* Isser 1926. On a high bank of 50-100 m width, some 30 m away from the river in a much thinned vegetation

(*Rubus sp., Aristolochia clematitis, Agrostis stolonifera*). 115 m a.s.l., alluvial sand and clay, 700 mm, 1 m/km.

15. Downstream Satu Mare, 12. 06. 1992. *Salicetum triandrae* Müller-Görs 1958 on a flat river bank (*Phragmites australis, Lycopus exaltatus, Agrostis stolonifera*). 115 m a.s.l., alluvial sand, 700 mm, 1 m/km.

16. The confluence with river Tisza, at Vásárosnamény. *Salicetum triandrae* Müller-Görs 1958 on a steep bank (*Rubus sp., Calystegia sepium,* 100 m a.s.l., alluvial sand, 700 mm, 1 m/km).

17. Sárkánykert at the Szamos/Someş confluence with river Tisza, 30. 08. 1966. *Salicetum albae-fragilis* Isser 1926. *Rubus sp., Echinocystis lobata,* alluvial sand.

18. Vásárosnamény, steep bank of the Tisza, 31. 07. 1967. *Salicetum triandrae* Müller-Görs 1958, alluvial sand.

The geographical location of each sampling site is shown in Figure 1.

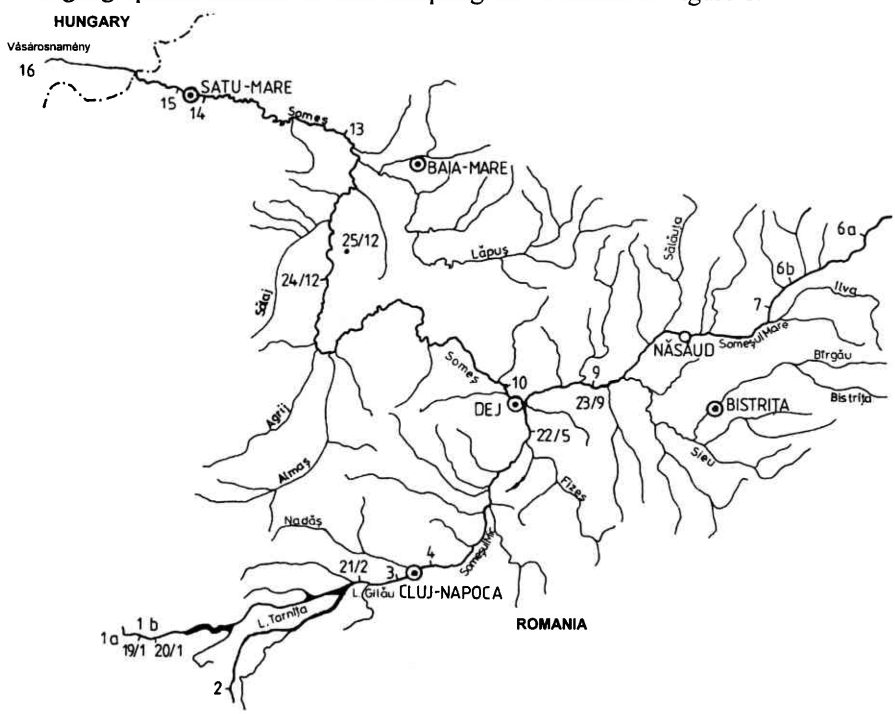


Figure 1. Map of the geographical distribution of sampling sites along the Someş/Szamos river

Environmental status of sampling sites

Under given climatic conditions the animals (snails inclusively) will develop a homogenous zoocoenotic character within a geographic region with free migration. The forests (Bába 1992 a) and running waters serve as routes for fauna dispersal, provided that these ecological corridors are undisturbed (Erdősi, 1935; Bába, 1978, 1979; Bába et al. 1982-83; Bába, 1992 a). Examining the entire length of the river Someş/Szamos in this respect, we found everywhere evidences of inhibition of fauna migration and biodiversity development by human activities. The fauna movements generally start from the direction of mountains. The human effects hindering fauna dispersal occur up to the montane zone of all three mountains considered. These effects are of various kind. In order to slow water running people often build wood weirs in streambeds, which lead to the death of riparian tall communities (at Munţii Gilău and Rodna). The *Petasitetum* stand emerging after the disturbance are not taller than 20 cm. The cover of riparian vegetation is disrupted by man-made constructions, supporting roads along the watercourse. The reservoirs (at Munţii Gilăului) or local water barriers hamper the continuous fauna movement and with high precipitation lead to soil acidification and degradation over large areas. The intensive deforestation and grazing, both retarding the regeneration of the original vegetation (Muntele Mare) further amplify this latter process. In this mountain only one specimen of *Arion subfuscus* was found after several kilometres of thorough investigation.

At lower altitudes the crop production and animal husbandry confines the natural riparian vegetation to a narrow band (sampling sites 9 and 10). The plastic and metal wastes thrown away by the local population along the river are carried over several tens of kilometres when the water level is high (site 7). A municipal dumping ground has been settled near the sampling site 14. On the lowland, the river flood plain is completely treeless, thus there are no refugees for the fauna, which existed in the previous century to control the Someş/Szamos waterway.

In contrast with these impediments on the lowland (Great Hungarian Plain), the fauna migration is facilitated by numerous smaller watercourses coming from the neighbouring mountains and hilly regions and reaching the Szamos/Someş (sampling sites 10 and 13).

Results and discussions

1. Species recorded and their distribution

The expedition in the Someş/Szamos Valley resulted in a collection of 763 living individuals and 168 shells belonging to 58 species (data of sites 17 and 18 are not included). Some species are montane forest dwellers requiring high moisture content in biotopes (ecological species group 1). Zoogeographically these are (East) Carpathian (9.1), *Fagion illyricum-moesiacum* (5.2.2.) or xeromontane (2.1.) elements. Their distribution to lowland till the river could not be proved. This is not probable for the xeromontane rock dwellers (Table ; species 4, 5, 14), the Boreo-montane species (10.2.; *Ena montana*) and the Carpathian and Balkan montane species (*Argna, Semilimax, Vitrea transylvanica, V. diaphana, Carpathica, Cochlodina marisi, Balea fallax, B. stabilis, Vestia, Bulgarica, Trichia bielzi*).

The large water surface of the reservoir at Gilăului markedly reduces the temperature fluctuations in its environs. This altered mesoclimate promotes settling of the

Carpathica species of high moisture requirements even at the foothills. The occurrence of *Ruthenica filograna* and *Trichia hispida* at the edge of a *Querco p. Carpinetum* forest stand is due to the close proximity of a hilly region and the fauna transportation by countless unnamed minor watercourses. These two species turn up in the flood plain of the Someş/Szamos, as *Querco petreae-Carpinetum* stands proceeding down to the riverbank (site 15).

Similar factors promote *Cochlodina laminata* and *Perforatella vicina* to reach lowland areas with annual precipitation above 600 mm (sampling sites 13 and 17). These two species are widespread on the northern part of the Great Hungarian Plane in Hungary, where large forested areas were and still are. Hungarian researches (Bába 1977, 1983a, 1986) showed that the riparian forests (*Fraxino-Ulmetum*) enable the establishment of river-carried montane snail species need high moisture. There are not such forest types in the flood area on the Romanian part of the Someş/Szamos Valley. Data from sites 22/9 and 24/2 show that *Perforatella vicina* is able to inhabit thickets growing on the riverbank.

The absence of the Daco-Podolian *Hygromeria transsylvanica* and *Chilostoma banaticum* - both requiring continental climatic conditions - is due to the lack of gallery forests along the lowland reaches of the Someş/Szamos. This is in contrast with the pattern found earlier in the flood area of the river Mureş (Soós, 1943), where these two species coexisted with *Arianta arbustorum* in extensive gallery forests. Their occurrence in the Hungarian part of the Mureş was proved by the author's own collection in 1972. *Cochlodina laminata* was found to be associated with *Perforatella vicina* at several localities near Vásárosnamény downstream the confluence of the Someş/Szamos and Tisza rivers (Bába, 1992 d).

The co-occurrence of *Chilostoma* and *Hygromia* at Benesat in a thicket growing underneath a railway viaduct (site 24/12) is supposedly due to the fauna distribution by waterways from the nearby Ţibleş Mountains, whence both snail groups have been reported earlier (Grossu 1983). Probably the same is true for *Trichia bielzi*. The water reservoirs and the treeless conditions of the flood areas at foothills might hamper their further dispersal downstream of Gilau Mountains and Rodna Mountains. The appearance of *Chilostoma* in the high flood area on site 3 may be the remnant of a former population.

In three snail species an unhindered distribution was observed in the riparian zone along the Someş/Szamos. *Bradybaena fruticum* is a continental ubiquitous species living in riparian tall communities, thickets and grassy places influenced by human activities along the watercourse. *Helix lutescens* is a Ponto-Pannonian species with continental climatic preferences, which inhabits tree rows and banks and narrow places between these and adjoining agricultural fields. Its distribution along the river has also been observed earlier (Soós, 1943). Both species were also found at Vásárosnamény even in sites not listed in Table Numerous individuals of the amphibian (continental) *Succinea putris* were observed downstream Beclean on rocks emerging from the water of Someş/Szamos.

The third freely distributed species is the ubiquitous *Deroceras rodnae* with an Alpino-Carpathian area. Due to its high moisture requirements this species follows rivers closely.

Analysing the distribution patterns of 48 montane snail species, it has been established that the migration along the rivers is hindered not only by the treelessness of the flood area, but also by water pollution. Thus, among the rivers entering Hungary from Transylvania, Crişul Repede does not carry any montane species because of its heavily polluted water (Bába, 1992 d).

2. Study of species distribution by zoogeographical methods

By the applied zoogeographical methods it was possible to follow geographically the distribution of fauna group elements. In Figure 2. the distribution of the four most important fauna groups distinguishing montane and lowland areas are shown. The Central Asian xeromontane, petrophilous elements (2.1) occur only at the upper reaches of the Someş/Szamos. Having high moisture requirements, the Boreo-alpine (10.1) and Boreo-montane (10.2) species occur in the montane zone or occasionally at lower places in humid gorges and river valleys. This is also true for *Arianta arbustorum*, which is similarly spread in gallery forests of the Danube Valley. The European montane elements (9.1, 9.2, 9.3, 9.4, 9.5), some continental (*Hygromia, Chilostoma*) and hydrophilous species of wide ecological tolerance range can also populate river valleys (e.g. *Perforatella bidentata*). The members of the Siberian-Asian fauna groups (1.1, 1.2, 1.3, 1.4) typically inhabit areas of lower altitude, although exceptionally they may occur in montane alder forests or in forests and grasslands underwent to human disturbances, where their proportion increases (Bába, 1992 c, e). They can also be considered as representatives of lowland fauna in contrast with the rest of the groups in Figure 2. having a montane character.

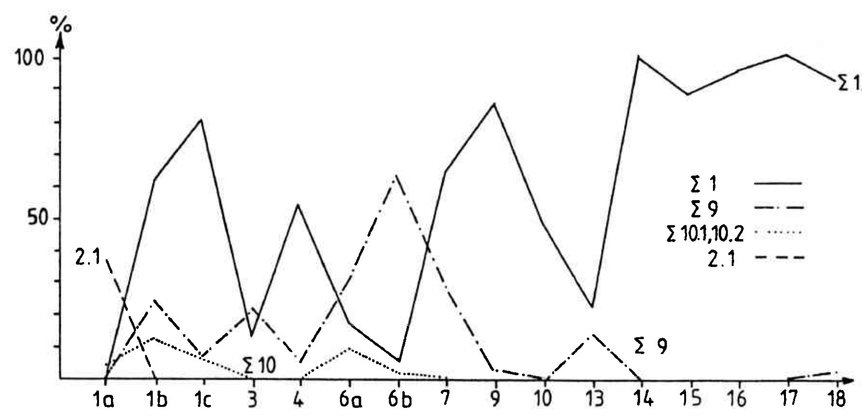


Figure 2. Percentage proportion of Siberian-Asian (1: 1.1, 1.2, 1.3, 1.4), Central European montane (9: 9.1, 9.2, 9.3, 9.4, 9.5), xeromontane (2.1), and Boreo-alpine / Boreo-montane (10: 10.1, 10.2) fauna groups of each sampling site

The fauna groups 2.1, 10/10.1 and 10.2 do not extend beyond the altitude of 400-600 m a.s.l. (Figure 2., *Pyramidula, Sphyradium, Arianta, Ena*: Table 1.). Among the European montane group, the hydrophilous Carpathian species of narrow tolerance range (*Cochlodina marisi, Balea stabilis, Vestia elata, Argna, Oxychilus orientalis, Trichia bielzi*) are similarly confined to the montane localities (the occurrence of *Trichia bielzi* at Benesat may results from immigration from neighbouring mountains).

The Carpatho-Sudetian (9.2) *Vestia gulo* and the East Baltic (9.3) *Ruthenica filograna* found in sampling site 13 is probably due to the influence of a local oak forest and creek. The same can be true for the snail assemblage on site 24/12.

The Alpo-Carpathian ubiquitous *Deroceras rodnae* (sites 15 and 16) and the Carpatho-Sudetian (9.2) *Perforatella vicina* (sites 22/5, 25, 12 and 17) species may extend their area much further. The high proportion of Siberian-Asian fauna groups on sites 1b, 1c, 4, 9, and 10 indicate human disturbances, while on sites 14, 16 and 18 it reflects the continental character of snail assemblages in primordial *Salicetum triandrae* stands (Bába, 1980 - 81).

Explantation of Table :

Sampling sites (sampled by the quadrate method) (1b, 1c), number of individuals, species diversity, abundance and diversity data, and abbreviations of zoogeographical (I) and ecological (II) species groups, and of Lozek's habitat types (III). Sites 17 and 18 are located in the Hungarian section of the rivers Someş/Szamos and Tisza, and serve as controls of collection during this expedition. Sites 19-25/1-12 are additional localities for snail collection, which were pointed out in the vicinity of major sites (19-25) and were sampled by thinning. The cross sign indicates species represented by shells on a given site.

Environmental status of sampling sites

1. Zoogeographical approach

The collective values of continental and subatlantic fauna groups - based on percentage abundance data - indicate the predominance of continental climate in lowlands, and subatlantic climate in the mountains (Bába, 1982, 1983, 1992 c, Bába et al. 1982 -83).

The ratio of continental fauna groups increases significantly as altitude and precipitation (Tufescu, 1965) simultaneously decrease (Figure 3.). The sampling sites at Gilău Mountains (1a), Rodna Mountains (6a, 6b) and those of hilly regions covered by typical forests (13) are dominated by subatlantic fauna elements. Lacking of continental patterns reflects human disturbances (sites 1b, 1c, 3, 4 and 10).

