

THE PHYSICAL –CHEMICAL DESCRIPTION AND THE ANALYSIS OF THE MAIN PERTURBING FACTORS OF THE VÂLSAN HYDROGRAPHIC BASIN

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Abstract. The present work contains the presentation of the aquatic ecosystem, laying emphasis on the physical –chemical description of the basin and on the analysis of the main perturbing factors, which have led to the ecologic disturbance and changes in the Vâlsan biocenotic structure.

At present the Vâlsan is under a cumulative effect of the upstream perturbing factors caused by the hydro-electric constructions and the human activity and undergoes some depreciation of the water quantity and quality. This requires urgent measures to diminish them. Restoring the Vâlsan ecologic equilibrium is a necessity, which can be achieved by providing a minimum flow for aquatic flora and fauna protection as well as a proper quality of the flooding waters.

Key words: *Vâlsan, physical-chemical parameters, perturbing factors, ecologic disturbance*

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. In rendering profitable the hydro-electric potential of the Argeș hydrographic basin, they have also included the planning of the Vâlsan and its tributary Dobroneagu whose flow gathered in the Vâlsan Lake, went through the hydro-electric power station to the Vidraru Lake. This work is the main cause of the biocenotic disturbance because the accumulation doesn't leave any servitude flow upstream the dam; the river waters recover their flow due to the tributaries potential and phreatic resources. The accumulation has led to the continuous decrease of the phreatic layer, which caused an important change in its contribution to the river supply; in the dry years a decrease of the flow has been recorded. Downstream, the Vâlsan tends to maintain its natural conditions.

MATERIAL AND METHODS

The data presented and processing in this paper have been taken from "Romanian Waters" National Administration - DAAV Pitești reflecting the situation in August 2004.

The tests have been taken from the following sections (figure 1):

- Upstream the Vâlsan Lake;
- Entrance of the Vâlsan gorges;
- Exit of the Vâlsan gorges;
- Brădet;
- Mălureni.

In placing the stations the following criteria have been under consideration:

- Influence of the hydro-technical planning;
- Anthropical factor (disorganized tourism, rural planning);
- River ability of self-filtering and restoration.

The research has aimed at describing each section from morphologic, climatic, hydrologic and physical-chemical point of view.

RESULTS AND DISCUSSIONS

The physical - chemical description of the Vâlsan

The results are presented in tables 1-5.

The analysis results according to STAS 4706/88, surface waters values show that, in all the five sections, the Vâlsan River goes to category I of quality.

The only high values admitted have been recorded in section Brădet because of the great anthropic influence for the following descriptors:

