

THE IMPACT OF THE ANTHROPIC FACTORS ON DISRUPTING AND DESTABILIZING THE ECOLOGICAL BALANCE OF THE VÂLSAN RIVER

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Abstract

*The Vâlsan river is the only ecosystem in Romania and in the world where *Romanichthys valsanicola*, a Tertiary era relict, lives; this fish has a strictly limited habitat range and is on the Red List of U.I.C.N – under resolution D-46 of the E.C., as a “critically endangered species”. At present, the river Vâlsan is subjected to a cumulative effect of the disrupting factors upstream, as a result of the hydroelectrical structures and of human activity. It also suffers a number of negative effects relating to the quantity and the quality of its water, which require taking urgent steps in order to be diminished. The present paper presents the comparative situation of the invertebrate and piscicultural fauna prior to, and after, the beginning of the functioning of the Vâlsan hydrotechnical structure.*

*Keywords: Vâlsan, *Romanichthys*, aquatic invertebrates, ichthyofauna*

1. INTRODUCTION

The Vâlsan is part of the Argeș basin and springs from the glacial hollow placed under the Scărișoara Mare peak (2495 m) at 2310 m altitude; it is 83 km long, covers 358 square kilometers and flows into the Argeș at 312 m altitude in Merișani (Vlăduțu, 2008).

The natural regimen of the river Vâlsan is greatly influenced by the setting into motion of the hydroelectric plant in 1967. This hydroelectric construction represents the main cause for the biocoenotic imbalance on the Vâlsan river, because the accumulation does not let any servitude streamflow downstream of the dam, and the waters of the Vâlsan river are regenerated only thanks to the potential of its tributaries and the phreatic sources. The construction of the accumulation has contributed to the constant reduction of the phreatic resources, which has led to a radical change in its contribution to the filling of the river; in the droughty years, a depletion of the streamflow can be noticed.

The determination of the evolution of the river-bed contour was done by interpreting and comparing the cross-sections taken at the Brădet hydrometric station. By comparing these cross-sections made over the years, one can notice a deepening of the river bed in the thalweg. This alteration of the thalweg can be accounted for through the retention of the rough material – stones, bigger pebbles and gravel – in the accumulation lake. Due to the low speed of the water, determined by the values of the streamflows, erosion in the thalweg is not spectacular, and the major ensuing modification that is detectable lies in the evolution of the type of the substratum. According to the nature of the terrain in the cross-sections sampled, if before the beginning of the hydroelectric exploitation this belonged to the rock-and-stone type, in the more recent period, and especially after 1985, the substratum is sandy and stony.

Other perturbing factors that affected the aquatic, geographic and biocoenotic eco-system are (Vlăduțu et al., 2006):

- radical transformation of biotope as a sequence of constructing hydrotechnic centers;
- lack of servitude flow, the river being dried downstream the dam;
- important variation of the Vâlsan flow caused by the use of the lake water to produce power;
- depreciation of the river bed in the process of stone, gravel and sand extraction used in constructions which has a negative effect on the benthonic species;
- damming and deviation of the Dobroneagu tributary;

- intensive deforestation and road constructions;
- water disturbing by trailing the logs along the river beds;
- negative effects caused by Diesel oil leak, use of fertilizers, pesticides washed in the river beds;
- inobservance of the Romanian legislation on the environment protection.

The waters of the river Vâlsan are characterized, under the current circumstances, by three distinguishable sectors (figure 1): from the springs to the Vâlsan lake: a rapid flow over a stony bed, with a rich rheophilous fauna, and an excellent quality of the water; downstream of the dam – owing to the lack of the servitude streamflow, the river is regenerated only in the tributary streams and is restored to a better state starting with the area of the gorges down to Brădet (biodiversity is on the increase from the dam down to Brădet); downstream of the village Brădet the effects of organic loading and pollution are strongly manifest, although the rapid stream and the stony bed provide good habitat conditions for the rheophilous fauna; biodiversity decreases, and only two or three species have an increased abundance.