No.	Species	I	II	III	1a	1b	1c	3	4	6a	6b	7	9	10	13	14	15	16	17	18	19/1	20/1	21/2	22/5	23/9	24/12	25/12	Σ
1	Succinea oblonga Draparnaud, 18	1.2	3	RU	-	-	-	-	-	-	-	+	-	-	-	1	-	1	5	-	-	-	-	-	-	-	-	7
2	Succinea putris Linné, 1758	1.1	3	RU	-	-	-	-	-	-	-	18	-	5	-	7	1	7	21	10	-	-	-	-	20	-	-	89
3	Succinea elegans Risso, 1826	8	3	RU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2
4	Cochlicopa lubrica O.F. Müller, 1774	1.4	3	BW	-	-	2	-	-	1	-	2	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	10
5	Pyramidula rupestris Draparnaud, 1801	2.1	4	S	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
6	Sphyradium doliolum Bruguière, 1792	2.1	2	W	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+
7	Argna bielzi Rossmässler, 1859	9.1	1	W	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
8	Vallonia pulchella O.F. Müller, 1774	1.4	3	S	-	-	-	-	-	-	-	-	-	1	+	-	-	-	34	-	-	-	-	-	-	-	-	35
9	Ena montana Draparnaud, 1801	10.2	1	W	2	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
10	Discus ruderatus Ferussac, 1821	1.1	3	W	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
11	Arion subfuscus Draparnaud, 1805	1.1	2	W	-	2	1	1	-	2	1	1	6	2	1	-	9	1	-	-	4	-	-	-	2	-	-	30
12	Arion sylvaticus Lohmander 1937	7	3	W	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4
13	Vitrina pellucida O.F. Müller, 1774	1.4	4	BW	1	13	14	-	+	6	-	1	-	-	-	-	+	-	-	-	-	3	1	-	-	-	-	39
14	Semilimax semilimax Ferussac 1802	7	1	W	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
15	Phenicolimax annularis Studer, 1820	2.1	4	S	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
16	Vitrea transsylvanica Clessin, 1877	5.2.2	1	W	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2
17	Vitrea diaphana Studer, 1820	5.2.2	2	W	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
18	Vitrea crystallina O.F. Müller, 1774	6	1	BW	-	-	-	-	-	-	-	-	-	-	1	-	-	-	3	-	-	-	-	-	-	-	-	4
19	Aegopinella pura Alder, 1830	1.2	5	W	-	2	1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
20	Aegopinella epipedostoma Fagot, 1879	8	4	W	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
21	Nesovitrea hammonis Ström, 1765	1.1	3	BW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	4
22	Oxychilus draparnaudi Beck, 1837	8	5	BW	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
23	Oxychilus orientalis Clessin, 1887	9.1	3	W	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
24	Carpathica calophana Westerlund, 1881	9.1	1	W	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
25	Zonitoides nitidus O.F. Müller, 1774	1.4	3	RU	-	-	-	-	-	-	-	2	-	-	1	-	-	5	9	13	-	-	-	-	-	-	-	30
26	Limax cinereoniger Wolf, 1803	6	1	BW	-	-	-	-	-	1	3	-	-	-	1	-	-	-	-	-	3	-	1	-	-	-	-	10
27	Limax maximus Linné, 1758	8	5	BW	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
28	Bielzia coerulans M. Bielz, 1851	9.2	1	W	-	-	-	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
29	Deroceras laeve O.F. Müller, 1774	1.3	3	RU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	4
30	Deroceras reticulatum O.F. Müller, 1774	1.3	4	BW	-	-	-	-	-	-	-	-	-	-	-	3	1	-	5	1	-	-	-	-	1	-	-	11
31	Deroceras rodnae Grossu et Lupu, 1965	9.4	2	BW	-	3	-	-	-	4	2	1	1	-	-	-	2	1	-	-	-	-	1	-	-	-	1	16
32	Euconulus fulvus O.F. Müller, 1774	1.4	5	BW	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
33	Cochlodina laminata Montagu, 1803	6	2	W	-	-	-	1	-	-	-	-	1	-	7	-	-	-	-	-	-	-	-	-	-	-	-	9
34	Cochlodina marisi A. Schmidt, 1857	9.1	2	BW	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
35	Ruthenica filograna Rossmässler, 1836	9.3	4	W	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
36	Macrogastra latestriata A. Schmidt, 1857	9.3	1	E	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
37	Laciniaria plicata Draparnaud, 1801	5.2.2	2	W	1	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	4
38	Balea biplicata Montagu, 1803	5.2.2	2	BW	-	-	-	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
39	Balea fallax Rossmässler, 1836	5.2.2	1	W	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
40	Balea stabilis L. Pfeiffer, 1847	9.1	2	W	1	-	-	-	-	1	4	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	7
41	Vestia elata Rossmässler, 1836	9.1	1	W	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
42	Vestia gulo E. A. Bielz, 1859	9.2	1	W	-	-	-	-	-	1	12	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	15
43	Bulgarica vetusta Rossmässler, 1836	5.2.1	2	BW	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24
44	Bulgarica cana Held, 1836	9.3	1	W	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
45	Bradybaena fruticum O.F. Müller, 1774	1.1	5	BW	-	-	-	1	19	-	-	7	15	1	1	-	1	-	-	-	3	-	-	-	25	2	-	75
46	Monarcha costhusiana O.F. Müller, 1774	8	4	S	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	9
47	Perforatella bidentata Gmelin, 1788	9.3	3	W	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
48	Perforatella vicina Rossmässler, 1842	9.2	2	W	-	-	1	+	+	-	-	12	-	-	1	-	-	-	2	-	2	3	-	1	1	-	1	24
49	Perforatella rubiginosa A. Schmidt, 1853	1.1	3	RU	-	-	-	+	1	-	-	1	3	1	2	5	25	12	17	12	-	-	-	-	-	-	-	79
50	Hygromia transsylvanica Westerlund, 1876	9.5	1	W	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3
51	Trichia hispida Linné, 1758	5.2.2	2	BW	-	-	-	+	4	-	-	4	-	3	4	-	6	-	-	-	1	-	-	-	-	-	-	22
52	Trichia bielzi A. Schmidt, 1860	9.1	1	W	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	6
53	Euomphalia strigella Draparnaud, 1801	3	5	BW	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
54	Arianta arbustorum Linné, 1758	10.1	3	BW	-	4	2	-	-	3	1	-	-	-	-	-	-	-	-	-	25	2	-	-	-	-	-	37
55	Chilostoma faustinum Rossmässler, 1838	9.5	2	W	-	-	-	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
56	Chilostoma banaticum Rossmässler, 1838	9.5	2	W	-	8	1	2	-	-	-	-	-	-	-	-	-	-	-	-	8	2	-	-	-	2	-	23
57	Isognomostoma isognomostoma Schröter, 1784	9.4	2	W	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
58	Cepaea vindobonensis Ferussac, 1821	3	4	BW	-	-	-	-	1	-	-	-	-	1	1	-	-	-	-	-	-	-	-	1	1	-	-	5
59	Helix pomatia Linné, 1758	5.3	4	BW	-	-	-	1	1	-	1	-	-	2	-	-	-	-	-	-	-	-	-	1	3	-	-	9
60	Helix lutescens Rossmässler, 1837	5.3	4	S	-	-	-	+	4	-	1	-	1	1	-	-	-	-	-	-	-	-	1	3	9	-	-	20
	Σ No of species				66	33	27	14	37	45	38	50	29	31	23	16	51	27	102	36	47	10	6	5	62	6	4	765
	Abundance A/m^2				-	52,8	43,2	22,4	59,2	7,2	60,8	80,0	46,4	49,6	36,8	25,6	81,6	43,2	163,2	57,6	-	-	-	-	-	-	-	
	Species density (average)				-	2,0	2,0	1,2	2,5	2,3	2,7	3,0	1,8	2,4	1,8	1,2	2,7	1,9	4,7	2,1	-	-	-	-	-	-	-	
	Diversity				-	2,35	2,55	2,83	2,32	3,7	3,41	2,64	2,06	3,00	3,11	1,75	2,23	2,00	2,719	1,716	-	-	-	-	-	-	-	
	Percentage of juvenile				-	42,4	25,9	28,5	51,3	13,07	35,1	66,0	37,9	67,7	45,5	68,75	9,80	14,8	-	-	-	-	-	-	-	-	-	
	Mortality				-	17,5	48,07	66,6	41,2	0	8,10	13,8	0	8,8	21,4	5,88	54,46	0	-	-	-	-	-	-	-	-	-	

Table 1.

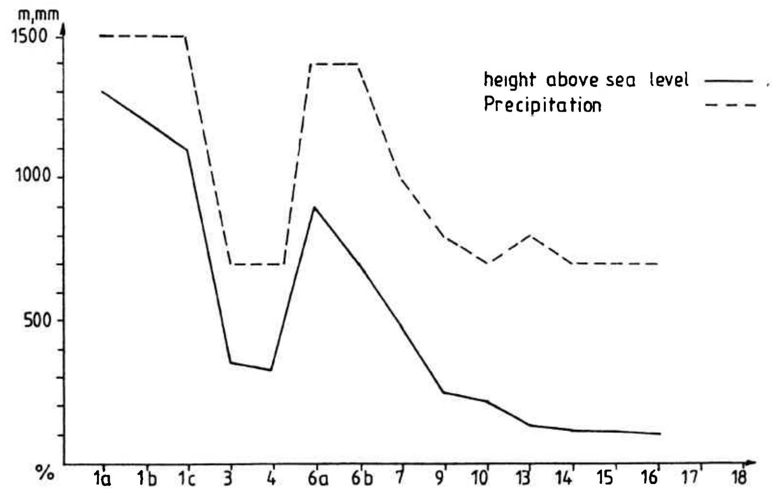
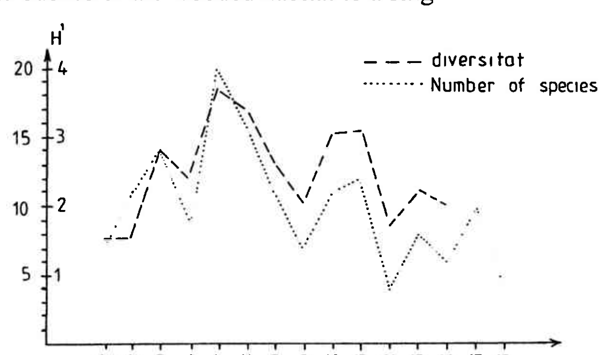


Figure 3.

2. Ecological approach; the characteristics of snail assemblages

The structural characteristics of snail assemblages may also reflect their environmental status. The variation in diversity and species number of the assemblages studied are shown in Figure 4. These values depend on many factors, such as the position of the assemblage in a successional series. The number of species and diversity are generally low in an initial successional stage (*Petasitetum, Salicetum triandrae*). These parameters were indeed low on sites 1b, 1c (both are at Gilău Mountains), 4 and 9.

The abundance and mortality percentage is compared in Figure 5. In contrast with the very high abundance value of an undisturbed willow-poplar forest on site 17 (the confluence of the Someş/Szamos and Tisza rivers), rather low values were found in the same forest type on sites 3, 4, 9, 10 and 15. This is most probably because of a gradual shrink of trees or bushes of the wooded habitat to a sing



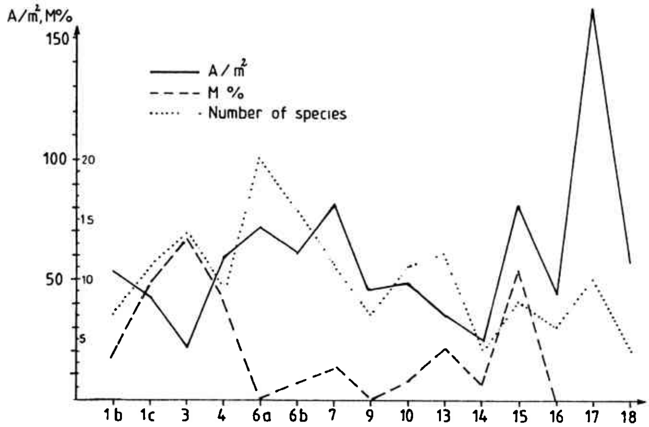


Figure 5. Variation in abundance, mortality percentage and species number among sampling sites

The high proportion of dead individuals on sites 1c, 3, 4 and 15 indicate an increased human impact. Indeed it could be seen during our expedition upstream and downstream Cluj, and in a heavily thinned forest in the vicinity of a dumping ground upstream Satu Mare.

The distribution frequency in Lozek's habitat types shows the following trend (Fig. 6). The riparian species predominate mostly on the lowland sites. The steppe dwellers (*Phenicolimax, Pyramidula*) are dominant components on rocks near the spring (site 1a). The occurrence of steppe dwellers (*Vallonia, Monacha, Helix lutescens*) in willow-poplar forests on sites 3 and 4 indicates human impact.

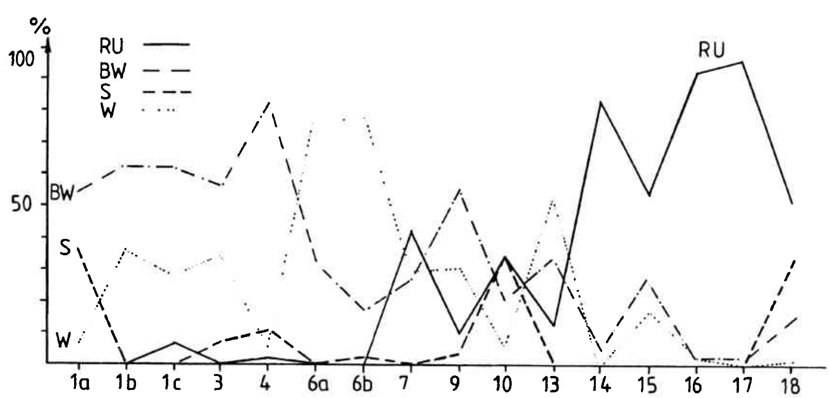


Figure 6. Percentage proportions of Lozek's habitat types at the sampling sites
W: forest dwellers, BW: bush forest dwellers, RU: riparian hydrophilous elements, S: steppe dwellers.

The forest dweller species reach a dominant status in the montane zone (Rodna Mountains), in undisturbed initial communities and in oak-hornbeam forests (site 13). However, in disturbed primordial *Petasitetum* vegetation (1b and 1c) and in willow-poplar forests (9 and 15) bush forest dweller species are the most abundant.

In addition to riparian hydrophilous species, bush dwellers (and occasionally steppe dwellers) appear in initial *Salicetum triandrae* habitats (sites 14, 16 and 18).

The water conditions of sampling sites are compared to differences in the moisture requirements of snail assemblages and the amount of annual precipitation on each site in Figure 7. In accordance with Lozek's habitat types, subhydrophilous components (1-2) follow a trend similar to that of the riparian ubiquitous (RU) and forest dwellers (W). Xeromesophilous elements (4) reach high abundance on sampling sites 1b, 1c and 10, while moderately high on site 4. The ubiquitous elements (5) tend to increase, but still remain in relatively low values in sites 1b and 1c, whereas outstandingly high ones in sites 4 and 9.

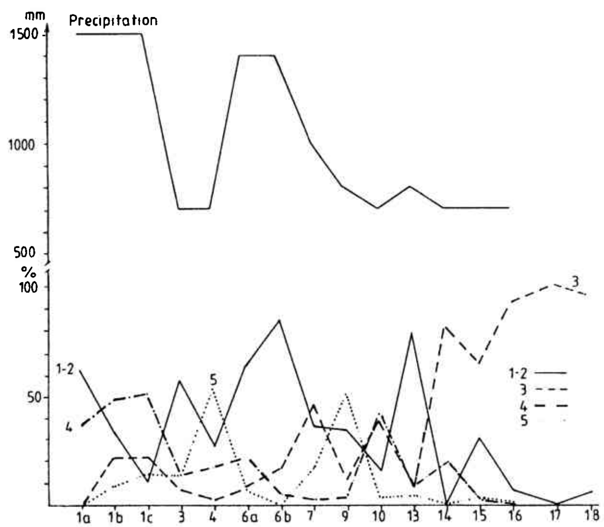


Figure 7. Percentage proportions of ecological species groups at the sampling sites
1: hydrophilous shade species, 2: subhydrophilous species, 3: riparian ubiquitous,
4: xero-mesophilous elements, 5: ubiquitous species

The characterisation revealed here indicates different aspects of structural changes in snail assemblages. A slight human influence is reflected in diversity and abundance figures in the low ratio of forest dweller species and in the ecological species group composition of the initial *Petasitetum* stands in sites 1b and 1c.

In sites 4, 9, 10 and 15 the number of species, diversity, low abundance and high mortality values, increasing ratio of bush forest dwellers, steppe dwellers, xeromesophilous and ubiquitous species indicate various degree of human impact. These characteristics are more homogenous on sampling sites with successionally initial

Salicetum triandrae vegetation, than those with more advanced willow-poplar forests. The background of this phenomenon must be a habitat reduction and harmful effects of agricultural practices on adjacent fields. We could not detect any direct influence of water pollution on the terrestrial snail assemblages of riparian vegetation.

3. Relationships among snail assemblages

Four cluster cores emerge in the dendrogram in Figure 8. The first two include the rock dwellers collected by thinning in two mountains (Gilău and Rodna), and in *Petasitetum* communities (*Petasitetum albae, P. kabikliana*). The next cluster core contains snail assemblages occurring in *Salicetum albae-fragilis* stands that underwent to human influence on sites 3, 4, 9 and 10. The last core contains *Salicetum triandrae, Salicetum albae-fragilis* and *Telekio-Alnetum* stands. The *Querco petreae-Carpinetum* plant association differs from these four cluster cores.