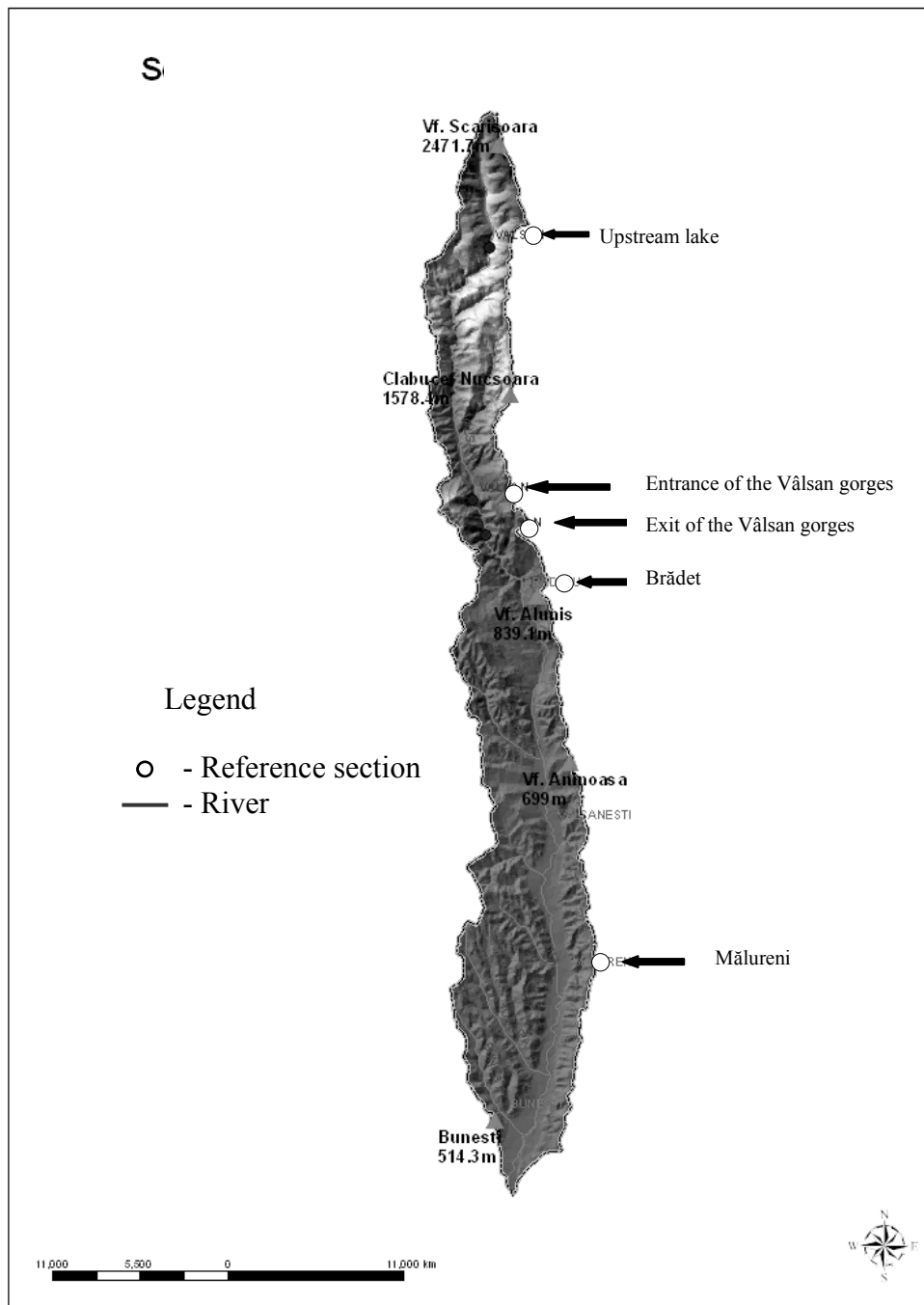


Figure 1. Reference sections of Vâlsan River

- CBO₅ - the biologic consumption of oxygen measured every five days - value recorded 5.2mg/l (5.0 is the accepted value for category I of quality);
- CCO-Mn - chemical consumption of oxygen obtained by the use of potassium permanganate method (value for category I of quality is 10.0 mg/l)
- P- Phosphorus - measured 0.11mg/l (maximum value is 0.10mg/l).

Analysis of the main perturbing factors of the Vâlsan River

The only regular polluting source in the hydrographic basin of the Vâlsan is the waste water of the Brădet Sanatorium (hospital, block of flats and hotel). The flow of the waste water in the Vâlsan is:

- medium flow - 3.50l/s
- maximum daily flow -3.80 l/s
- maximum hour flow is 4.00 l/s.

Every year, a quantity of 0.110 mil. m³ waste water is evacuated in the Vâlsan. Before the evacuation, the waste water goes through the filtering station made up of an INHOFF vertical decanter, a bio-filter and a chlorination station.