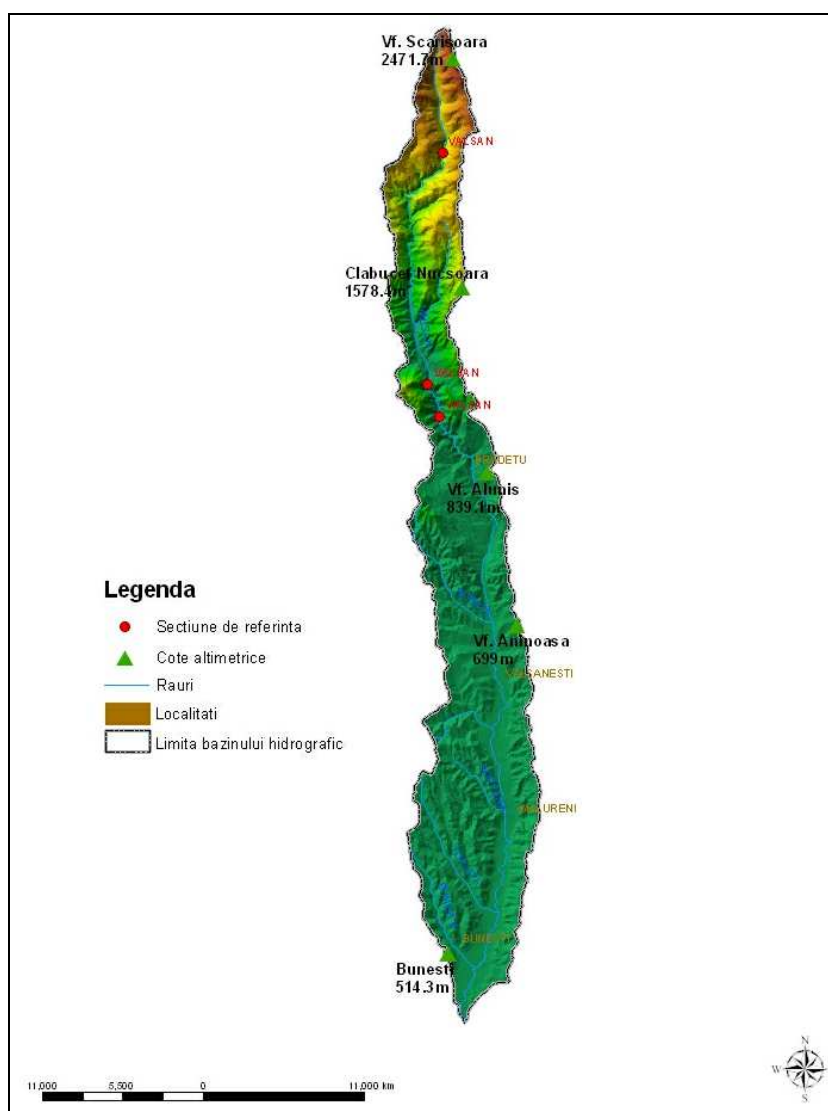


Figure 1. Valsan river basin

2. MATERIALS AND METHODS

In the 1950-2012 interval, on the occasion of the exploratory trips along the river Vâlsan, samples of benthonic and piscicultural fauna were taken, and subsequently determinations were made, with the results which will be presented in the following sections.

3. RESULTS AND DISCUSSION

The invertebrate fauna before the checking of the river has a great importance, as it represents a valuable witness, providing the possibility of directly comparing the situation in the past with the current one; it can also provide indications as to the trophic spectre of the fish species *Romanichthys valsanicola*.

Of previously published works (Vlăduțu, 2008; Vlăduțu, 2006; Vlăduțu, 2002) one can notice that the dominant populations of the ecosystem of the river Vâlsan before the arresting of the flow were the littorheophilous forms, namely: among the mayflies – *Rhithrogena semicolorata*, *Ecdyonurus venosus*, *Ephemerella ignita*, *Baetis carpathicus*, *Baetis pumilis*; among the stoneflies – *Perla burmeisteriana*, and also other species belonging to the the genera *Cloroperla*, *Protonemura* and *Leuctra*; among the caddis flies – *Sericostoma personatum*, *S. timidum*, *Brachycentrus montanus*, *Rhyacophilla septemtrionis*, *Rhyacophilla nubila*, *Microsoma minima*, *Stenophilax stillatus* etc.; among the dipteres – *Blepharocera fasciata*, *Odagonia monticola*, *Prosimulium hirtipes*, *Eukiferiella longicalar*, *Limnophyes transcaucasicus* (Table 1).