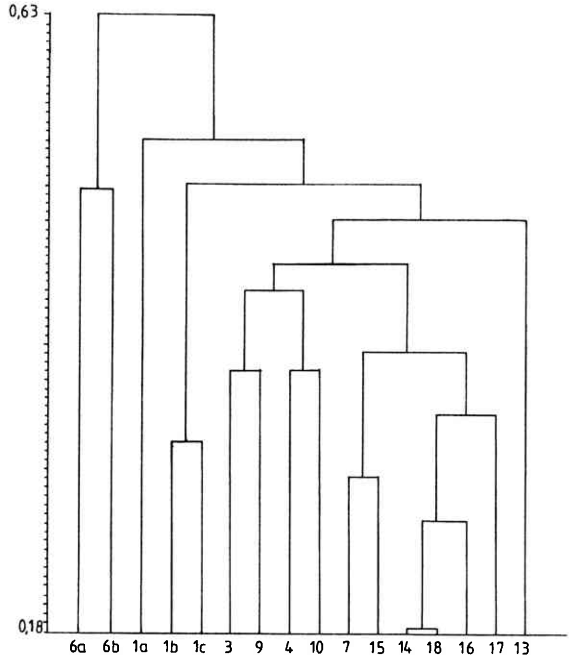


Figure 8. Dendrogram of the Sokal-Michener group average cluster analysis with the indication of sampling sites

The groups obtained by Principal Coordinates Analysis (Figure 9.) agree with the cluster cores detailed above. The snail assemblages in *Petasitetum* plant communities of the two mountains differ from those in *Telekio-Alnetum* (7) and *Querco-Carpinetum* (13) plant communities. Also, the snail assemblages of disturbed *Salicetum albae-fragilis* stands on sites 3, 4, 9 and 10 separate from those in seminatural *Salicetum albae-fragilis* forests occurring on sites 14-18.

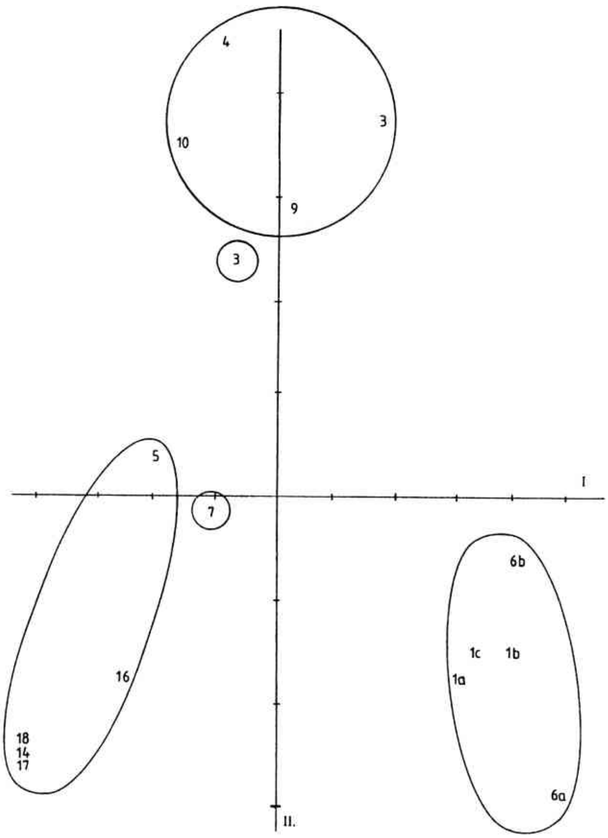


Figure 9. Results of Principal Coordinates Analysis (PRINCOOR). The various plant communities and the willow-poplar forest underwent human activities differ clearly from each other in the composition of their snail assemblages.

Conclusion

The expedition in the Someş/Szamos River Valley resulted the collection of 763 living and 168 shell snail individuals belonging to 58 species. The quadrate and thinning methods were used during collection. The vegetation in the sampling sites included montane and lowland riparian plant communities of early (*Petasitetum albae, P. kitaibeliana, Telekio-Alnetum* and *Salicetum triandrae*) or advanced (*Salicetum albae-fragilis*) successional stages, and *Querco p. Carpinetum* forests of hilly region often extending down to riverbanks (Soó 1964, Coldea 1990).

The plant communities differ from each other also in their snail assemblages composition, as it is shown by the results of cluster and principal component analyses (Figure 7. and 8.).

It was concluded, that ubiquitous and continental species (*Bradybaena, Deroceras rodnae, Succinea putris, Helix lutescens*) dominate among snails transported by the Someş/Szamos over long distances. Species of narrow ecological tolerance range can find their way to the riparian vegetation of the Someş/Szamos Valley through minor watercourses arriving from neighbouring hills and mountains. The fauna distribution from the spring region is hindered by water reservoirs, shrinkage of forest habitats to single row of trees along the river and the lack of riparian gallery forests in the flood area. In these extremely constrained forest habitats settling of snail individuals taking place during high water levels is not probable.

We could not detect any direct influence of water pollution on the terrestrial snail assemblages of the riparian vegetation. However, disturbance in the flood area was proved by changes in the zoogeographical and ecological characteristics of snail assemblages (Figures 2. - 8.). The biotopes are under the strongest human impact resulting from forest management (site 1b and 1c at Gilău mountains), or logging in the flood plain to convert these lands into agricultural fields. The garbage discharge in the neighbourhood of the riparian vegetation also causes major disturbances. These human interventions were seen upstream and downstream Cluj (sites 3 and 4), downstream Beclean (site 9), Căşeiu (10) and upstream Satu Mare (15).

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Contribution to the knowledge of the myrmecofauna of the River Someş valley

Bálint Markó

Abstract

In the present study the author contributes to the knowledge of the myrmecofauna of the River Someş by presenting a checklist of 20 species, containing also the *Myrmica salina* which is identified for the first time in Romania. The majority of the species are satellite, and only five species present core characteristics in the river valley. These are *Lasius niger*, *Tetramorium caespitum*, *Formica rufibarbis*, *F. cunicularia*, and *F. pratensis*. Most of them are opportunistic species.

The author launches the idea that occasional floods may have a decisive role in forming the ant-fauna of the riverbank.

Keywords: myrmecofauna, the River Someş valley

Introduction

Although continuous researches on the ants of Romania have been carried out since the 1950's (Paraschivescu 1978) the checklist of the species has not been accomplished yet as there are a lot of regions still to be searched by specialists.

Transylvania constitutes more or less an exception to these conditions, as the first studies in this region were carried out at the end of the XIX century by Müller and Worrel. Later Mocsáry and Röszler collected here and from the middle of the century studies on the ants of Transylvania were carried out mainly by Paraschivescu and additionally by Knechtel (Paraschivescu 1983). Nowadays Markó (1997a, 1997b) has begun myrmecofaunistical researches in Transylvania, publishing his first results on the myrmecofauna of the River Crişul Repede valley, and on different types of forests.

Little is known about the myrmecofauna of the River Someş valley. Only the upper part of the Someşul Mare river valley, one of the main branches of the Someş was studied by Paraschivescu (1978). Nothing is known about the valley of river Someşul Mic. Nevertheless zoogeographically it would be important to study these valleys as they may serve as ecological corridors for some species (Markó 1997b).

This study offers the first data to the knowledge of the myrmecofauna of river Someş, which study should be continued in the future.

Materials and methods

The sampling was carried out between 14-18 August of 1996 during the Someş Expedition. Five sample-sites were chosen along the River Someş from Dej, where the Someşul Mic and the Someşul Mare join and form the River Someş, to the Romanian-Hungarian border downstream Satu Mare. The sample sites were: Letca (Cluj county), Someş-Odorhei (Cluj county), Ţicău (Sălaj county), Arduzel (Maramureş county) and Vetiş (Satu Mare county). Four of the sample sites are open, mainly sandy riverbanks, while one (Arduzel) is an oak-forest in a distance of 1.5 kilometres from the river, but still lying in its valley.

The sampling was effectuated by collecting the specimen from the ground and from the nests, or in the case of Arduzel 15 pitfall traps were used, arranged in a 10x20 m^2 grid (3x5 trap-lines). Water and sodium chloride were put in the traps. The specimen collected were preserved in 70 % ethyl alcohol.

The keys of Collingwood (1979), Petrov & Collingwood (1993), Seifert (1988, 1992) and Somfai (1959) were used for the identification of the specimen.

Results and discussions

In the collected material 20 species were identified (Table 1.), from which the *Myrmica salina Ruzsky 1905* is reported for the first time in Romania (Paraschivescu 1978). Although this species is considered as a characteristic species for salinas, Seifert (1988) mentions that it does not inhabit salinas exclusively, nevertheless high salinity habitats seem to be preferred by this species on the basis of its dominance and abundance. In this case this species was found in an open grassland inside the dam at Vetiş, about 50 meters from the river, near a cornfield.

The number of species collected is not high at all, even if we consider that Paraschivescu (1978) summarised the number of known species to 74 to which Markó (1997b) added two new species (total 76). In addition on the basis of the Hungarian fauna which has been updated by Gallé et al. (in press) to more than 100 species, we can assume that the number of ant species living in Romania may well exceed the 100 limit, and considering this, the number of species reported from the River Someş valley is quite small.

The greatest number of species was found in the forests (14 species) and not in the riverbank, where the number of species does not exceed even 10. Only five species were found to have more than 0,5 constancy: *Tetramorium caespitum*, *Lasius niger*, *Formica rufibarbis*, *F. cunicularia*, and *F. pratensis*. All of these species are common, and according to Pisarski's categories (in Gallé 1994), most of them are opportunistic species: *Tetramorium caespitum*, *Formica rufibarbis*, *F. cunicularia*, while *Lasius niger* is an aggressive, and *Formica pratensis* is a territorial species. Thus it seems to be obvious that these riverbanks are preferred mainly by a few species, baring the occasional disturbance caused by the flood. Gallé (1966, 1967, 1969) observed that

Species / Sampling sites	Letca	Someş-Odorhei	Cheile Ţicăului	Arduzel	Vetiş
1. Myrmica rubra (L.)			X	X	
2. Myrmica salina Ruzsky					X
3. Myrmecina graminicola (Latreille)				X	
4. Tetramorium caespitum (Linné)	X	X	X	X	X
5. Stenamma westwoodi Westwood		X		X	
6. Leptothorax nylanderi (Förster)				X	
7. Diplorhoptrum fugax Latreille		X			X
8. Dolichoderus quadripunctatus Linné				X	
9. Prenolepis nitens (Mayr)				X	
10. Camponotus fallax (Nylander)				X	
11. Camponotus truncatus (Spinola)				X	
12. Lasius niger (Linné)	X	X	X	X	X
13. Lasius platythorax Seifert				X	
14. Lasius brunneus (Latreille)			X	X	
15. Lasius flavus (Fabricius)			X		X
16. Formica rufibarbis Fabricius	X			X	X
17. Formica cunicularia Latreille	X	X			X
18. Formica cinerea Mayr	X	X			
19. Formica pratensis Retzius	X	X		X	X
20. Formica polyctena Förster					X
Total no. of species	6	7	5	14	9

Table 1.: The checklist of collected species

Lasius niger was present all along the Tisza river in its flood area, while *Tetramorium caespitum*, which also had a great constancy in the valley of the Tisza, preferred the damsides and the top of the dam, which were not affected by the flood. In the case of the Someş we could not observe such segregation.

At Someş-Odorhei 8 *Tetramorium caespitum* nests were observed on 2 m^2 on a riverbank with hardly any vegetation cover, indicating its preference for such habitats.

The number of species related to the number of inhabited sample-sites (Figure 1.) reveals the fact that the majority of species is not characteristic for the riverbank of the Someş. Most of them are satellite while only a few species can be considered as core. The relation presented above does not support Hanski's theory (1982), which says that this relation shows a bimodality: the majority of species are satellite and core while the number of species occurring in not too much but also not too few sample-sites is small. Nevertheless we cannot consider that our study denies this theory because the number of samples is too small to jump to such conclusions.

Considering each data it can be concluded that there are only very few species preferring the riverbanks, and as such they are able to tolerate the perturbation caused by an eventual flood in the searched sample sites at the river Someş.

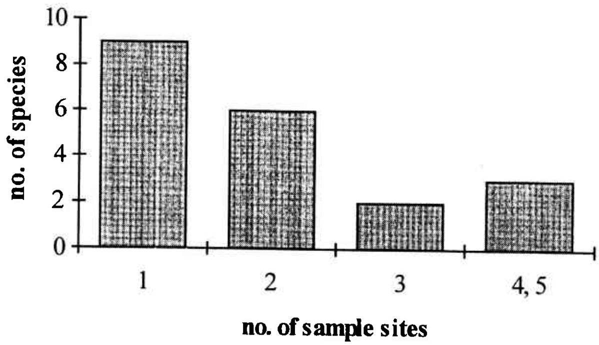

Figure 1. Relation between number of species and inhabited sample sites

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The herpetofauna of the River Someş/Szamos[1] basin

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Abstract

This paper presents the herpetofauna of the Someş river basin. 20 species were recorded, from which 12 are amphibians and 8 are reptiles. 11 habitat types favourable for amphibians and 8 types for reptiles have been identified in the mountain area of the Someşul Cald where 7 amphibian species and 6 reptile species were found.The number of amphibian species was bigger in the beech forests, than in the nearby spruce-fir forests. The reptiles have larger populations in the beech forests, although more species were found in the spruce-fir forests (5 species) that in the beech forests (4 species). The differences between these two types of habitats studied are mainly caused by two factors: the low pH of water and soil determined by the spruce-fir forest and especially by the *Sphagnum* moss, which could disturb certain amphibian species; and the floristic poverty of spruce-fir area, which probably determines a poverty of invertebrate fauna, this being the cause of the low number of amphibian and reptile populations in that area.

Keywords: Someş river basin, herpetofauna, distribution, habitat

Introduction

Till now the herpetofauna of Transylvania was poorly examined by herpetologists, large areas being not mapped yet. The main field observations have been carried out in summer 1997, during the Someş expedition. They were completed in spring and summer 1998 at the springs of the river Someşul Cald, and in the hill and hillock areas of this river basin, in Sălaj and Bistriţa counties.

List of the amphibian and reptile species

CLS. AMPHIBIA
ORD. URODELA
Fam. Salamandridae

1.Triturus alpestris (Laur.) 1768 (Alpine Newt)

A common species at this altitude, pretty often seen in puddles, swamps and ditches at the road verges, or on mountainsides. Although there are a lot of swamps and puddles in the spruce-fir forests, the mountain newt population is rather poor in comparison to

[1] The first name is Romanian, and the second Hungarian

other similar habitats studied by us in the Meridional Carpathians (Retezat and Cibin Mountains etc.). It has been observed at Bazarul Someşului Mare, Ic Ponor and Valea Arin.

2.Triturus vulgaris (Linnaeus) 1785 (Smooth Newt)

A species whose spread is altitudinally limited, reaching approximately a height of 1000 m. It has been seen together with the previous species into some swamps, but in a considerably reduced number in the mountain area. It must be remarked that it has been observed during previous research works in the Sureanu, Poiana Rusca and Metaliferous Mountains. Three newt species - *Tr. alpestris, Tr. vulgaris* and *Tr. cristatus* - live together at this altitude. We did not find the species last mentioned, in spite of the fact that there are favourable microhabitats. In the hill and hillock areas this species is present in only two localities (Ilva Mică and Pomi). Due to the destruction of its favourable habitats the populations of this species are continuously decreasing.

3.Triturus cristatus Laurentus, 1768 (Warty Newt)

A species of large size, preferring larger swamps in comparison to other species. It is present only in the hill area in three localities (Ratin, Recea Mică and Zalău).

4.Triturus montandoni (Boulenger) 1880 (Montandon' s Newt)

It is an endemic species for the Carpathic Basin. It has large populations in the Eastern Carpathians in mountain areas. It has been seen only in two localities, in Valea Mării and at its junction with the Someş river.

5.Salamandra salamandra Linnaeus, 1758 (Fire Salamander)

It is a terrestrial, nocturnal species that comes near the swamps only during the reproduction period in order to lay down the larvae. Excepting this period of time this species can be seen in the forests, till an altitude of 1400-m. Adult salamanders or larvae in puddles have not been observed in the spruce-fir forests, but it has large populations within beech forests. This species has also been seen in Zalău and Ratin.

ORD. ANURA

Fam. Discoglosidae

6.Bombina variegata (Linnaeus) 1758 (Yellow-Bellied Toad)

It is a species spread altitudinally between 400 and 1600-1700 m. There should be large populations of this species within the studied area, considering the existence of many favourable places, such as puddles between 1 and 15 m^2 with various depths, areas which should offer the best conditions to this species. The Yellow-Bellied toad has been seen only in the limestone area, in puddles at road verges. The situation is completely different in the hill area, where apparently this is the most common species of amphibians, being practically seen in almost all localities that have been studied.

7.Bombina bombina (Linnaeus) 1761 (Red Belly Toad)

It is a plain species, sensitive to water quality. Due to this fact it has rather rarely been seen in the studied area (Stâna and Recea Mică).

Fam. Bufonidae

8.Bufo bufo (Linnaeus) 1758 (Common Toad)

It is a common species in the Someş basin, rising altitudinally till 1300-1400 m. It seems that it is not disturbed by the acidic pH of the mountain areas, as it has been seen in both plain swamp areas and mountain side areas. The presence of tadpoles close to swamps indicates the existence of pretty large populations. This species has been seen in nine localities, in both hill and hillock areas: Aval Sângeorz Băi, Ilva Mică, Valea Mării, Arduzel, Ţicău, Stâna, Ratin, Recea Mică and Zalău.