Table 1. Section Upstream Lake

Hydrographic basin parameters

| Eco area | Dominant geology | Basin surface in the reference section (square km) | Yearly pluviometric average (mm) |
|------------|------------------|--|----------------------------------|
| Carpathian | Siliceous | 57 | 1200 |

Morphologic, climatic and hydrographic parameters of the reference section

| The structure of the river bed | Slope (‰) | River depth (m) | River width (m) | Altitude (m) | Yearly air temperature average (0 ⁰ c) | Q l/s/km ² | q _{95%} l/s/km ² |
|--------------------------------|-----------|-----------------|-----------------|--------------|---|-----------------------|--------------------------------------|
| Stones and gravel | 30 | 0.2 | 4 | 930 | 0 | 29 | 3.22 |

Physical –chemical description of the reference section

| Physical chemical parameters | | Recorded values |
|--|-------------------------|-----------------|
| Dissolved oxygen (mg/l O ₂) | | 8.9 |
| Total P (mg P/l) | | - |
| NO ₂ ⁻ (mgN/l) | | 0.002 |
| Electric conductivity (µs/cm ²) | | 85 |
| P-PO ₄ (mg P/l) | | 0.087 |
| NH ₄ ⁺ (mgN/l) | | 0.090 |
| pH | | 7.53 |
| Total N (mgN/l) | | - |
| MTS (mg/l) | | 8 |
| Alkalinity (mev/l) | | 0.7 |
| NO ₃ (mgN/l) | | 0.655 |
| Specific polluting agents (natural background) | Fe total (mg/l) | 0.294 |
| | Mn ²⁺ (mg/l) | 0.0196 |
| | Pb ²⁺ (µg/l) | 0.0 |
| | Zn ²⁺ (mg/l) | 0.0242 |
| | Cu ²⁺ (mg/l) | 0.0001 |
| | Ni ²⁺ (µg/l) | 0.039 |

Table 6 shows the characteristic values of the main descriptors of the polluting waste water measured at the exit. As the table shows, there are high values over the limit of organic matter, oxygen and ammonium: 85% for CBO₅, 1025.5 for CCO-Mn and 750% for NH₄. The decrease in water quality is also caused by high concentration of polluting local sources (dwellings not connected to the canal system, disorganized camping, sheep desinfestation etc.).

Table 2. Section the Vâlsan Gorges entrance

Characteristics of the hydrographic basin

| Eco area | Dominant geology | Basin surface in the reference section (km ²) | Yearly pluviometric average (mm) |
|------------|------------------|---|----------------------------------|
| Carpathian | Siliceous | 92 | 900 |

Morphologic, climatic and hydrologic parameters of the reference section

| The structure of the river bed | Slope (‰) | River depth (m) | River width (m) | Altitude (m) | Yearly air temperature average (0 ⁰ c) | Q l/s/km ² | q _{95%} l/s/km ² |
|--------------------------------|-----------|-----------------|-----------------|--------------|---|-----------------------|--------------------------------------|
| Stones and gravel | 24 | 0.3 | 4 | 835 | 4 | 27 | 3.10 |

Physical-chemical description of the reference section

| Physical-chemical parameters | | Recorded values |
|---|-------------------------|-----------------|
| Dissolved oxygen (mg/l O ₂) | | 8.4 |
| Total P (mg P/l) | | 0.0 |
| NO ₂ ⁻ (mgN/l) | | 0.002 |
| Electric conductivity (μs/cm ²) | | 105 |
| P-PO ₄ (mg P/l) | | 0.087 |
| NH ₄ ⁺ (mgN/l) | | 0.090 |
| pH | | 7.48 |
| Total N (mgN/l) | | 0.0 |
| MTS (mg/l) | | 8 |
| Alkalinity (mev/l) | | 0.9 |
| NO ₃ (mgN/l) | | 0.701 |
| Specific polluting agents (natural background) | Fe total (mg/l) | 0.041 |
| | Mn ²⁺ (mg/l) | 0.0065 |
| | Pb ²⁺ (μg/l) | 0.0 |
| | Zn ²⁺ (mg/l) | 0.004 |
| | Cu ²⁺ (mg/l) | 0.0007 |
| | Ni ²⁺ (μg/l) | 0.0408 |

