

## ASPECTS RELATED TO THE EVALUATION OF THE ECOLOGICAL STATUS OF THE SURFACE WATERS IN GORJ COUNTY

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**Abstract:** *The evaluation of the ecological status of surface waters is done according to the requirements of The Water Framework Directive, on the basis of biological, chemical and hydromorphological elements. This paper presents aspects related to the ecological status of rivers and accumulation lakes which are located in Gorj County, by surveillance the evolution of the quality elements.*

**Key words:** *surface water, quality elements, ecological status*

### 1. INTRODUCTION

Following the mandatory compliance of the communitary acquis, Romania has committed to implement The Water Framework Directive (2000/ 60/ EC), adopted by The European Union and by the European Council on 23 October 2000, together with the other member states of The European Union and now holds a firm position regarding the steps to be taken in this process. The Water Framework Directive was transposed into the national law by Law no. 310/ 2004 for amending and supplementing The Law no. 107/1996, The Water Law. It establish a common framework for the sustainable and integrated management of all water bodies and offers the European Commission, the member and candidate states the opportunity to cooperate within a new partnership, based on the participation of all stakeholders, for the protection of inland waters and ground waters by preventing pollution at the source and establishing an uniform mechanism of control of the pollution sources.

In order to establish an effective control of water pollution, The Directive

provides as a fundamental objective, common to all states that are implementing it, to achieve “the good ecological and chemical status” for all waters until 2015. Therefore, The Water Framework Directive clearly establishes the deadline by which waters must achieve a minimum threshold of quality by reducing emissions from human, industrial and agricultural activity [1].

Defining the "good status" is based on a new concept of ecological quality that takes into account the biological, chemical and physical characteristics. The key factor of the Water Frame Directive is "integration" which takes into account all natural and human factors that can influence the quantity and quality of water resources. The new strategy for monitoring and characterization of water quality is based on a new concept of integrated water monitoring which involves a triple integration, namely: of investigation areas at river basin, of environments, and of monitored elements/components (biological, hydromorphological and phisico - chemical). [2].

In line with Article 8 (1) of the Water Framework Directive (2000/60/EC), The Member States of the European Union have

established monitoring programs for surface waters, groundwater and protected areas in order to know and establish their "status" within each basin. In Romania the established monitoring programs became operational on 22.12. 2006, applying on surface water bodies, groundwater and protected areas. The National Integrated Monitoring includes the following six subsystems: rivers, lakes, transitional waters, coastal waters, groundwater, wastewater (control monitoring of wastewater discharged into natural receivers).

## 2. QUALITY ELEMENTS EVALUATED IN ORDER TO DETERMINE THE ECOLOGICAL STATUS OF SURFACE WATERS

Ecological status is an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters, classified in accordance with Annex V of the Water Framework Directive 2000/60/EEC. Evaluation of environmental/ecological potential of surface water bodies is achieved through integration of quality elements (biological, phisico - chemical support, specific pollutants). The ecological status/ecological potential end consider the 'one out - all out "and the worst situation [3].

The environmental objective (quality) for a surface water body is considered to be achieved when the body of water falls in very good or good ecological status or in a good ecological potential.

Characterization of the ecological status under the Water Framework Directive requirements is based on a classification system in five classes, namely: very good, good, moderate, poor and bad, defined and represented as follows:

- for the very good condition - values of biological, hydromorphological and physico-chemical elements properties of surface water is characterized by the values associated with those unspoiled areas (reference) or minor anthropogenic alterations;

- for the good condition – the values of phsico - chemical and biological elements are characterized by mild deviations compared to the characteristic unaltered values areas (of reference) or minor anthropogenic alteration;

- for the moderate status - biological elements values for surface waters deviates moderately from the characteristic values unaltered areas (reference) or minor anthropogenic alterations;

- for the poor condition – no major alterations of the biological elements; relevant biological communities differ substantial form those normally associated to the unaltered unspoiled areas conditions (of reference) or minor anthropogenic alterations;

- for the bad state - there are severe alterations in the values of biological elements, a number of relevant biological communities are absent from those present in unspoiled areas (reference) or minor anthropogenic alterations [4].