9.Bufo viridis Laurentus 1768 (Green Toad)

It is a rarer species at higher altitudes because of its thermophilous feature, but it is resistant to dryness and it can be seen in areas where other species cannot survive. Even if it has not been seen at all in the mountain area it has been seen in six localities in the hill areas: Arduzel, Stâna, Sânmihaiu Almaşului, Chendremal, Ratin, and Aval Sângeorz.

Fam. Ranidae

10.Rana temporaria Linnaeus 1758 (Common Frog)

It is a common species in mountain areas, being well adapted to the low water pH. The populations of the Someş basin are large - in April approximately 200 egg clumps were seen in the swamps of the rivers, at the springs of the river Someşul Cald. In the rest of the territory its presence is rarer and instead of this species we can meet *Rana dalmatina* here.

11.*Rana dalmatina* Bonaparte 1839 (Agile Frog)

It is a thermophilous species that does not live in a higher altitude of 1000 m. It is common in the habitats of hill and hillock areas, having been seen in seven localities: Aval Năsăud, Beclean, Stâna, Ciumăra, Poarta Sălajului, Sânmihaiu Almaşului, and Zalău

13.Rana esculenta complex (Rana ridibunda Pallas 1771 *and R. lessonae* Camerano 1878 (Green Frogs)

This group of species, whose systematic positions have not been precisely delimited yet, can be seen in almost every fresh or running waters and in swamps, covering an area between hills till an altitude of 800 m. In the Someş basin these species have been seen in most of the studied localities.

Probable species: *Pelobates fuscus* (Laurentus 1768) and *Hyla arborea* (Linnaeus 1758).

CLS. REPTILIA

ORD. SAURIA

Fam. Lacertidae

1.Lacerta agilis Linnaeus 1758 (Sand Lizard)

It is a widespread species, from the plain to an altitude of 1400-1500 m, which prefers sunny places by the watercourse, depending on a certain degree of humidity. In the Someş basin it is widespread because it have been seen in seventeen localities. It must be noticed that its populations are larger in the hill area in comparison to those in the mountain area.

2.Lacerta viridis (Laurentus) 1768 (Green Lizard)

It is the largest representative of this family in our country, a thermophilous species, that lives till an altitude of 700-800 m. In the hill area of the Someş basin this species can rarely be seen on the southern sides. It could been seen in nine localities: Beclean, Amonte Someş Odorhei, Stâna, Ciumăra, Românaşi, Poarta Sălajului, Chendremal, Ratin, and Zalău.

3.Podarcis muralis Bielz 1856 (Common Wall Lizard)

This species is rarely present in the studied area, which is at the northern limit of its area, where the Common Wall Lizard has only a disperse spreading, having been seen only in the rocky microhabitats of Mediterranean influence. It has been seen in only two localities: Tarniţa and Smida, at the springs of the Someşul Cald.

4.Lacerta vivipara Jacquin 1787 (Viviparous Lizard)

This species is much more adapted to the unfavourable conditions of climate, reaching the altitudes of 2000 m. It has been seen at the skirts of the spruce-fir forest, especially in limestone areas, in four localities: Ic Ponor, Lac Baraj, Valea Arin and Valea Mării.

Fam. Anguidae

5.Anguis fragilis(Nordmann) 1840 (Slow Warm))

A common ovoviviparous species, spreading till altitudes of 1900 m. It has been seen in the wet but not in the *Sphagnum* pastures of the beech area, although its presence is not impossible there. It can pretty often be seen in the wet lawns of the hill area. It was found in five localities: Stâna, Sânmihaiu Almaşului, Chendremal, Ratin and Zalău.

ORD. SERPENTES

Fam. Colubridae

6.Natrix narix (Linnaeus) 1758 (Grass Snake)

A common species from the plain till altitudes of approximately 1000 m. It can be seen especially in the hill and hillock areas: Aval Gherla, Aval Năsăud, Beclean, Amonte Someş Odorhei, Ciumăra, Poarta Sălajului, Sânmihaiu Almaşului, and Ratin.

7.Natrix tessellata (Laurenti) 1768 (Dice Snake)

It is a semiaquatic species. It can be seen near running and stagnant waters. It was found only in two localities (Someş Odorhei and Ciumăra).

Fam. Viperidae

8.Vipera berus (Linnaeus) 1758 (Adder)

It is a widespread species in both spruce-fir and beech forests, on the southern sides of the mountains, in the glades of meadows (four localities). The density of the population is not uniform being connected with the disperse presence of *Lacerta vivipara* populations, which represent the food resource for the young vipers. It was found in Ic Ponor, Lac Baraj and Valea Arin.

Probable species: *Elaphe longissima* (Laurenti) 1768 and *Coronella austriaca* Laurenti 1768

The distribution of herpetofauna in the mountain area of the Someşul Cald river basin

Although the altitude is not very high (950-1200 m), due to specific pedoclimatic conditions there are some characteristic features of the mountain area of the Someşul Cald between the Someşul Cald gorges and the tail of the artificial Hydro Power Station lake Beliş, namely:

- Starting upstream the lake till approximately 4 km from the entrance of the gorges of the Someşul Cald spruce-fir forests and mezohigrophilous lawns are predominant, where the *Sphagnum* mosses grow explosively.

- Upstream the spruce-fir area, the limestone base rock of Someşul Cald gorges is covered by compact beech forests and glades, where the river flows from East to West.

In order to establish the influence that pedoclimatic conditions have on the composition of herpetofauna both characteristic habitats of herpetofauna and existing species have been identified. The results are presented in Table 1. and 2.

Comparing the two vegetation areas, we reached the conclusion that the beech area, although its surface and microhabitat diversity is more limited, shelters a large number of amphibian species, larger, than the spruce-fir areas do. So, only two species live in the swamp of the flooded meadow while in the beech areas five species have been seen. The situation was the same in the other three comparable types of habitats: swamps, lawns and forests.

This obvious difference may have two reasons: the low pH of water and soil, determined by the spruce-fir forest and especially by the *Sphagnum* moss, which can disturb certain amphibian species, and the floristic poverty of spruce-fir area, which probably determines a poverty of invertebrate fauna, this being the cause of the low number of amphibian populations in the area. The spruce-fir area shelters a large number of amphibian species although altitudinally this area is situated higher.

There are six reptile species in the two studied areas (four of lizard and two of snakes).The analysis of data in Table 2. shows us that there are only four species living in the beech area, in comparison to the spruce-fir area where six species are present. It may be the effect of the altitude, but the populations can be found in the beech area are better represented by their number.

	SPRUCE FIR AREA						BEECH AREA				
	A	B	C	D	E	F	G	H	I	J	K
Triturus alpestris	***	*	**				**	*			**
Triturus vulgaris	*						*				
Salamandra salamandra									*		
Bombina variegata							*	*			
Bufo viridis				*						*	
Bufo bufo	**			**		*	*	**	**	*	*
Rana temporaria	**	**	*	*	*	*	***		**	*	*
Number of species	4	2	2	3	1	2	5	4	3	3	3

Table 1. Spreading of amphibian species in the studied habitats

A: Swamps at the tail of the lake;
B: Swamps in flooded meadow with *Sphagnum*;
C: Swamp at the road verges;
D: Area changed by human impact;
E: *Sphagnum* lawns;
F: Spruce-fir forests;
G: Swamps in flooded meadows without *Sphagnum*;
H: Swamps by the roads;
I: Lawns without *Sphagnum*;
J. Scree, rock- piles; K: Beech forest.***Common; **rare; *sporadic

	SPRUCE FIR AREA				BEECH AREA			
	A	B	C	D	E	F	G	H
Podarcis muralis	*	*						
Lacerta vivipara	*	*			*	**	**	**
Lacerta agilis			*			*		
Anguis fragilis		*	*		*	*	*	
Natrix natrix				*				
Vipera berus		*	*		*	*	*	*
Number of species	2	4	3	1	3	4	4	3

Table 2. Spreading of reptile species in the studied habitats

A: rock-piles;
B: Skirts of forest, southern side;
C: Pasture, southern side;
D: Flooded meadow glade and forest;
E: Flooded meadow glade;
F: Pasture, southern side;
G: Skirts of forest;
H: Limestone scree and rock-piles ***Common; **rare; *sporadic

The only important differences between these two areas are in the flooded meadows, because *Anguis fragilis* has not been seen in the spruce-fir area while it was found in the beech area. There might be an explanation if we take in consideration the fact that in the spruce-fir area the meadows are exposed to a strong human impact (gardens, pasturing, wood exploitation).

Conclusions

- The herpetofauna consists of 20 species in the Someş basin, from which 12 are amphibians and 8 are reptiles.

- 11 habitat types favourable for amphibians of and 8 types for reptiles were identified in the mountain area of the Someşul Cald where 7 amphibian species and 6 reptile species were found.

- More amphibian species live in the beech area than in the nearby spruce-fir area.

- The reptiles have larger populations in the beech area, although more species live in the spruce-fir area (5 species) than in the beech area (4 species).

- The differences between the two studied types of habitats are mainly caused by two factors, namely the low pH of water and soil. Determined by the spruce-fir forest and especially by the *Sphagnum* moss, which could disturb certain amphibian species, and the floristic poverty of spruce-fir area, which probably determines a poverty in the invertebrate fauna, this being the cause of the low number of amphibian and saurian populations in this area.

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Studies on the amphibians of the Someş/Szamos[1] River-Valley

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Abstract

The present paper shows the results of the investigations on distribution of amphibians in Someş river valley. During the Someş/Szamos expedition only 8 species were identified (although 17 species were known from the river valley), mostly due to the timing of the investigations and, in case of the species from hilly and plain areas, due to the destruction of natural habitats. The authors supplementary investigations added other 7 species to the regional faunistical list. The most endangered species of the Someş river valley is the Moor Frog (*Rana arvalis*): because of habitat destruction, many local populations of this species are already extinct in most of the sites where they were known before.

Keywords: herpetofauna, amphibians, River Someş/Szamos, ecological status, endangered species

Introduction

Someş river system is situated in north-western part of Romania having a complex structure, most of the secondary watercourses occurring in the upper parts (mountain and hilly areas) of the watershed. The total surface of the catchment area is 1,501,500 ha (2/3 of the surface is placed at the left side of the main river course). The monitoring of the hydrological dynamic of Someş river started in 1868 (establishment of the hydrological station at Satu Mare) (Diaconu, red., 1971). The main geomorphologic regions crossed by various watercourses belonging to Someş river are: mountains (Apuseni, Rodna, Ţibleş, Gutăi) hilly areas (Someşelor Plateau, Transilvaniei Plain, Baia Mare Basin) and lowlands (Someşelor Plain) (Badea et al, reds., 1983).

The first records on the amphibian species occurring in the Someş river valley could be found in the work of Bielz A., published in 1888: the respective printing contains data on 7 taxa of amphibians. In the same period, Méhely (1891, 1892) provides information on other 4 species. Few years later, Werner (1897) have mentioned one new species for the regional list (*Pelobates fuscus*). Călinescu's work (the first Romanian herpetological monograph) contains information on 13 amphibian species living in the close

[1] The first name is Romanian, and the second Hungarian

neighborhood of Someş river (Călinescu, 1931). The 14th species (*Bufo viridis*) will be mentioned only 30 years later, by Fuhn (1960). Recent studies of Török (1997a and 1997b) provide information on two newt species which are new taxa for the regional list. In the same year, Arntzen et al. (1997) were publishing an article on *Triturus dobrogicus*, species found near to the lower sector of the Someş river.

The present paper shows the result of the herpetological studies carried out in the Someş river valley, including discussions on the actual status of amphibian populations and observations on the species occurring in the Someş basin (even if they have not been found during the investigations).

Materials and methods

In the 21.07.1992 - 03.08.1992 period (the so-called Someş/Szamos Expedition) 17 sampling stations were studied. The stations were situated along the main river courses of the Someş catchment area. In each station we were walking along transacts parallel to the river shore and we were making observations on the species, number of specimens, status of habitats. During the same year, many supplementary field-investigations have been carried out, mostly in the Baia Mare Basin and in the vicinity of Cluj. For species identification we have used classic guides: Arnold and Burton (1978) and Fuhn (1960, 1969). For a precise localization of the sampling sites, the Universal Transverse Mercator (UTM) system was used for squares of 10x10 km (Lehrer and Lehrer, 1990). The UTM codes are mentioned in parentheses after the name of each locality.

Results

1. *Salamandra salamandra* (Fire Salamander) was not observed during the investigations, due to the timing of the field investigations (summer is not the proper period for identifying amphibians). Fire Salamander was mentioned by Bielz (1888) from Năsăud (LN 03), by Borcea (1983) from Rodnei Mountains (without precise location of the site) and by Cogălniceanu (1991) from the western limit of Baia Mare Basin (FT 78 and FT 88). Recent studies of Török (1997a) show the existence of stabile populations of Fire Salamander in the catchment area of Lăpuş river (tributary to Someş river). Based on these results, our opinion is that the species has viable populations in the forested areas from the upper parts of the Someş valley (Apuseni Mountains, Rodnei Mountains and the border area of the hilly regions).

2. *Triturus cristatus* (Warty Newt) is one of the most common species of amphibians in the hilly areas of the Someş river valley. During the investigations we have not captured any Warty Newt, but in 1992 the species was observed at Bozinta Mica (FT 87), Cluj (FS 98) and Ilba (FT 78). Supplementary field investigations carried out by the author show the occurrence of Warty Newts in several sites placed in the vicinity of the

Someş valley: Baci (FS 88), Fânațele Clujului (FS 99), Lăpuşel (FT 87) and Sat Săsar (FT 88). The species was also mentioned by Fuhn (1960) from Gherla (GT 21) and Năsăud (LN 03).

3. *Triturus dobrogicus* (Danube Crested Newt). There is only one reliable record from the close neighborhood of Someş catchment area: Arntzen et al. (1997) mentioned village Andrid (ET 96) as the north-western limit of the range of the species. Being a species adapted to the ecological conditions of wetlands from plain areas, the Danube Crested Newt is a relatively common species in the floodplains of the main rivers from Hungary (Andren et al., 1994). Consequently, we assume that the species is occurring in the floodplain of the lower Someş river (between Satu Mare and the confluence of Someş and Tisa rivers).

4. *Triturus vulgaris* (Smooth Newt) is also one of the common species of the wetlands of Someş river valley. In the hilly areas (Someşelor Plateau, Baia Mare Basin) we have observed populations belonging to the subspecies *Triturus vulgaris ampelensis* at Bozinta Mica (FT 87), Cluj (FS 98) and Ilba (FT 78). The author's supplementary field investigations show the occurrence of Smooth Newt populations at Baci (FS 88), Fânațele Clujului (FS 99) and Recea (FT 87) (see Török, 1997b). Other records of the species: Năsăud (LN 03; see Bielz, 1888), probably this population belongs to the subspecies *Triturus vulgaris vulgaris* (according to the paper of Cogălniceanu, 1991).

5. *Triturus montandoni* (Montandon's Newt) was not captured during the investigations. Studies of Török (1997b) show that the species is common in the mountain areas of Lăpuş catchment area (belonging to Someş hydrological basin). Montandon's Newt is also mentioned by Borcea (1983) from Rodnei Mountains (without precise location of the collecting station). Based on our previous observations, we consider that Triturus montandoni has stabile populations in those areas of the Someş valley which are situated in the Eastern Carpathians (the species is not occurring in Apuseni Mountains).

6. *Triturus alpestris* (Alpine Newt) was observed in Apuseni Mountains (FS 66): four specimens were found under a stone, between the river and a carriage road. Borcea (1983) mentioned the existence of the species in Rodnei Mountains. Having the same ecological requirements like Montandon's Newt, the Alpine Newts are probably numerous both in Apuseni and Rodnei Mountains.

7. *Bombina bombina* (Fire-bellied Toad) was not observed during the Someş-Szamos Expedition, but in 1992 one specimen was caught at Ulmeni (FT 75) (see Török, 1997b). Human activities have negative impact on this species, the Fire-bellied Toad populations being unable to survive in polluted waterbodies (ponds, oxbows, etc.) from Someş river valley.

8. *Bombina variegata* (Yellow-bellied Toad) is one of the most common frogs in Someş river valley. The author (see Török, 1997b) has identified Yellow-bellied Toad populations at: Apuseni Mountains (FS 46), Anies (LN 35), Ardusat (FT 77), Arieşu de

Câmp (FT 87), Cicârlău (FT 88), Cluj (FS 98), Dănestii Chioarului (FT 76), Fărcaşa (FT 77), Gardani (FT 76), Ilba (FT 78), Pribileşti (FT 77), Săbişa (FT 76), Sălsig (FT 76), Seini (FT 79), Sârbii Fărcaşa (FT 77), Ulmeni (FT 75). Méhely (1892) indicated the presence of the species at Beclean (KN 82) and Gherla (GT 21). Bielz (1888) mentioned a population of Yellow bellied Toad at Năsăud (LN 03). Based on our investigations (carried out in the vicinity of these human settlements) we consider highly probable the occurrence of the species in these three sites, too. The species has stable populations all over the catchment area of Someş river (Török, 1997b).