Table 3. Section The Vâlsan Gorges exit

Hydrographic basin parameters

| Eco area | Dominant geology | Basin surface in the reference (km ²) | Yearly pluviometric average (mm) |
|------------|------------------|--|----------------------------------|
| Carpathian | Siliceous | 106 | 800 |

Morphologic, climatic and hydrologic parameters of the reference section

| The structure of the river bed | Slope (%) | River depth (m) | River width (m) | Altitude (m) | Yearly air temperature average (0 ⁰ c) | Q l/s/km ² | q _{95%} l/s/km ² |
|-----------------------------------|--------------|--------------------|--------------------|-----------------|--|--------------------------|---|
| Stones and gravel | 20 | 0.3 | 3 | 720 | 6 | 26 | 2.95 |

Physical-chemical description of the reference section

| Physical-chemical parameters | | Recorded values |
|---|-------------------------|-----------------|
| Dissolved oxygen (mg/l O ₂) | | 8.6 |
| Total P (mg P/l) | | 0.0 |
| NO ₂ ⁻ (mgN/l) | | 0.029 |
| Electric conductivity (μs/cm ²) | | 229 |
| P-PO ₄ (mg P/l) | | 0.043 |
| NH ₄ ⁺ (mgN/l) | | 0.0 |
| pH | | 7.56 |
| Total N (mgN/l) | | 0.0 |
| MTS (mg/l) | | 8 |
| Alkalinity (mev/l) | | 1.6 |
| NO ₃ (mgN/l) | | 0.655 |
| Specific polluting agents (natural background) | Fe total (mg/l) | 0.0174 |
| | Mn ²⁺ (mg/l) | 0.0084 |
| | Pb ²⁺ (μg/l) | 0.0 |
| | Zn ²⁺ (mg/l) | 0.0071 |
| | Cu ²⁺ (mg/l) | 0.0007 |
| | Ni ²⁺ (μg/l) | 0.039 |

Other perturbing factors that affected the aquatic, geographic and biocoenotic eco-system are:

- 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.

Table 4. Section Bradet

Hydrographic basin parameters

| Eco area | Dominant geology | Basin surface in the reference (km ²) | Yearly pluviometric average (mm) |
|------------|------------------|---|----------------------------------|
| Carpathian | Siliceous | 110 | 750 |

Morphologic, climatic and hydrologic parameters of the reference section

| The structure of the river bed | Slope (‰) | River depth (m) | River width (m) | Altitude (m) | Yearly air temperature average (0 ⁰ c) | Q l/s/km ² |
|--------------------------------|-----------|-----------------|-----------------|--------------|---|-----------------------|
| Stones, gravel and sand | 18 | 0.3 | 8 | 700 | 8 | 33 |

Physical-chemical description of the reference section

| Quality descriptors | Values | | | Concentration Flow Level | Quality |
|---|---------|--------|---------|--------------------------|---------|
| | Minimum | Medium | Maximum | | |
| Water temperature | 1.0 | 9.8 | 19.0 | - | - |
| pH | 7.6 | 8.0 | 8.3 | - | I |
| Dissolved oxygen (mg/l O ₂) | 8.4 | 9.7 | 11.6 | 9.4 | I |
| CBO ₅ | 1.2 | 3.0 | 5.2 | 3.1 | I |
| CCO-Mn | 3.1 | 6.2 | 11.3 | 6.9 | I |
| Constant residuum | 202.0 | 304.7 | 431.0 | 297.0 | I |
| NH ₄ ⁺ (mgN/l) | 0.0 | 0.15 | 0.38 | 0.17 | I |
| NO ₂ ⁻ (mgN/l) | 0.01 | 0.02 | 0.09 | 0.03 | I |
| NO ₃ (mgN/l) | 0.0 | 1.0 | 1.8 | 1.1 | I |
| Suspensions | 2.0 | 11.8 | 24.0 | 10.7 | - |

In 2004, the climate changes represented an important ecologic perturbing factor in the Vâlsan basin.