Table 1. Biological elements, frequency and monitoring parameters within the surveillance program and operational program (rivers and lakes)

Quality elements		Parameters	Frequency			
			Surveillance programe		Operational programe	
			Rivers	Lakes	Rivers	Lakes
Biological elements	Phytoplankton	Taxonomic composition	2/year	4/year	3/year	4/year
	Microphitobentos	Taxonomic composition	2/year	1/year	3/year	2/year
	Macrophites	Taxonomic composition	1/3 years	1/3 years	1/3 years	1/3 years
	Zoobenthos	Taxonomic composition	2/year	1/year	3/year	1/year
	Fish fauna	Taxonomic composition	1/3 years	1/3 years	3/year	1/3 years

The ecological status characterized on the basis of the worst situations is evaluated using classification systems comply with the provisions of The Water Framework Directive applicable to:

- biological elements: rivers - phytoplankton, benthic macroinvertebrates and fish fauna; lakes - phytoplankton; transitional waters;
- physico - chemical elements:
- general physico-chemical elements: rivers - thermal conditions (water temperature), oxygen (dissolved oxygen),

acidification status (pH), nutrients (N-NH<sub>4</sub><sup>+</sup>, N-NO<sub>2</sub><sup>-</sup>, N-NO<sub>3</sub><sup>-</sup>, P-PO<sub>4</sub><sup>3-</sup>, P total ); lakes - the oxygen (dissolved oxygen) and nutrients (total phosphorus);

- specific pollutants: rivers, lakes, Zn, Cu, As, Cr, toluene, acenaphthene, xylene, phenols, polychlorinated biphenyl compounds [5].

The quality elements assessed of rivers and lakes, the frequencies and monitoring parameters for each quality element are presented in tables 1 and 2.

Table 2. Psyc – chemical elements, parameters and monitoring frequency in the surveillance and operational program (rivers and lakes)

Psyco – chemical elements		Parameters	Frequency			
			Surveillance program		Operational Program	
			rivers	lakes	rivers	lakes
Transparency		Materials in suspension, Turbidity, Colour	6/year	4/year	6/12/year*	4/year
Termical conditions		Temperature	6/year	4/year	6/12/year*	4/year
Oxygenation conditions		Dissolved oxygen, CCO – Mn and/or CCO – Cr, CBO <sub>5</sub> (COT)	6/year	4/year	6/12/year*	4/year
Salinity		Conductivity/ TDS	6/year	4/year	6/12/year*	4/year
Status		pH/Alcalinity	6/year	4/year	6/12/year*	4/year
Nutrients		Nitrates, nitrites, ammonia, Ntot, orthophosphate, Ptotal,	6/year	4/year	6/12/year*	4/year
Priority substances	Materials in suspension	Heavy metals: Cd, Ni, Pb, Hg	6/year	12/year	6/year	12/year
	Sediments	Heavy metals and organic micropollutants relevant for sediment	1/year	1/year	1/year	1/year
Pollutants specific non-priority		Other heavy metals	6/year	4/year	6/year	4/year

\* Is monitored 12 / year when admitted concentration is at risk due to nutrients and organic matter, respectively 6/year when admitted concentration is at risk due to hydromorphological alterations priority substances

### 3. ASSESSMENT OF SURFACE WATER QUALITY (RIVERS AND LAKES) IN GORJ COUNTY

In 2012, the assessment of surface water quality in Gorj county was performed according to the Water Law no. 107/1996 as amended and supplemented, while using and testing methodologies on classification

systems and comprehensive assessment of the status of surface developed according WFD 2000/60/EEC on the basis of biological, chemical and morphological. The evaluation was conducted on the body of water, which is the base that is used for establishing, reporting and verifying how to achieve the environmental objectives of the WFD target. By "Body of surface water" means a discrete and significant element of surface water such as: river, lake, channel, sector river, sector channel.

Ecological status of water bodies in Gorj county of determined from monitoring

conducted in 2012 by SGA Gorj is presented in table 3.