9. *Pelobates fuscus* (Common Spadefoot). During our investigation we have found at Beclean (KN 82) one larva of Common Spadefoot. The specimen was swimming in a small pond (filled with aquatic vegetation) placed at the western limit of Beclean city, in the close vicinity of Someş (Someşul Mare) river. The Common Spadefoot was also mentioned by Werner (1897) from Gherla (GT 21) and by Balint Markó (in verbis) from Fânațele Clujului (FS 99). Taking into account the secretive life of this species and the existence of soft soils (proper environment for the spadefoots) in most parts of Someş catchment area, we assume that the species is relatively common in the hilly and plain sectors of Someş river valley.

10. *Bufo bufo* (Common Toad). During our investigations common toads were observed only in Rodnei Mountains (LN 04), but various publications contain data on the occurrence of the species in other zones of the Someş river valley: Cluj (FS 98 ; Fuhn 1960), Dej (GT 12; Bielz, 1888), Gherla (GT 21; Fuhn, 1960). Disappearance (clearance) of natural forests from hilly and plain areas caused the fragmentation of the range of populations. Small populations are existing in several forests, but they are isolated: wide agricultural fields make impossible the direct contact between these local populations (Török and Béres, 1996).

11. *Bufo viridis* (Green Toad). Along the Someş river valley Green Toads were observed at Arduzel (FT 75), Lucăceşti (FT 76), Pribileşti (FT 77). The species was identified in areas close to the river valley at Fânațele Clujului (GS 09), Recea (FT 87). The Romanian scientific literature also contains data on the occurrence of the Green Toad in other zones of the Someş valley: Cluj (FS 98; Fuhn, 1960), Dej (GT 12; Fuhn, 1960), Gherla (GT 21; Fuhn, 1960) and Năsăud (LN 03; Cogălniceanu, 1961). The Green Toad is highly adaptable species, occurring even in big human settlements.

12. *Hyla arborea* (European Tree Frog) was not observed during the Someş-Szomes Expedition (due to the timing of the investigations), even if this frog is relatively common species in the Someş river catchment area. The author have identified populations in the following sites, close to the Someş river valley (Török, 1997b): Ardusat (FT 77), Bozinta Mica (FT 87), Busag (FT 88), Buzeşti (FT 77), Cicărlău (FT 88), Ilba (FT 78), Lucăceşti (FT 76), Pribileşti (FT 77), Sabisa (FT 76), Sârbii Fărcaşa (FT 77), Tohat (FT 76) , Ulmeni (FT 75). The European Green Frog was also mentioned by Bielz (1888) from Năsăud (LN 03) and by Fuhn (1960) from Cluj (FS 98), Dej (GT 12) and Gherla (GT 21).

13. and 14. *Rana esculenta* (Edible Frog), *Rana ridibunda* (Marsh Frog) and hybrids of the two species were mentioned by various authors from the following sites:
Rana esculenta - Dej (GT 12; Fuhn, 1960), Gherla (GT 21; Boulenger, 1897), Năsăud (LN 03; Bielz, 1888) and probably Satu Mare (FT 39; Cogălniceanu and Tesio, 1991)
Rana ridibunda - Gherla (GT 21; Fuhn, 1960), probably Seini (FT 79; Cogălniceanu and Tesio, 1991) and Someşeni (GS 09; Bielz, 1888)
hybrids between *Rana esculenta* and *Rana ridibunda* - in their article, Cogălniceanu and Tesio (1993) mentioned green frog hibrids from Cluj (FS 98), Dej (GT 12), Gherla (GT 21) and probably Seini (FT 79).
During the Someş/Szamos Expedition we have observed specimens belonging to „esculenta" complex at: Beclean (KN 82), Dej (GT 12), Gherla (GT 21), Sârbii Fărcaşa (FT 77) and Vetiş (FT 39). The author has found green frogs in several other places of the Someş river catchment area (see Török, 1997b).

15. *Rana dalmatina* (Agile Frog) was not observed during the expedition, but other studies of the author (Török 1997b; Török and Béres, 1996) show the existence of the species in hilly areas of the Someş basin: Baciu Gorge (FS 98), Cluj (FS 97), Fersig (FT 76). The species was also mentioned Méhely (1891) from Bont (GT 20), Dej (GT 12) and Gherla (GT 21). The clearance of the forested areas had a negative impact on this species, only small and isolated populations surviving in the close vicinity of the Someş river.

16. *Rana temporaria* (Common Frog) is more common in the undisturbed mountain areas. During the Someş/Szamos Expedition we could observe the Common Frog in two stations from the Apuseni Mountains (FS 46 and FS 66) and in Rodnei Mountains (LN 04). In each case many young and old specimens could have been found in relatively small surfaces (stripe-like wetlands along the shoreline of the watercourses). The species was also mentioned in the scientific literature at Cluj (FS 98; Méhely, 1891) and Năsăud (LN 03; Bielz, 1888). The author identified the species at Baciu Gorge (FS 98) area placed at about 5 km northward to the Someşul Mic river.

17. *Rana arvalis* (Moor Frog) was practically eradicated from the Someşelor Plateau, Baia Mare Basin and Someşului Plain. In the past the species was known in several sites: Apa (FT 69; Micluţa, 1969), Baia Mare (FT 98; Micluţa, 1969), Bonţida (GT 20; Méhely, 1891), Cluj (Fejérváry-Langh, 1943), Dej (GT 12; Méhely, 1891) and Gherla (GT 21; Méhely, 1891). The last living specimen from Cluj was captured in 1951 at a wetland situated at the limit of the city (Stugren and Popovici, 1960). In the early 50's the wetland was drained, a new neighbourhood was established and since then no other Moor Frog was observed in the area (Stugren, 1983). The population from Baia Mare had the same evolution: drainage of the wetland and occurrence of buildings caused the total disappearance of the local Moor Frogs (Török and Béres, 1996). In case of the other sites there are no recent information on the existence or non-existence of the species.

Conclusions.

Scientific literature contains data on 17 species of amphibians from the Someş river valley. During the Someş/Szamos expedition we have identified 8 species in various sampling sites. Other investigations (carried out by the author in the same year in the same hydrological basin, in sites situated in the vicinity of Someş river) provided information on other 7 species. The Moor Frog (*Rana arvalis*) seems to be the only one species which became extinct in most of the sites where there were local populations few decades ago. The Danube Crested Newt was not recorded from the Someş river valley, but it is highly probable the occurrence of the species in the lower parts of Someş basin.

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Avifauna of the River Someş/Szamos[1] valley

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Introduction

The avifauna of the Someş valley was not studied systematically until present time. Only some data with avifaunistical character are published by Antal & Libus 1975, Béldi & Mannsberg 1970, Béres 1977, Filipaşcu 1966, Korodi 1974, Munteanu 1983 from certain parts of the investigated area. The main aim of this study is to elaborate a general survey of the avifauna of the Someş valley and its tributaries and to give an image about the avifauna of this relatively densely populated area as well as a first complete checklist of the Someş valley in order to fix a starting point for future investigations. Special attention was payed to complete the distribution of existing species (Weber, Munteanu, Papadopol 1994) and the avifaunistical list of the Someş valley.

Keywords: avifauna, Someş/Szamos valley

Methods

All data are collected by direct observations during the summer of 1992. The avifaunistical observations were made in each station systematically along the Someşul Rece, Someşul Cald, Someşul Mic, Someşul Mare and the „united“ Someş until its confluence with the Tisza river. The avifaunistical list was completed with other occasional data and with those found in literature.

At each station a transect of 1 km length was precisely investigated qualitatively and quantitatively during an hour, using mostly acoustic mode of counting in *Passerinae* species, and the presence and especially all typical signs of breeding avifauna was noted. The whole observation and transect counting was carried out between 2-13 and 18-24 June and repeated between 20 July - 7 August 1992. The localisation of counted 10 ha transects is figured in the attached map. In Hungary it was possible only during the last trip, where the surroundings of Vásárosnamény was investigated even at the confluence of the Someş and the Tisza.

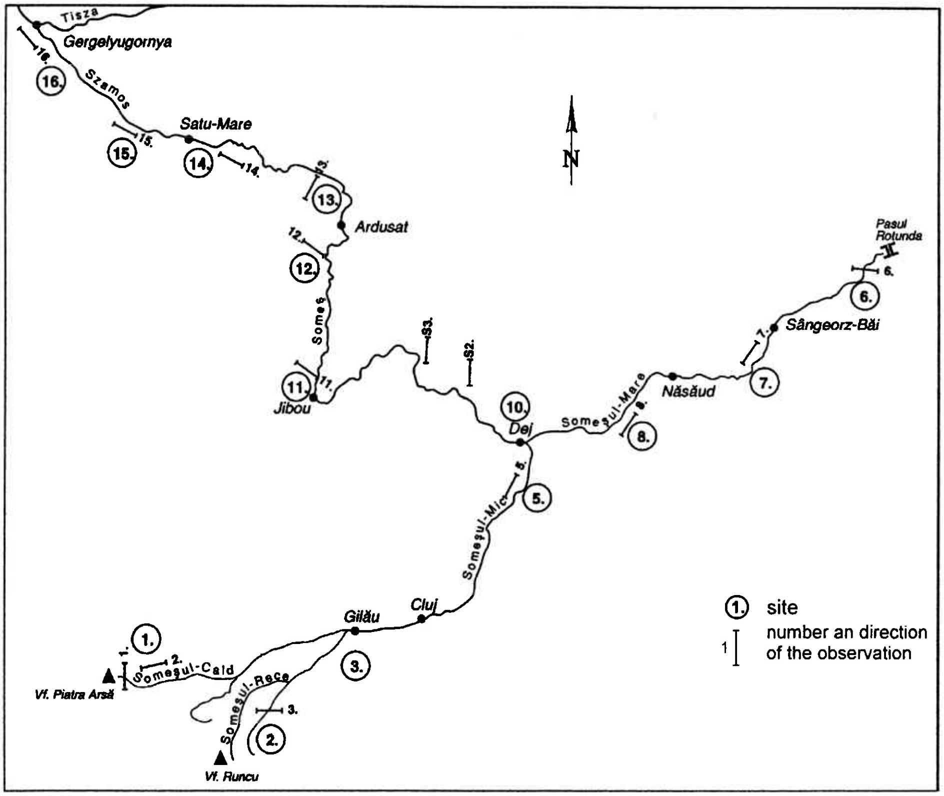
Results

The present avifaunistical checklist of the Someş valley include a number of 226 species with different status. In this number, all observations and avifaunistical information available are included. This number cannot be considered as definitive. Our

[1] The first name is Romanian, and the second Hungarian

list is surely not complete, we miss especially data about migrating and wintering species. The distribution of breeding species at 13 stations and 3 special bird-counting places are summarised in an attached table. We consider as breeding species those from which we collect direct (Figure 1.) and indirect data about breeding (nests, pull, imm., singing, territorial pairs).

Number/ observation station (see Map)



Map

1. Ic Ponor/ Bazarul Someşului
2. Ic Ponor/ Moloh-Rădeasa
3. Blăjoaia/ Someşul Rece
4. Upwards of Cluj
5. Downwards of Gherla
6. Downwards of Şanţ Arinu
7. Downwards of Sângeorz Băi
8. Downwards of Năsăud
9. Ineu/ Cabana Brazilor
S1 Vârful Roşu

10. Downwards of Dej
S2 Dej/ Căşeiu
S3 Căşeiu
11. Someş-Odorhei/ Năpradea
12. Sălsig
13 Downwards of Baia Mare/ Pomi
14. Upwards of Satu Mare
15. Downwards of Satu Mare/ Vetiş
16. Vásárosnamény/ Hungary

Station	1	2	3	4	5	6	7	8	9	S1	10	S2	S3	11	12	13	14	15	16
No.of breeding species	9	16	17	8	15	22	33	14	17	3	13	6	10	7	9	9	14	15	16

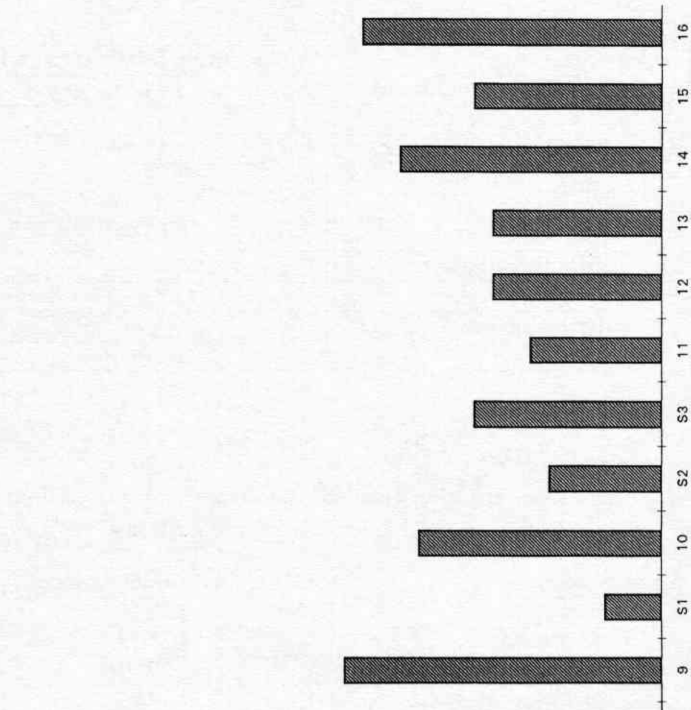


Figure 1. Number of breeding species

Transect 1.
Ic Ponor/ Bazarul Someşului
River bed, very abrupt stoneslopes, 60 years old spruce forest at the upper parts of the slope.

Nr.	Species	Abundance	Dominance (%)
1.	Troglodytes troglodytes	7	24.13
2.	Erithacus rubecula	5	17,24
3.	Phylloscopus collybita	4	13,79
4.	Motacilla cinerea	6	20,68
5.	Cinclus cinclus	2	6,89
6.	Parus caeruleus	2	6,89
7.	Pyrhulla pyrhulla	1	3,44
8.	Fringilla coelebs	1	3,44
9.	Turdus merula		
Total		29	100

Transect 2.
Ic Ponor/ Moloh-Rădeasa
Left riverside, stony slope from the riverbed, moderately steep, predominantly with spruce-wood, few beech at the slope, moderately grazed pasture at the top.

Nr.	Species	Abundance	Dominance (%)
1.	Parus ater	16	28,07
2.	Parus cristatus	18	31,57
3.	Parus caeruleus	6	10,52
4.	Nucifraga caryocatactes	4	7,01
5.	Regulus regulus	6	10,52
6.	Phylloscopus collybita	3	5,26
7.	Troglodytes troglodytes	2	3,5
8.	Erithacus rubecola	2	3,5
9.	Loxia recurvirostra	2	3,5
10.	Motacilla cinerea	4	7,01
11.	Cinclus cinclus	2	3,5
12.	Falco tinunculus	1	1,75
13.	Fringilla coelebs	1	1,75
14.	Phylloscopus trochillus	1	1,75
15.	Turdus viscivorus	1	1,75
16.	Dryocopus martius	1	1,75
17.	Pyrhulla pyrhulla	3	5,26
Total		57	100

Transect 3.
Blăjoaia/ Someşul Rece
60 years old spruce forest at the slopes, 20 % moderately grazed pasture.

Nr.	Species	Abundance	Dominance (%)
1.	Fringilla coelebs	6	8,21
2.	Parus ater	14	19,17
3.	Regulus regulus	10	13,69
4.	Turdus viscivorus	7	9,58
5.	Hirundo rustica	8	10,95
6.	Motacilla alba	4	5,44
7.	Parus caeruleus	7	9,58
8.	Pyrhulla pyrhulla	3	4,1
9.	Phoenicuros ochrulus	2	2,72
10.	Dendrocopos major	2	2,72
11.	Nucifraga caryocatactes	1	1,36
12.	Lanius collurio	2	2,72
13.	Muscicapa striata	2	2,72
14.	Phylloscopus trochillus	2	2,72
15.	Phylloscopus collybita	1	1,36
16.	Garrulus glandarius	1	1,36
17.	Buteo buteo	1	1,36
Total		73	100

Transect 5.
Gherla
Left riverside, sparsely forested riverbank, agricultural area in the valley, 20 years old oak-, beech- and maple trees at the slopes.