The huge rain quantity caused freshet and torrents, which carried tree-trunks and stone downstream and eroded the riverbanks.

This destroying effect was also enhanced by massive deforestation (Annex - photo).

Table 5. Section Mălureni

Hydrographic basin parameters

| Eco area | Dominant geology | Basin surface in the reference section (km ²) | Yearly pluviometric average (mm) |
|------------|------------------|---|----------------------------------|
| Carpathian | Siliceous | 130 | 557 |

Morphologic, climatic and hydrologic parameters of the reference section

| The structure of the river bed | Slope (‰) | River depth (m) | River width (m) | Altitude (m) | Yearly air temperature average (0 ⁰ C) | Q l/s/km ² |
|--------------------------------|-----------|-----------------|-----------------|--------------|---|-----------------------|
| Stones, sand and mud | 12 | 0.5 | 11 | 423 | 12 | 41 |

Physical-chemical description of the reference section

| Quality descriptors | Values | | | Concentration Flow Level | Quality |
|---|---------|--------|---------|--------------------------|---------|
| | Minimum | Medium | Maximum | | |
| Water temperature | 1.0 | 11.0 | 20.0 | - | - |
| pH | 7.7 | 8.1 | 8.4 | - | I |
| Dissolved oxygen (mg/l O ₂) | 6.6 | 8.9 | 10.4 | 8.7 | I |
| CBO ₅ | 2.8 | 5.9 | 8.3 | 6.1 | I |
| CCO-Mn | 2.8 | 5.9 | 8.3 | 6.1 | I |
| Constant residuum | 227.0 | 345.1 | 439.0 | 360.2 | I |
| NH ₄ ⁺ (mgN/l) | 0.0 | 0.17 | 0.44 | 0.17 | I |
| NO ₂ ⁻ (mgN/l) | 0.0 | 0.02 | 0.04 | 0.02 | I |
| NO ₃ (mgN/l) | 0.1 | 0.8 | 2.1 | 0.9 | I |
| Suspensions | 8.0 | 20.2 | 36.0 | 18.2 | - |

Table 6. The exit waste water section in the Bradet sanatorium

| Quality descriptors | Values | | | | | | Highest values | |
|------------------------------------|--------|--------|---------|---------|---------|--------|----------------|--------|
| | Limit | | Maximum | Minimum | Average | | t/an | % |
| | mg/l | t/an | mg/l | mg/l | mg/l | t/an | | |
| CBO ₅ | 60.00 | 6.623 | 170.00 | 52.00 | 111.00 | 12.252 | 5.629 | 85.00 |
| CCO-Mn | 10.00 | 1.104 | 146.10 | 79.00 | 112.55 | 12.423 | 11.31 | 1025.0 |
| Suspensions | 100.0 | 11.023 | 83.00 | 48.00 | 68.00 | 7.506 | - | - |
| NH ₄ ⁺ mgN/l | 1.00 | 0.11 | 12.00 | 5.00 | 8.50 | 0.938 | 0.828 | 750.00 |
| NH ₂ ⁻ mgN/l | 1.00 | 0.11 | 0.72 | 0.037 | 0.379 | 0.042 | - | - |
| NH ₃ mgN/l | 10.0 | 1.104 | 3.80 | 0.36 | 2.08 | 0.23 | - | - |
| pH | 7.00 | - | 8.10 | 7.20 | 7.65 | - | - | - |

CONCLUSIONS

The importance of the Vâlsan as a unique area of sculpinperch or Romanian darter (*Romanichthys valsanicola*) required its establishment as a National Reservation, which 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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Annex I The Vâlsan River after the freshets and torrents – august 2004 - (photo 1 - 4)