Table 1 - The situation of the important rheophilous groups before and after the building of the dam

Before the damming	After the damming
MAYFLIES	
- dominating all the river course of the Vâlsan, especially through the association: <i>Baetidae</i> (among which <i>Baetis alpinus</i> , <i>Baetis luteri</i> and <i>Baetis sinaicus</i> –stenothermal species, living in cold, mountainous and sub-mountainous waters, and preferring sediments in rough gravel) <i>Rhithrogena semicolorata</i> , <i>Ecdyonurus venosus</i>	- the dominant forms are the larvae <i>Baetis rhodani</i> – an indicator for ecosystems having a rather high organic load; - <i>Ecdynorus venonus</i> disappears and <i>Ecdyonurus dispar</i> , which favours fine sediments, multiplies.
STONEFLIES	
- presence: five genera, typically rheophilous - more pretentious than mayflies as to the quality conditions of the water, oxigen, etc.	- have nearly all disappeared
CADDIS FLIES	
- well represented by populations belonging to species indicating oligosampling waters	- the number of taxa in this group has got down from 12 to 3, which is another confirmation of the tendency of the river biodiversity to decrease

Romanichthys valsanicola, or sculpinperch, was discovered (Dumitrescu, Bănărescu, Stoica) in the Vâlsan River in the year 1956, in the Argeș River in 1957 and in the Doamnei River in 1958. As early as the first explorations made along the above-mentioned rivers, it was noticed that *Romanichthys valsanicola* was a rare species (the frequency of catching the sculpinperch was 50 to

200 times lower than that corresponding to the other species). It was considered a species typical of the Argeş river between Cumpăna and downstream of Albeşti (the area of the *Thymallus thymallus* and the *Barbus meridionalis*), for the Doamnei River at Corbi, and for the Vâlsan River, between a point upstream of Brădet and Vâlsăneşti. In the original description of the genus and species *Romanichthys valsanicola* (Dumitrescu et al., 1957), the presence in the Vâlsan River was noted, within the boundaries of the village Galeş, of another seven species of teleost fishes: *Leuciscus cephalus*, *Phoxinus phoxinus*, *Alburnoides bipunctatus*, *Barbus peloponnesius petenyi*, *Sabanejewia romanica*, *Orthrias barbatulus*, *Cottus gobio*. There are arguments according to which the areas as found in the years 1958-1967 are not the initial one, so that the sculpinperch reached some 25 km near the confluence of the Vâlsan and the Argeş rivers. The withdrawal of the species upstream is the result of the anthropic impact (deforestation, extension of agricultural exploitation, fruit-tree spray treatments and herbicidal treatment of crops, extraction of ballast and sand in the minor bed of the Vâlsan river, etc.).

Among the sixteen taxa of fishes noticed for the ichthyofauna of the Vâlsan river before the dam-checking (Stoica, 1967), twelve have been found again and are present in the current biocenotic structure of the river, namely: *Salmo trutta fario*, *Leuciscus cephalus*, *Phoxinus phoxinus*, *Alburnoides bipunctatus*, *Barbus peloponnesius petenyi*, *Sabanejewia romanica*, *Cottus gobio*.

Among the factors incriminated by the disappearance of *Romanichthys valsanicola* from the Argeş and Doamnei rivers, and partially in the Vâlsan river, the most significant concern the hydrotechnical extensions that affected the river-bed, ballast exploitation and washing, alterations of the main course, the strong disturbance of the substratum, the increase in turbidity, the reduction of the streamflow in the river-bed, the effect of the chemical substances used for phyto-sanitary treatments, illicit fishing and exploitation of stone in the beds of the rivers, which have directly affected the living conditions of the bottom piscicultural fauna.

The situation became critical in the years 1967-1987, and 1997-2002, when, to the effect of periods characterised by driness – manifesting itself through strong reductions in the bed streamflow, and lowering of the phreatic sources downstream of the dam – was added, for the first period, the effect of uncontrolled washing of the barrier-lake, with silt and detritus deposits accumulating in the minor bed of the Vâlsan river.

The importance of the species *Romanichthys valsanicola* lies in the following aspects: the fish represents a genus, and also the only species of that genus. *Romanichthys valsanicola* was discovered in 1956 in the Vâlsan River, within the limits of the village Galeş (which is part of the Brăduleţ commune), by the Romanian ichthyologists Bănărescu, Dumitrescu and Stoica; the fish represents an endemism, and its range is very limited. Initially, its known habitat range was: in the river Argeş, between Arefu and upstream of Curtea-de-Argeş, in the Doamnei River, in the Corbi area, in the Vâlsan River, downstream of Brădet up to a point upstream of Mălureni (Bănărescu et al., 1995). At the present moment, it only survives in the Vâlsan River, being in fact the genus with the smallest habitat range of all the European ichthyofauna. *Romanichthys valsanicola* is a relict species from the Tertiary era, a fish species going back some 20-75 million years. By its antiquity, *Romanichthys valsanicola* is considered a living fossil (Bănărescu, 1965), which could solve a certain number of problems that are still being debated. Judging by its taxonomic, phylogenetic and zoogeographical characteristics, the importance of this species for science can be fully appreciated.