Table 3. Ecological status of water bodies in Gorj county (2012)

Water course	Code of body water	Assesment of biological elements	Assesment of general physico-chemical elements	Assessment of specific pollutants	Ecological status
Motru	RORW7.1.36_B86	Very good	Good	Good	Good
Motru	RORW7.1.36_B88	Very good	Good	Good	Good
Tismana	RORW7.1.31_B35	Very good	Good	Good	Good
Tismana	RORW7.1.31_B37	Good	Good	Good	Good
Jales	RORW7.1.31.7_B49	Good	Good	Good	Good
Sadu	RORW7.1.20_B20	Moderate	Good	Good	Moderate
Amaradia	RORW7.1.26_B34	Very good	Moderate	Good	Moderate
Jiu (West Jiu)	RORW7.1_B51	Very good	Good	Good	Good
Jiu (West Jiu)	RORW7.1_B14	Very good	Good	Good	Good
Susita I	RORW7.1.25b_B29	Very good	Good	Good	Good
Jiu (West Jiu)	RORW7.1_B28	Good	Moderate	Good	Moderate

Table. 4. Ecological potential of accumulation lakes in Gorj county (2012)

Lake	Code of body water	Assesment of biological elements	Assesment of general physico-chemical elements	Assesment of specific pollutants	Ecological potential
Tg. Jiu - Vădeni	ROLW7.1_B26	Good ecological potential	Moderate ecological potential (N-NO <sub>3</sub> <sup>-</sup> , P-PO <sub>4</sub> <sup>3-</sup> ).	Good ecological potential	Moderate
Turceni	ROLW7.1_B56	Maximum ecological potential	Good ecological potential	Good ecological potential	Good
Valea Mare	ROLW7.1.36_B88	Maximum ecological potential	Good ecological potential	Good ecological potential	Good
Tismana (Down-stream)	ROLW7.1.31_B36	Maximum ecological potential	Good ecological potential	Good ecological potential	Good

In total in Gorj county, in 2012, were assessed twenty-one bodies of water, of which:

- In terms of biological elements, one body water presented moderate ecological status (4,76%), four bodies of water showed good ecological status (19,05%) and sixteen bodies water presented very good ecological status (76,19%).

- In terms of general physico-chemical elements, seventeen water bodies showed good ecological

state, and four water bodies showed moderate ecological status.

In terms of specific pollutants, all the bodies had good ecological status.

Integrated assessment of quality elements monitored showed that five of the twenty-one water bodies monitored showed moderate ecological status and the rest of the good ecological state.

In assessing the ecological status (ecological potential) of accumulation lakes in Gorj County were considered: biological elements, physico-chemical elements and specific pollutants listed in table 1, table 2 and the following criteria for abiotic typology of accumulation lakes of Jiu river basin:

- Altitude lake is located: mountain area (> 800 m) hill and plateau area (200-800 m), lowland area (<200 m);
- Lake catchment geology: limestone, siliceous or organic (meq/l);
- The average depth of the lake: very low (<3 m), low (3-15 m) and large (> 15 m);
- Retention time low (<3 days), medium (3-30 days) and high (30 days)

Ecological potential of accumulation lakes in Gorj county, in 2012 (data provided by SGA Gorj), after evaluating integrated quality elements monitored are presented in table 4.

#### 4. CONCLUSION

Assessment of surface water quality in Gorj county, in 2012, was obtained using methodologies on classification systems and comprehensive assessment of the status of surface prepared in accordance with the requirements of the Water Framework Directive 2000/60/EEC. For this purpose were evaluated twenty-one water bodies (subsystem rivers) and four water bodies (subsystem lakes) based on monitoring biological elements, physico-chemical elements and specific pollutants under the European Directive and national legislation.

In the case of accumulation lakes were considered and criteria for abiotic typology of these water bodies of Jiu river basin. Integrated assessment of quality elements monitored in Gorj county, have framed water bodies in moderate and good ecological status. Indicators that caused moderate ecological status were nutrients, present in the form of  $N-NO_3^-$  and  $P-PO_4^{3-}$ . Evaluation results show that values biological and physico-chemical elements general is characterized by moderate deviations or mild to characteristic values or reference unspoiled areas.

#### REFERENCES

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