Nr.	Species	Abundance	Dominance (%)
1.	Fringilla coelebs	7	23,33
2.	Parus major	5	16,66
3.	Parus caeruleus	4	13,33
4.	Coccothraustes coccothraustes	2	6,66
5.	Sitta europaea	2	6,66
6.	Sylvia atricapilla	1	3,33
7.	Dendrocopos major	1	3,33
8.	Emberiza citrinella	1	3,33
9.	Lanius collurio	1	3,33
10.	Erithacus rubecula	1	3,33
11.	Turdus merula	1	3,33
12.	Turdus philomelus	1	3,33
13.	Carduelis chloris	1	3,33
14.	Garrulus glandarius	1	3,33
15.	Falco tinnunculus	1	3,33
Total		57	100

Transect 7.
Sângiorz Băi
Agricultural area, both slopes partly covered by beech- and pinewood, and partly by pasture.

Nr.	Species	Abundance	Dominance (%)
1.	Phylloscopus collybita	8	12,88
2.	Parus major	8	12,88
3.	Aegithalus caudatus	2	3,22
4.	Fringilla coelebs	2	3,22
5.	Turdus pilaris	2	3,22
6.	Carduelis cannabina	2	3,22
7.	Carduelis chloris	2	3,22
8.	Motacilla alba	3	4,83
9.	Parus caeruleus	3	4,83
10.	Carduelis carduelis	2	3,22
11.	Lanius collurio	2	3,22
12.	Passer domesticus	2	3,22
13.	Saxicola rubetra	2	3,22
14.	Corvus cornix	2	3,22
15.	Parus palustris	1	1,61
16.	Sylvia borin	1	1,61
17.	Sylvia atricapilla	1	1,61
18.	Oenanthe oenanthe	1	1,61
19.	Pica pica	1	1,61
20.	Phylloscopus trochilus	1	1,61
21.	Anthus trivialis	1	1,61
22.	Sitta europaea	1	1,61
23.	Emberiza citrinella	1	1,61
24.	Garrulus glandarius	1	1,61
25.	Erithacus rubecula	1	1,61
26.	Troglodytes troglodytes	1	1,61
27.	Parus palustris	1	1,61
28.	Turdus philomelos	1	1,61
29.	Turdus merula	1	1,61
30.	Picus viridis	1	1,61
31.	Dendrocopos major	1	1,61
32.	Accipiter gentilis	1	1,61
33.	Buteo buteo	1	1,61
34.	Falco tinnunculus	1	1,61
Total		62	100

Transect 8.
Năsăud .
Riversides with willow and alder bushes, agricultural area in the valley, pasture covered the slopes and the wooded hilltops.

Nr.	Species	Abundance	Dominance (%)
1.	Carduelis carduelis	6	13,04
2.	Parus major	4	8,68
3.	Motacilla alba	4	8,68
4.	Passer domesticus	16	34,78
5.	Pica pica	2	4,34
6.	Corvus cornix	2	4,34
7.	Lanius collurio	2	4,34
8.	Troglodytes troglodytes	2	4,34
9.	Oriolus oriolus	2	4,34
10.	Parus major	1	2,17
11.	Parus caeruleus	1	2,17
12.	Saxicola rubetra	1	2,17
13.	Dendrocopos major	1	2,17
14.	Turdus merula	1	2,17
15.	Buteo buteo	1	2,17
Total		46	100

Transect 9.
Ineu/ Cabana Brazilor
Alpine limit of forest and alpine pasture, 1000-1400 m altitude, some buildings, pygmy pine and juniper thickets .

Nr.	Species	Abundance	Dominance (%)
1.	Anthus spinoletta	8	9,6
2.	Parus ater	18	19,2
3.	Regulus regulus	15	18
4.	Motacilla alba	15	14,4
5.	Carduelis cannabina	12	7,2
6.	Fringilla coelebs	6	7,2
7.	Lanius collurio	6	2,4
8.	Loxia curvirostra	2	3,6
9.	Turdus torquatus	3	3,6
10.	Prunella collaris	3	2,4
11.	Nucifraga caryocatactes	2	1,2
12.	Oenanthe oenanthe	1	1,2
13.	Corvus corax	1	1,2
14.	Falco tinnunculus	1	1,2
15.	Serinus serinus	1	1,2
16.	Phoenicurus ochrulus	1	1,2
17.	Buteo buteo	1	1,2
Total		83	100

Transect S1.

Vârful Roşu

Alpine pasture, 1200- 1400 m altitude, *Rhododendron*, pygmy pine and juniper thickets, extremely overgrazed, some abrupt vertical stoneslopes and walls.

Nr.	Species	Abundance	Dominance (%)
1.	Prunella collaris	2	16,66
2.	Anthus spinoletta	10	83,34
Total		12	100

Transect S2.

Dej/ Căşeiu.

River valley, intensive agricultural area, sparsely bushed line along the riverside, scarce pasture, heavy polluted water, big rubblebanks in the riverbed.

Nr.	Species	Abundance	Dominance (%)
1.	Charadrius dubius	2	6,24
2.	Tringa hypoleucos	1	3,12
3.	Parus major	4	12,5
4.	Motacilla alba	2	6,24
5.	Sylvia communis	1	3,12
6.	Passer domesticus	22	68,73
Total		32	100

* Ardea cinerea 3 ind. not nesting

Transect S3.

Căşeiu.

River valley with small bushline at both riversides, intensive agriculture in the valley, some abrupt walls at both riversides.

Nr.	Species	Abundance	Dominance (%)
1.	Motacilla alba	1	11,11
2.	Streptopelia decaocto	2	22,22
3.	Columba palumbus	1	11,11
4.	Oriolus oriolus	1	11,11
5.	Picus viridis	1	11,11
6.	Sturnus vulgaris	3	33,33
Total		9	100

* Alcedo atthis 1 ind. not nesting
* Ciconia ciconia 1 ind. not nesting

Transect 11.
Someş-Odorhei/ Năpradea.
Treeless or very scarcely bushed riversides, few old willow trees, big rubblebanks, intensive agriculture in the whole valley.

Nr.	Species	Abundance	Dominance (%)
1.	Passer montanus	8	38,08
2.	Motacilla alba	5	23,8
3.	Carduelis carduelis	4	19,04
4.	Carduelis cannabina	2	9,52
5.	Emberiza citrinella	1	4,76
6.	Charadrius dubius	1	4,76
Total		21	100

Transect 12.
Sălsig.
Few willow trees and willow-thicket at right riverside, big rubblebanks, intensive agricultural area.

Nr.	Species	Abundance	Dominance (%)
1.	Passer montanus	10	40
2.	Passer domesticus	6	24
3.	Carduelis carduelis	4	16
4.	Motacilla alba	2	8
5.	Galerida cristata	1	4
6.	Phasianus colchicus	1	4
7.	Charadrius dubius	1	4
Total		25	100

* Egretta alba 1 ind. not nesting
* Ardea cinerea 1 ind. not nesting
breeding col. in Agrişu de Jos

Transect 13.
Downwards Baia Mare/ Pomi
Left riverside, intensive agriculture, willow-bushes along the riverside, big rubblebanks, some extremely overgrazed pasture.

Nr.	Species	Abundance	Dominance (%)
1.	Carduelis cannabina	3	16,65
2.	Passer montanus	4	22,2
3.	Sylvia atricapilla	2	11,1
4.	Motacilla alba	2	11,1
5.	Parus major	2	11,1
6.	Pica pica	2	11,1
7.	Lanius collurio	1	5,55
8.	Galerida cristata	1	5,55
9.	Charadrius dubius	1	5,55
Total		18	100

Transect 15.
Satu Mare/ Vetiş.
Big sand and rubblebanks, few willow bushes at both riversides, in some places abrupt riversides, agricultural area. The riverbank is partly used as a beach and camping site by people.

Nr.	Species	Abundance	Dominance (%)
1.	Alcedo atthis	1	6,66
2.	Falco tinnunculus	1	6,66
3.	Tringa hypoleucos	1	6,66
4.	Charadrius dubius	1	6,66
5.	Acrocephalus palustris	1	6,66
6.	Pica pica	1	6,66
7.	Sturnus vulgaris	7	46,62
8.	Streptopelia decaocto	2	13,33
Total		15	100

* Larus ridibundus 400 ind.

Transect 16.
Vásárosnamény .
Wooded riversides, gallery forest at the confluence of the Someş and theTisza, some sandbanks, right riverside partly covered by weekend cottages, garden-zone, beach. Intensive agricultural area.

Nr.	Species	Abundance	Dominance (%)
1.	Passer montanus	18	23,58
2.	Parus major	15	19,65
3.	Carduelis carduelis	6	7,86
4.	Carduelis chloris	5	6,55
5.	Parus caeruleus	5	6,55
6.	Acrocephalus palustris	3	3,93
7.	Phylloscopus collybita	3	3,93
8.	Oriolus oriolus	2	2,62
9.	Fringilla coelebs	2	2,62
10.	Columba palumbus	2	2,62
11.	Streptopelia turtur	2	2,62
12.	Aegithalos caudatus	2	2,62
13.	Pica pica	2	2,62
14.	Alcedo atthis	1	1,31
15.	Tringa hypoleucos	1	1,31
16.	Charadrius dubius	1	1,31
17.	Motacilla alba	1	1,31
18.	Muscicapa striata	1	1,31
19.	Sitta europaea	1	1,31
20.	Dendrocopos major	1	1,31
21.	Lanius collurio	1	1,31
22.	Motacilla flava	1	1,31
23.	Turdus philomelos	1	1,31
24.	Hippolais icterina	1	1,31
25.	Ciconia ciconia	1	1,31
26.	Hirundo rustica	22	28,82
27.	Sturnus vulgaris	20	26,2
28.	Streptopelia decaocto	15	19,65
Total		76	100

The avifauna of the Someş valley is typical of the studied area (North-Transylvania). Excepting the upper, montane, scarcely populated beech-spruce forests, a part of the river valley and its tributaries, the anthropogenic activity affects in high degree the natural biotopes, i.e. the whole valley is intensively used by agriculture. The intensive agricultural exploitation and dense population affects heavily on the natural habitats and also on the avifauna along the river. Higher abundance level is reached only in the upper, montane part of the Someş valley and at its confluence with the Tisza river.

Considering all published data available – Antal & Libus 1975 (43 species), Béldi & Mannsberg 1970 (92 species), Béres 1977 (222 species), Filipaşcu 1966 (113 species), Korodi 1974 (148 species), Munteanu 1989 (87 species) – and including our own observations of summer 1992, the avifauna of the Someş valley contains 226 species. Among these species there are a few species extinct and from Romania, , e.g. *Aegypius monachus*, *Gyps fulvus*. Taking into consideration the new water accumulation at the Someş river and their attraction for waterbirds, this list will surely be increase in the future.

The species abundance and dominance level varies in each studied transect. Natural habitats, especially beech- and sprucewood, but also areas with smaller anthropogenic impact in the middle reaches of the Someş river accommodate a numerous bird species in high abundance. In some cases the extensive agricultural use of land has not a negative influence on the avifauna; moreover in special instances and places the anthropogenic activities contribute to an increased biodiversity of vegetation and better breeding and feeding conditions for some bird species. Nevertheless intensively exploited agricultural areas, especially in the middle reaches of the Someş valley, contain barely poor avifauna, with a few species and reduced number of some common species. The abundance varies from a minimum of 9 breeding pairs of 6 species in 10 ha, found in transect Căşeiu, to a maximum met in transect Ineu-Cabana Brazilor with 83 pairs of 17 species and in transect Vásárosnamény with 76 pairs of 28 species of breeding birds.

Our results, comprising between the values of 290-830 pairs/km^2, found in montane regions, exceed the limits given by Munteanu (1989) for beech- and sprucewood in Bihar Mountains and are alike to those reported from Vlădeasa Mountain. There are no quantitative data available for comparative studies on the middle and, partly on the lower section of the Someş valley.

In the spring area of all Someş tributaries the human impact is relatively low. These mostly woody areas have just a small number of inhabitants and a very low population density. With a few exceptions, in such hardly disturbed and mostly natural habitats a typical -but not special- montane bird fauna occurs. Among the more interesting species, we mention especially *Ciconia nigra, Aquila chrysaetos, Aquila heliaca, Aquila pomarina, Hieraetus pennatus, Circaetus gallicus, Tetrao urogallus, Tetrastes bonasia, Scolopax rusticola, Glaucidum passerinum, Aegolius funereus, Bubo bubo, Strix uralensis, Picoides tridactylus, Anthus spinoletta, Motacilla cinerea, Nucifraga caryocatactes, Cinclus cinclus, Prunella collaris, Ficedula parva*, etc., which are present with considerable populations in some parts. Unfortunately, in the last few decades, some important sections of the Someş valley were transformed from natural flowing river into water catchment basins. In the same time, the populations of some bird species typical of the riverbed, as *Charadrius dubius, Tringa hypoleucos, Cinclus cinclus, Motacilla cinerea,* decreased significantly. On the other hand, the existence of large free water surfaces and a better food supply attracts waterfowls in higher number in, especially *Podicipinae, Ardeinae, Larinae* and *Anatinae*, among which we can expect some new species for the hilly and montane region.

In the middle section of the Someş valley we met a relative heavy anthropogenic impact on the natural environment, realized especially in intensive agricultural use, overgrazing and also in water pollution. The breeding bird population was relative small, containing a reduced species spectrum and dominating by some common, ubiquitous and widespread species. Relatively natural habitats, such as bush- and wood strip, trees, extensive pasture- and grassland remained only in small areas, intercalating among agricultural lands, where we could find some interesting bird species, e.g. *Pernis apivorus, Falco subbuteo, Perdix perdix, Coturnix coturnix, Crex crex, Otus scops, Athene noctua, Alcedo atthis, Merops apiaster, Upupa epops, Lanius collurio, Oriolus oriolus, Sylvia nisoria, Saxicola rubetra, Saxicola torquata, Parus lugubris* . The big sand- and rubblebanks in the middle and upper sections of the Someş valley were populated by relatively strong population of *Charadrius dubius* and *Tringa hypoleucos*.

In the lower zone of the Someş valley, as it is well demonstrated by transect 16 (Vásárosnamény), the rich bird population were strictly linked to the existence of bushy- or wooded areas. Also in this part of the Someş valley a relatively large population of *Ciconia ciconia* were found. It is also well known, that the north-western part of Romania is an important migrating route of some bird species. These routes have a decreasing importance in the last half century for *Grus grus*. Much intensive observations about migration of *Passerinae*, and also of waterfowl and *Limicolae* started only some years ago.

Conclusions

The changes in large parts of the Someş riverside had important influences upon the avifauna, species diversity and population largeness. The deforestation, construction of catchment basins, intensive agriculture in the neighbourhood of the river bed, drainage, river regulation, water pollution, and also cutting and clearing from bushes and trees along the river bed changed the whole area and endangered the whole population of bird species. The increasing anthropogenic impact along the Someş valley became strongly connected with loss of biodiversity and particularly with the loss of highly specialised bird species.

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Bird fauna of the reservoirs situated on the Someşul Cald Valley

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Abstract

This paper presents the results of the ornithological surveys performed on the reservoirs situated on the Someşul Cald Valley during the years 1977-1998. Due to the fact that these reservoirs freeze only partially during winters they become a proper wintering site for water birds. A total of 21 species were recorded on the lakes, including some common species, like *Anas platyrhynchos*, as well as some species rare in Transylvania and also in Romania, like *Phalacrocorax pygmaeus*, *Egretta alba*, *Aythya marila* and *Somateria mollissima*. Few passage birds occur during spring and autumn.

Keywords: bird fauna, reservoirs, Someşul Cald Valley

Introduction

The problem regarding the influence of reservoirs on bird fauna was brought into ornithologists' attention only during the last decades as a natural consequence of the appearance of many man-made basins on the map of Romania, created as water sources for industry and agriculture. In our country, the first concerns coincide with the creation of the first big reservoir (Bicaz Lake in the Eastern Carpathians in 1960). During the next years the ornithological research extended to other reservoirs in the Moldavian Bistriţa Valley (Munteanu, 1960-1976) and later to those in Argeş basin and along the middle section of Olt and its tributaries (Mătieş, 1969-1974). After a long break a similar research began on the lakes on Siret and on reservoir Stânca-atefăneşti on river Prut. Unfortunately, no one made similar researches, although till now about 100 reservoirs have been created in Romania. The only exceptions are the lakes on river Someşul Cald, whose waterfowl began to be studied in 1978, shortly after building of reservoirs.

The spreading of bird population on reservoirs is a very interesting biological phenomenon. It can very often be seen and it has usually three stages.