The disrupting factors that undermine the aquatic ecosystem of the river Vâlsan are in the main: a drastic reduction of the streamflow downstream of the accumulation dam, which prevents the water from sustaining life in a variety of biotopes, mainly “littoral” ones, which are, as a rule, the best represented both from a qualitative, and a quantitative point of view (Bănărescu et al., 2004).

The species of chironomids / midge larvae, caddis flies, mayflies, rheophilous species representative of the trophic spectre of *Romanichthys valsanicola*, have disappeared, which has induced a new biocenotic aspect, and a disruption of the functions of the aquatic ecosystem. The damming of the Dobroneag stream has increased the local water deficit; there was an allochthonous

contribution by the Brădet complex, namely the replacing of a number of species favouring clean water by others, characteristic of ecosystems having a high organic load; the reduction of the number of specimens in the species *Romanichthys valsanicola* can be related to the effects of the Vâlsan accumulation lake (retention of rocks and stones), which has resulted in some stenothermal species, which prefer sediments in rough gravel and pebbles, being replaced by other, which favour fine sediments. The defective exploitation of the barrier-lake, and more especially the uncontrolled washing, has induced a real ecological catastrophe – in 1987 alone, 20,000 m³ of alluvia were discharged into the river-bed, thus greatly affecting the aquatic fauna downstream; other anthropic activities specific to the region were: exploitation of river stones and gravel for individual needs, poaching, non-organized evacuation of waste waters (from villages and camping sites, from sheep disinfection, etc.)

The reduction of the negative impact caused by the anthropic activities to the aquatic environment along the river Vâlsan can be achieved through: bringing the water-filtering station in Brădet to normal functioning parameters, accompanied by a quantitative and qualitative control of waste waters before their discharge into the river; implementing a monitoring programme for the area, aiming at both the hydrological elements, and the physical, chemical and biological elements of the river water; carrying out the whole complex of physical, chemical and biological measurements and analyses aimed at determining the dynamics of the biocenotic component structure; establishing the habitat range of the species and observing its status of a “reservation area”; prohibiting the exploitation of ballast and river stone; prohibiting poaching and uncontrolled evacuation into the Vâlsan river of waste water coming from private properties and sheep disinfection; prohibiting non-organized camping and washing cars in the water of the Vâlsan river; building a camping site endowed with appropriate water-purification installations; modification of the manner of exploitation of the Vâlsan accumulation lake by allowing a minimal streamflow for the subsistence of the species *Romanichthys valsanicola*, in view of the uniqueness of the genus and its drastically restricted range; achieving a system through which, in times of flooding, and when the accumulation lake is washed, the alluvium may be deviated from the natural bed of the Vâlsan River by means of a water-clarifying lake, which should be built in the area downstream of the Brădet dam.

The alteration of the hydrological conditions as a result of the damming of the river Vâlsan and its tributary, the Dobroneagu stream, have determined major disruptions of the interrelations between the component parts of the ecosystem, which have resulted in a dramatic fall in biodiversity, and even the disappearance of certain species. To the modification of the streamflow course were added further noxious factors: a faulty manner of maintaining and exploiting the barrier-lake, a decrease in the quality of the water through the multiplication of the pollution sources, the exploitation of building stone and gravel from the river, poaching, diminution of the stony substratum in the bed of the river, directly affecting the sculpinperch’s sheltering possibilities.

Choosing an optimal solution requires work based on interdisciplinary studies, starting from scientific exploratory trips and detailed research of the species’ life conditions, while allotting concomitant EU funds with a view to saving this endangered species of foremost interest for mankind.

4. CONCLUSION

The importance of the Vâlsan as a unique area of sculpinperch or Romanian darter (*Romanichthys valsanicola*) involves further ecologic measures:

- reduction of negative impact of the anthropic activities on the aquatic environment by improving the filtering station parameters in the Brădet Sanatorium;
- area monitoring programme;
- respecting the “protected area” status;
- forbidding the excavation of the river bed, poaching and disorganized camping;

- judicious use of the lake for maintaining an upstream ecologic flow;
- construction of a decanter lake upstream dam.

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