The first stage begins shortly after the establishment of the new reservoir and can last from a few months to a year. It is characterised by an occasional appearance of waterfowl, especially with migratory species on their seasonal movements. Consequently, for the birds it is the best when the reservoirs are situated on the migration routes.

After being "discovered" by the birds, the second stage begins in the evolution of the lake, namely the development of the bird fauna. This stage is longer, lasts about 2-6 years, and it can be seen as an evolving, irregular phenomenon. It can trace important differences from one year to another from the point of view of bird fauna. It is an uncertain period, when the population size varies on short intervals or when certain species occur and disappear very irregularly. During this period the reservoirs have no regular breeding species. The biggest number of birds can be registered during the passage periods and some species (resident or winter visitors) during winter as these reservoirs usually freeze only partially in the second half of the winter.

After some years, when the bird fauna is developed, begins the stage of stability when certain species appear periodically and in constant number. We can now draw a "calendar" of arrivals and departures and the population size is almost the same. Birds get used to settle on the lake either for some hours or days during passage, or for months during the cold season. Moreover some species begin to breed on these newly created lakes or on their shores in the aquatic vegetation. The almost constant situation does not exclude the occurrence of some unusual events such as rapid increases or decreases in population number, species rare for that geographical area can occur or certain species can be present in unusual periods.

Among the four reservoirs in Someşul Cald basin, the most densely populated with waterfowl is Gilău Lake, due to the fact that it lies the closest to the hilly area (more accessible for birds), and also because of the rich food supply. The process of silting and eutrophication is obvious in the western area, proved by the marsh vegetation. This place became the feeding area of mallards, while the opposite bank where the forest vegetation reaches the water is ideal for breeding.

The Someşul Cald Lake very often shelters waterfowl, which come from Gilău, while birds on the Tarniţa Lake and Beliş Lake are very rare. Consequently, the following lines will refer only to the first two reservoirs mentioned, namely to Gilău and Someşul Cald.

Results of Ornithological Surveys

Ord. Gaviiformes

Gavia stellata	Occasional: 19.11.1994 (1 individual).
Gavia arctica	Rare, 5 winter records (14.02.1977, 23.03.1977, 9.01.1988, 28.09.1994, 8.02.1995).

Ord. Podicipediformes

Podiceps ruficollis	Present constantly in small number (max. 15 individuals) during the cold season (X - III). Bred at Gilău in 1988 (2 families with chicks on 20.08.1988).
Podiceps cristatus	Appears rarely, irregularly in different months, except IV-VII, each time 1-3 individuals.
Podiceps grisegena	Occasional, 23.03.1977 (2), 19.04.1988 (1 ind.)

Ord. Pelecaniformes

Phalacrocorax carbo	Occasional, in the cold season: 11.12.1993 (2 ind.), 11.03.1995 (1 ind.).
Phalacrocorax pygmaeus	Occasional, during winter: 21.01.1994 (2 ind.), 19.12.1998 (3 ind.).

Ord. Ciconiiformes

Egretta alba	Occasional: 26.11.1993 (2 ind.), 11.12.1993 (2 ind.).
Ardea cinerea	Occasional, although it can be seen frequently on the rivers in the Transylvanian Plain. There are only 3 records: 4.09.1980, 28.07.1981, 11.12.1993 (1-6 ind.).
Ciconia nigra	One record: 2 adults on 16-18.06.1998.

Ord. Anseriformes

Tadorna tadorna	Occasional: 26.11.1993 (1+1 ind.).
Cygnus olor	Occasional, in the winter months (XI-II); it was recorded 5 times (2-12 individuals).
Cygnus cygnus	5 records: 14.01, 17.01 and 25.02.1996 (1 ind, probably the same), 10.03.1996 (1), 19.12.1998 (1 adult + 1 chick).
Anas platyrhynchos	It is the most frequent species of the reservoirs, mainly as a winter visitor. Small groups of some tens of individuals arrive by the end of October and their number increase in November. Generally up to 2,000-2,500 individuals remain on these reservoirs during the winter months, most of them on Gilău. The maximum number of about 4,300 individuals was recorded during the winter 1995/1996. On the other hand, in *figure 1* it can be observed, that a small number of mallards was recorded during 1978-1987 and a slight increase happened in the following years when 2,000 individuals were recorded in the winter 1992/1993. Then, the total number varied between 2,000-4,000 individuals. Mallards from Gilău and Someşul Cald fly every evening regularly over Cluj and feed on river Someş, up-stream the town (Someşeni, Apahida, Jucu) and they return to the reservoirs early in the morning.
Anas acuta	Occasional, in the cold season: 07.01.1993 (1), 26.11.1993 (1), 25.02.1996 (5), 02.02.1997 (5).
Anas crecca	It is sometimes observed late autumn (X-XI – passage individuals) and constantly during January-February (10-65 individuals – winter visitors). The latest observation was made on 11.03.1995.
Anas querquedula	Occasional during the spring passage: 07.03.1983 (7), 19.04.1988 (7), 23.03.1998 (12).

Anas penelope	Occasional during the cold season, from October till March (13 records, maximum 11 individuals).
Anas strepera	Occasional: 25.01.1990 (1 ind.).
Netta rufina	Occasional, during winter 1994/1995: 15.01, 08.02 and 16.02.1995 (1, possibly the same).
Aythya ferina	Appears more often especially in the second half of the winter (months I, II), usually in small groups (max. 12 ind. on 17.01.1996); two records in the second half of the summer (28.07.1981, 20.08.1983).
Aythya nyroca	Occasional: 04.04.1977 (7), 24.01.1996 (1 ind.).
Aythya marila	Occasional: 21.01.1994 (1), 17.01.1996 (1 pair).
Aythya fuligula	Although during passage it can be only occasionally seen on reservoirs (9 records between December and March), it is not rare on the rivers in the plain.
Somateria mollissima	Exceptional occurrence both in Romania and on the studied reservoirs: one immature male on Gilău on 14.01.1996.
Bucephala clangula	It is a constant species on the reservoirs, being present during winter months (XII-II, rarely until III), although in small number (max. 27 individuals on 17.01.1996).
Mergus merganser	Occasional with only six records: 31.12.1980 (2 females), 24.01.1996 (1), and four records in January-February 1997 (2-11 individuals).
Mergus albellus	Occasional, it was recorded on 25.11.1995 (12), 12.01.1997 (1 individual) and 20.01.1997 (1 female), 19.12.1998 (1 female).

Ord. Gruiformes

Fulica atra	Arrives on the reservoirs by the end of October (nevertheless there are 2 records from September); it was observed here until the beginning or middle of March. Generally can 40-60 coots be seen, but sometimes even 140-200 individuals were observed (21.01.1994. 30.01.1995, 16.02.1995). Its departure seems to be in close relation with weather conditions, or, to be more precise, with the defrost of rivers in the plain.

Ord. Charadriiformes

Tringa erythropus	Occasional, 18.06.1998 (1 ind.).
Larus ridibundus	Although during the last 6-7 winters the black-headed gull has been observed regularly and in big number on the river Someşul Mic at Cluj, it comes rarely, almost occasionally to Gilău-Someşul Cald reservoirs, and stays only for short periods (even less than an hour). The records come from winter months (XI-I) and only one from September. Varying number, 1-90 individuals.
Chlidonias niger	Occasional, during spring passage: 01.05.1993 (2), 14.05.1993 (2). Conclusions

Reservoirs of the river Someşul Cald constitute especially a roosting site for the waterfowl during winter. Up to now 31 bird species were observed, belonging to 7 orders. The data about their number, observations and frequency are presented in Table 1. The following species can constantly be seen here during the cold season: *Anas platyrhynchos* (by far with the biggest population), *Podiceps ruficollis*, *Aythya ferina, Fulica atra* (partial migrant in Romania), *Anas crecca* and *Bucephala clangula* (winter visitors in Romania).

Other species observed during winter are as follows:
a)Winter visitors in Romania: *Gavia arctica, Gavia stellata, Aythya marila, Aythya fuligula, Cygnus cygnus, Mergus merganser, Mergus albellus;*
b)Partial migratory species: *Phalacrocorax carbo, Phalacrocorax pygmaeus, Cygnus olor, Larus ridibundus;*
c)Breeding, mostly migratory species among which only a few individuals spend the winter locally in Romania: *Podiceps cristatus, Anas strepera, Netta rufina, Aythya nyroca;*
d)Passage migrants in Romania, rarely occur during winter: *Anas penelope, Anas acuta.*

In spring and autumn individuals of some species migrating on the lowlands of Transylvania reach occasionally the mountain reservoirs, such as *Podiceps grisegena, Anas penelope, Anas querquedula, Chlidonias niger.*

By the second half of summer individuals of species breeding in Transylvania appear occasionally, such as *Podiceps cristatus, Ardea cinerea, Aythya ferina.*

Finally, some species occuring very rarely in Transylvania have also been observed on the reservoirs on river Someş, either in winter or during migration periods. They are *Phalacrocorax carbo, Phalacrocorax pygmaeus* (already cited at point b), *Egretta alba, Tadorna tadorna, Netta rufina, Somateria mollissima.*

If the winter and during migration the bird fauna is very rich (21 species), while the breeding fauna is represented only by mallard (*Anas platyrhynchos*) and little grebe (*Tachybaptus ruficollis*), with a maximum of 2-3 pairs in both species.

Going upstream the Someşul Cald river, the deeper in the mountains the reservoirs are situated, the less populated with birds, and almost only during winter (when they do not freeze). The only constant species on the Someşul Cald reservoir during the cold season is mallard (about 150-2,000 individuals) and little grebe (sporadic, isolated individuals) while on the Tarniţa and Beliş reservoirs mallard stops only occasionally, for short periods.

All these data prove (also for Someşul Cald valley) that the reservoirs situated in the Carpathian area attract waterfowl especially during their seasonal movements or during winter as long as they do not freeze. To a smaller degree they become roosting sites for wide distributed species as mallard.

On the other hand, none of the species mentioned above stop on the mountain rivers, such as Someşul Rece or Someşul Cald (upstream Tarniţa reservoir), since because of their rapid flow they do not suit for waterfowl as roosting site and cannot offer enough trophic resources.

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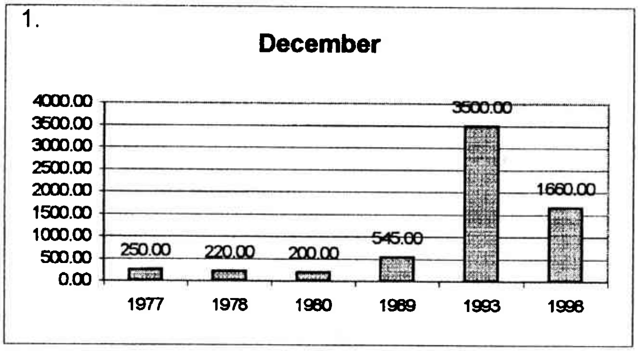
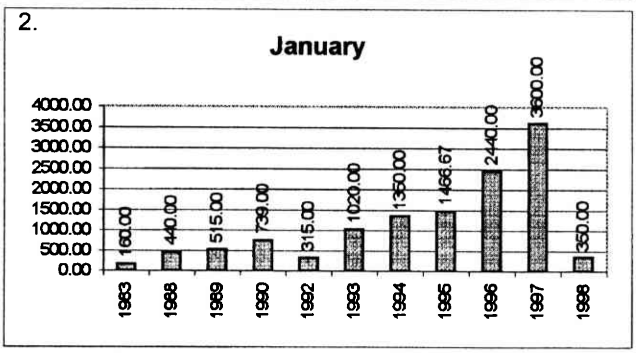
	No of recorded birds	% from the total	No of days of recording	Species frequency %
Anas acuta	12	0.01328%	4	5.26316%
Anas crecca	557	0.61623%	24	31.57895%
Anas penelope	73	0.08076%	13	17.10526%
Anas platyrhynchos	86668	95.88335%	72	94.73684%
Anas querquedula	26	0.02876%	3	3.94737%
Anas strepera	1	0.00111%	1	1.31579%
Ardea cinerea	13	0.01438%	5	6.57895%
Aythya ferina	93	0.10289%	21	27.63158%
Aythya fuligula	48	0.05310%	9	11.84211%
Aythya marila	3	0.00332%	2	2.63158%
Aythya nyroca	8	0.00885%	2	2.63158%
Bucephala clangula	128	0.14161%	24	31.57895%
Chlidonias niger	4	0.00443%	2	2.63158%
Ciconia nigra	2	0.00221%	1	1.31579%
Cygnus cygnus	6	0.00664%	5	6.57895%
Cygnus olor	30	0.03319%	5	6.57895%
Egretta alba	4	0.00443%	2	2.63158%
Fulica atra	2321	2.56779%	42	55.26316%
Gavia arctica	7	0.00774%	5	6.57895%
Gavia stellata	1	0.00111%	1	1.31579%
Larus cachinnans	1	0.00111%	1	1.31579%
Larus ridibundus	160	0.17701%	7	9.21053%
Mergus albellus	15	0.01659%	4	5.26316%
Mergus merganser	24	0.02655%	6	7.89474%
Netta rufina	3	0.00332%	3	3.94737%
Phalacrocorax carbo	3	0.00332%	2	2.63158%
Phalacrocorax pygmaeus	5	0.00553%	2	2.63158%
Podiceps cristatus	15	0.01659%	8	10.52632%
Podiceps grisegena	3	0.00332%	2	2.63158%
Podiceps ruficollis	151	0.16706%	29	38.15789%
Somateria mollissima	1	0.00111%	1	1.31579%
Tadorna tadorna	2	0.00221%	1	1.31579%
Tringa erythropus	1	0.00111%	1	1.31579%
	90389			

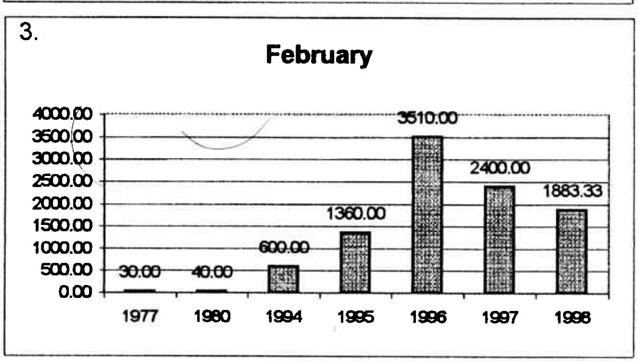
Table 1. Quantitative data of bird species recorded on reservoirs

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Gavia arctica	×	× ×	×						×			
Gavia stellata											×	
Podiceps ruficollis	———	———	———					×	×	× × ×	———	———
Podiceps cristatus	×	×	×					×	×		×	
Podiceps grisegena			×	×								
Phalacrocorax carbo			×									×
Phalacrocorax pygmaeus	×											×
Egretta alba											×	×
Ardea cinerea							×		×			×
Cygnus olor	× ×	×									×	×
Cygnus cygnus	×	×	×									×
Tadorna tadorna											×	
Anas penelope	×	× ×	× ×							×	×	
Anas strepera	×											
Anas crecca	———	———	———						× ×	× ———	———	———
Anas platyrhynchos	———	———	——— ×	× × ×	× × ×	×	×	× × ×	× × ×	× × ———	———	———
Anas acuta	×	× ×									×	
Anas querquedula			× ×	×								
Netta ruffina	×	× ×										
Aythya ferina	———	———					×	×		×	×	× ×
Aythya nyroca	×			×								
Aythya fuligula	×	×	×									×
Aythya marila	× ×											
Somateria mollissima	×											
Bucephala clangula	———	———	———									———
Mergus albellus	× ×										×	×
Mergus merganser	×											×
Fulica atra	———	———	× × ×						× ×	× ×	× × ———	———
Chlidonias niger					× ×							
Larus ridibundus	×								×		× ×	×
Ciconia nigra						×						
Tringa erythropus						×						

Table 2. Periods of bird presence on reservoirs







Figures 1,2,3. Average numbers of mallards (*Anas platyrhynchos*) observed in winter months.

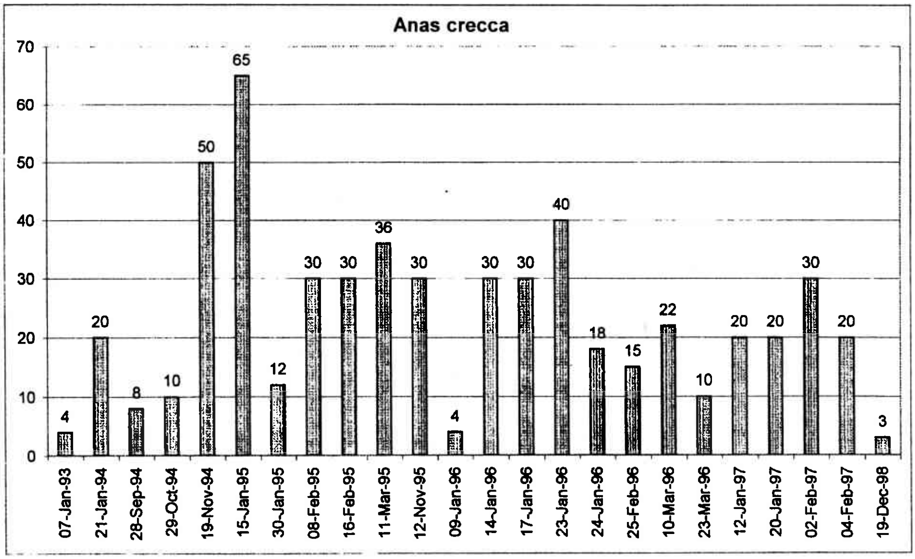


Figure 4. Results of daily counts of Teal *(Anas crecca)*

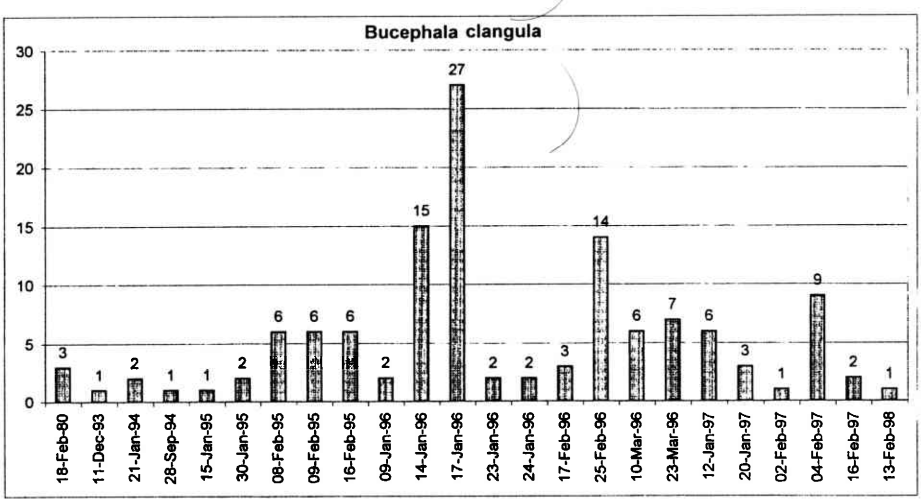


Figure 5. Results of daily counts of Goldeneye *(Buchephala clangula)*

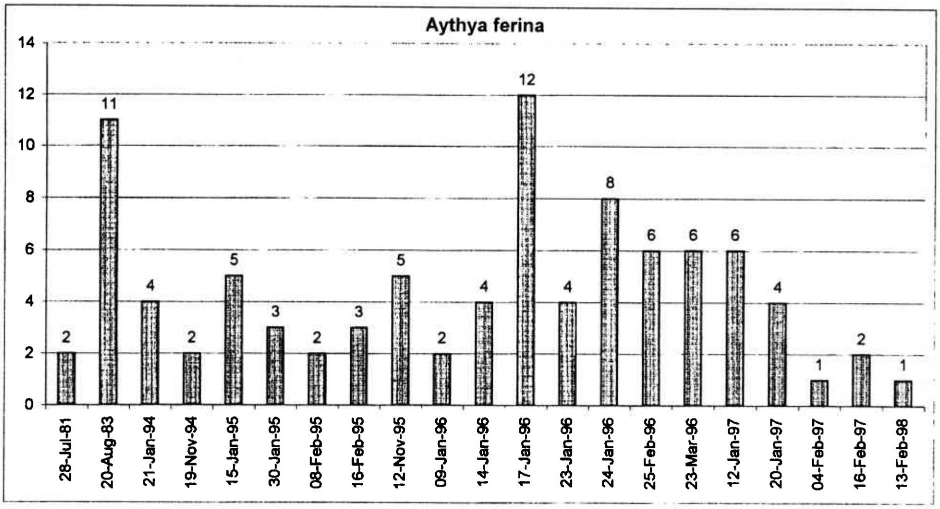


Figure 6. Results of daily counts of Pochard *(Aythya ferina)*

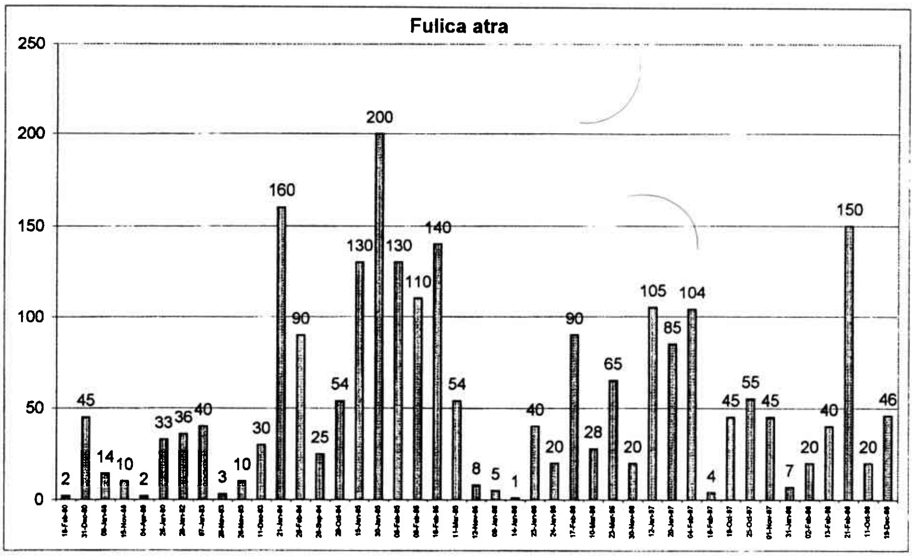


Figure 7. Results of daily counts of Coot *(Fulica atra)*

Conclusions of the River Someş/Szamos[1] researches

Andrei Sárkány-Kiss and Kunigunda Macalik

Abstract

This study is the summary of the different articles appearing in this volume. To illustrate the human impact, there are presented the River Someş/Szamos and their different sections one by one as they come. Final conclusions of the River Someş/Szamos researches are also listed.

Keywords: River Someş/Szamos, human impact

Discussion

This study is the summary of the different articles appearing in this volume and it lists the final conclusions of the researches conducted on the Somes/Szamos.

The Someş/Szamos river system is one of the most polluted ones of Transylvania. It has a lot of sectors from which sensitive organism populations like ephemeroptera and trichoptera larvae and Bivalvia species are totally missing. To illustrate the human impact, we will present these rivers and their different sections one by one as they come.

The **Someşul Cald/Meleg Szamos** springs are karst-waters, and this river has a natural aspect until the dam-lake from Beliş. A very valuable territory is the „Bazarul Someşului Cald" Strait in the upper section of the river. The entire valley up until Beliş is covered by large spruce wood forests, and in spite the fact, that there are some human settlements along the river, it hosts even the most sensitive organisms, like trout, plecoptera larvae and others. In the lower section of the river three dam-lakes were constructed: Beliş, Tarniţa and Gilău. In these twenty year old lakes significant sediments accumulations are to be found only where the river streams in and along the shorelines.

In the Tarniţa lake the sampling site was in the middle of the lake, where the water is 46 m deep. Due to this fact and because there is a rocky bottom, we managed to lift out sediment using the Van-Venn dredge only after numerous attempts. In this sediment we have not found living organisms at all.

In these lakes a process of eutrophication can be observed because of the still water, but inspite of this fact, the water can be considered as having good quality.

Although most of the drinking water of Cluj city comes from the third lake (Gilău) the upper lakes (Beliş, but especially Tarniţa) are intensively used for turistic purposes.

[1] The first name is Romanian, and the second Hungarian

The **Someşul Rece/Hideg Szamos** springs are heliocren ones, rising from cristal-stony areas. This region is home of large peat-bogs. Woody areas can be found only on slopes, while in the vicinity of the river there are grasslands, marshes and peat bogs. At Blăjoaia sampling site the water of the River Someşul Rece is brown coloured, because of the high humic acids content. The benthic fauna of the Someşul Rece differs from that of the Someşul Cald due to the different geological conditions.

From Blăjoaia to Gilău - where the Someşul Rece confluences with the Someşul Cald - two dam-lakes were constructed. In these places the water of the Someşul Rece river is conducted into the Someşul Cald river valley's dam-lakes through underground conducts. Downstream these places of drastic manipulations, the river simple stops to exist, and only the dried riverbed indicates where the Someşul Rece river was previously flowing. Downstream the dam-lakes the river is re-formed by the brooks from nearby areas and until the next dam-lake, the River Someşul Rece exists again, with its characteristic montainous fauna.

In the valley of Someşul Rece the intensive wood-cutting, and the numerous cottages on the two sides of the river, significantly modify the natural aspect of this region.

Downstream Gilău the river is called **Someşul Mic/Kis-Szamos**, and it runs in a concreted artificial canal, having a natural river-bed only from Floreşti on.

In the catchment area of this sector can be found the old drinking-water wells of Cluj, most of them being still in use. At the sampling site upstream Cluj the water of the river can be considered of good quality, and a lot of sensitive organisms can be found here (e.g. ephemeroptera and trichoptera larvae, *Ancylus fluviatilis*, *Unio crassus*, a. o.).

In Cluj most of the drain pipes flow directly into the river without any sewage treatment, so the organic-matter content of the river is high. The characteristic organisms of the benthic fauna are the oligochaeta; and macrophytes (*Potamogeton crispus, Myriophyllum spicatum*) can also be found in the river.

Twenty-thirty years ago in this portion of the river there were no macrophytes at all, but in some places the *Fontinalis antipyretica* could be found, which is a very sensitive species and it grows only in clean waters.

The river flowing through the town becomes more and more polluted, it's water smells bad, and it's high detergent content is indicated by the foam floating on the water-surface. Downstream Cluj, at Someşeni sampling site we have not found fish in the river at all.

From Cluj to Gherla both riversides are surrounded by agricultural crops. At the sampling site downstream Gherla an increased pollution of the river can be observed. The sediment is formed by thick silt in putrefaction, a lot of macrophytes are present and the benthic fauna is represented only by oligochaets.

The springs of the **Someşul Mare/Nagy-Szamos** are in Rodna Mountains, upstream Şanţ village. Until Rodna the river shows the characteristics of a typical mountain stream. At Şanţ sampling site the water quality is good, all the organisms which are characteristic to mountainous brooks are present. Downstream Şanţ, around Rodna there are non-ferrous metal exploitations and ore processing, and in this sector the river is polluted. In addition, the intense wood-cutting and processing also polluted the river, as in some places significant quantities of sawdust can be found in the river.

At Sângeorz Băi sampling site the most sensitive benthic organisms are missing.

Our theory was that by observing the Ilva tributary (which is a river in its natural state), we will be able to draw conclusions about the previous state of this section of Someşul Mare. But while working on the site, we realized, that the two rivers have a completely different geological substratum; therefore they can not be compared.

At the sampling site downstream Năsăud, the town's dumping ground is placed on the catchment area of the river. The sewages of the riverine settlements (especially those of Năsăud) increase the pollution that caused by the ore processing, so the Unionidae shells are missing, inspite the fact that the riverbed of this sector is suitable for the settling of these organisms.

At the sampling site near Beclean we have observed, that the sewage-treatment station of the town is incapable of purificating the sewages coming from the town, so near the place were the drain pipes pour into the river we have observed large *Sphaerotilus natans* colonies. However on the other side of the river, in 1992 we could still find *Spongilla lacustris*, but they disappeared by 1996 when we looked for them in vain. In 1996 we were able to collect here a single living specimen of *Unio crassus*, a species which we could not find in the past, but we suspect that this specimen probably came from a tributary of Someşul Mare.

At Dej the Someşul Mare confluences with the Someşul Mic. The tenth sampling site is downstream Dej, and inspite the fact, that the Someşul Mare is not so polluted, when its water mixes with that of the highly polluted Someşul Mic, the water quality of the **„united" Someş** decreases considerably. The waste waters coming from the cellulose-processing industry of Dej increase the pollution. The quality of the water and the living organisms are more or less the same as in the River Someşul Mic downstream Gherla.

The Letca sampling site was introduced later, in 1996, because we have observed that the quality of the water improved significantly until the 11 sampling site (Someş-Odorhei). The quality of the water in this sector was so high, that even moss-animals and shells are living in it. We concluded that this improvement is due to the fact, that the river is shallow, with high velocity, and stony bed, which make the increase of the water`s oxygen-content possible. The high oxygen-content allows the rapid chemical break-down of organic matter. This process is accelerated by the activity of filtering-organisms observed at Someş-Odorhei, Sălsig and Ţicău sampling sites. In the biological purification of the water moss-animals are playing a very important role. In some places these animals covered up to 25% of the riverbed.

The Lăpuş tributary brings with it the industrial and communal sewages of Baia Mare town, so the Someş is polluted again, not only with organic matter, but also with heavy metals and toxic materials.

Downstream Pomi sampling site the Someş can be considered very polluted: the moss-animals, shells, ephemeroptera larvae are all missing.

At Păuleşti sampling site the river is deeper, has slower velocity and sandy bottom. As a consequence, the oxidative processes are slower.

From Vetiş sampling site which is downstream Satu Mare (a town that also deverses significant quantities of sewages in the river) to Vásárosnamény (in Hungary), the Someş river's quality does not improve. As a result the River Someş deverses polluted water in the Tisa, which can be observed at the confluence of the two rivers.

Final conclusions

The Someş/Szamos river system is composed of five rivers: Someşul Cald/Meleg-Szamos, Someşul Rece/Hideg-Szamos, Someşul Mic/Kis-Szamos, Someşul Mare/Nagy-Szamos and the „united"Someş. Because of the different geographical and geological conditions all of these rivers present a unique aspect. All of them are characterized by specific chemical conditions, flora and fauna. In spite the fact, that in their reservoir there are a lot of valuable natural and seminatural areas, the human impact is also important.

The Someş/Szamos is one of the most polluted East tributary of the Tisa river.
The characteristics and problems of the Someş/Szamos are as follows:

1. The construction of the dam-lakes in valleys of the Someşul Cald and Someşul Rece rivers modifies the aspect of these regions. In addition the unregulated tourism and construction of cottages has a disastrous effect upon this region.

2. In the spring sectors the wood-cutting action is intense, and the wood-processing waste treatment is done irresponsibly.

3. The forests are absent in the middle and lower sections, where there are large agricultural crops in the immediate vicinity of the river. There are few trees, and the existing groves were felled. The river-banks are neglected, there is a lot of illegal waste accumulation, and in some cases (e.g. Năsăud) even the town's dumping ground is placed on the riverside right next to the riverbed.

In these sectors the gravel and sand exploitation is intense, too, and because of the mismanagement the oil pollution (from the exploitation-machines) is intense.

4. In the lower sectors the dams are too close to the riverbed, so the catchment areas are missing.

5. The non-ferrous metal exploitation and ore-processing pollute intensely the spring sector of Someşul Mare and the sector downstream Baia-Mare of the „united" Someş.

6. The communal and industrial sewage-production of the big towns and industrial establishments (Cluj, Gherla, Dej, Baia Mare, Satu Mare) is so intense that in some sectors it destroyed the existing associations. Some species have disappeared completely.

7. The segmental pollution isolates the local populations, fragmenting the once continous area. The disappearance of local populations decreased the intraspecific diversity, because in most of the cases the typical ecological forms have disappeared.

8. The water of the Someş presents a fast autoepuration because it is shallow and with high velocity. The runoff of the water on the rocky bed increase the oxygen content of the water and this makes regeneration possible within 70-80 km.

9. The river provides a lot of settlements with drinking-water, but because of the high pollution level it is unfit for human consumption, so there is urgent need for construction of the efficient sewage-treatment.

10. There are a lot of valuable wild areas in the Someş rivers` valleys, which need increased protection, like: „Cetatea Rădesei - Bazarul Someşului Cald“ Strait, the peat-bogs from the upper section of the Someşul Rece, „Fânaţele Clujului“ reservation, the „Sic-Săcălaia“ lake, the „Suatu“ reservation, the spring-region of the Someşul Mare, the lawns from Mogoşeni-Floreşti, and the mezohygrophil lowns from Benesat-Ardusat.

11. The protection of the river and that of the valuable wild areas is unimaginable without reconstruction, that is the restoration of at least some of the wetlands from the catchment areas and that of the groves. The „ecological corridor“ created in this way should become an important link between the valuable areas under increased protection.

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