

**COMPARATIVE ASSESSMENT OF THE WATER QUALITY IN THE RIVER OSAM**

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**ABSTRACT**

This study is an analysis of the qualitative condition of surface waters of the river Osam, conducted on the basis of a comprehensive assessment using water quality index. A comparison between the assessments of the status of river water is made using the reference values of selected physicochemical parameters for water quality according to the criteria of Regulation №7 / 1986 Regulation №4 / 2000 and Regulation № H-4 / 2012.

**Key words:** *water quality, water quality index*

**INTRODUCTION**

Nowadays the pollution of the environment and in particular of water resources is one of the most important issues.

For social life and economic development of society the water is a major factor. That is what makes both its quantity and quality important. The Osam river like many other rivers in Bulgaria are under the influence of industrial, agricultural and household utilities in its catchment area. For that reason the evaluation of the quality the Osam river water is very important. The analysis of the water quality of the Osam river was made based on the application of the integral index for its quality (Water Quality Index). The index used gives information about the water quality status of the rivers with regard to both its spatial and temporal dimensions.

The present study aims to analyze the change of water quality in the basin of the Osam river under the influence of anthropogenic activity for the period 1975-2010 in the time period and catchment basin (Fig. 1a)

*Methods of the study*

The changes of the water quality of the Osam river was identified by using an integral index (Water Quality Index). The Water Quality Index provides a convenient means of summarizing complex water quality data and facilitates its communication to the general audience. The CCME Water Quality Index (1.0), (CCME, 2001) is based on a formula developed by the British Columbia Ministry of Environment, Lands and Parks and modified by Alberta Environment. The Index incorporates three elements: scope - the number of variables not meeting water quality objectives; frequency - the number of times these objectives are not met; and amplitude - the amount by which the objectives are not met. The index produces a number between 0 (worst water quality) and 100 (best water quality). These numbers are divided into 5 descriptive categories to simplify presentation of the river water quality (Table. 1).

Table. 1

*Interval scheme for categorization of water quality by Water Quality Index  
(on CCME and Varbanov)*

Category	Interval of WQI	Evaluation of the status
Excellent	95 - 100	The waters are in their natural state. No anthropogenic load.
Good	80 - 94	The waters are natural except for single isolated cases of anthropogenic load and pollution.

Fair	65 – 79	The waters are generally defined as clean, but there are series of cases of anthropogenic load. Slightly polluted.
Marginal	45 - 64	The waters are largely subject to anthropogenic load. Polluted water.
Poor	0 – 44	The waters are continually anthropogenic load. Heavily polluted water.

**RESULTS AND DISCUSSION**

The monitoring posts for the water quality of the Osam river are positioned as follows: upstream - after Troyan, in the middle part of the stream - before Lovech, after Lovech and in the lower part of the stream - after Levski, after village of Obnova and near to Cherkvitsa (Fig. 1b).

*Comparative assessment of water quality in the Osam river basin according to the requirements of Ordinance №7/1986*

The results indicate that for the most of the period the water quality of the Osam river is defined as "excellent" and "good". It means that the river waters fully meet the requirements of Ordinance №7/1986 for the second and third river section category. The lowest index values of the water quality of the Osam river is indicated at Cherkvitsa post in 1978. Surface waters are heavily "contaminated" continually anthropogenic loaded .

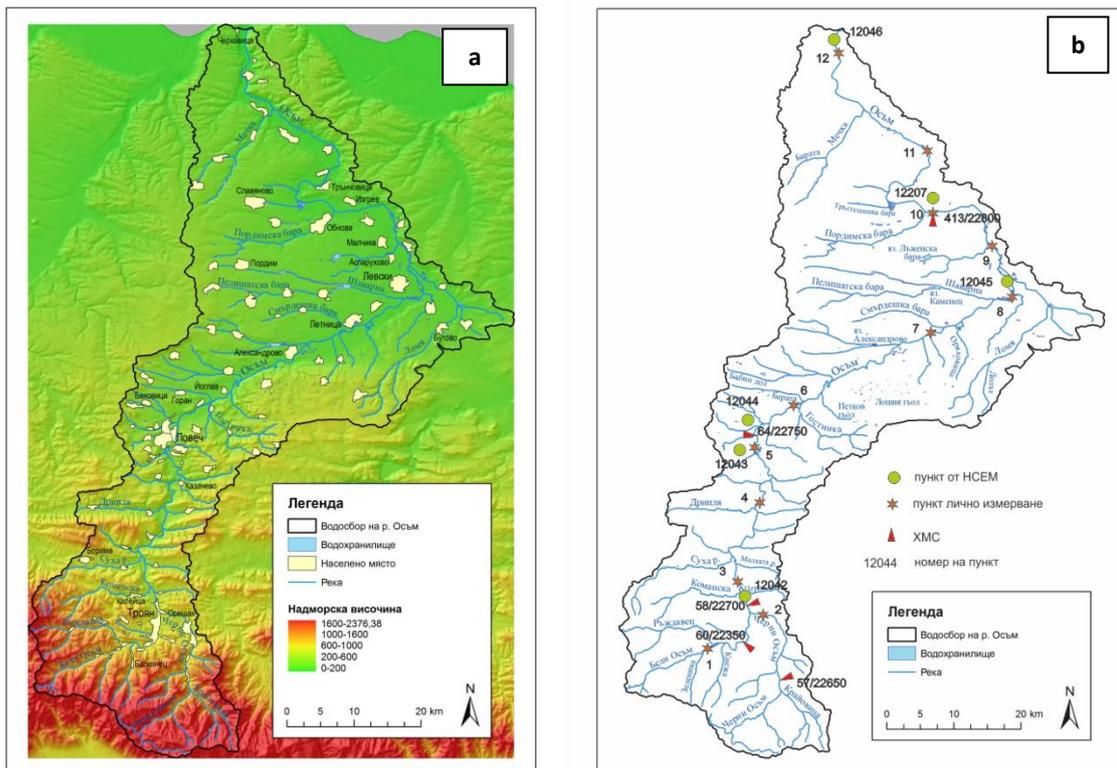


Figure 1. Schematic map of the catchment area of the Osam river (a); scheme of monitoring posts in the basin of the Osam river with data used in the article (b)

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During the analyzed period the water of the Osam river was categorized of poor category with

regard to its quality. In the whole period the river water does not provide the necessary conditions for trout and carp species. The anthropogenic load on the waters is high and they are defined as "highly contaminated" (Fig. 3a,b). "Fair" quality of river water is established only in certain years of the study period. Slight tendency of improving of the water quality of the Osam river is registered in 1989-1990.

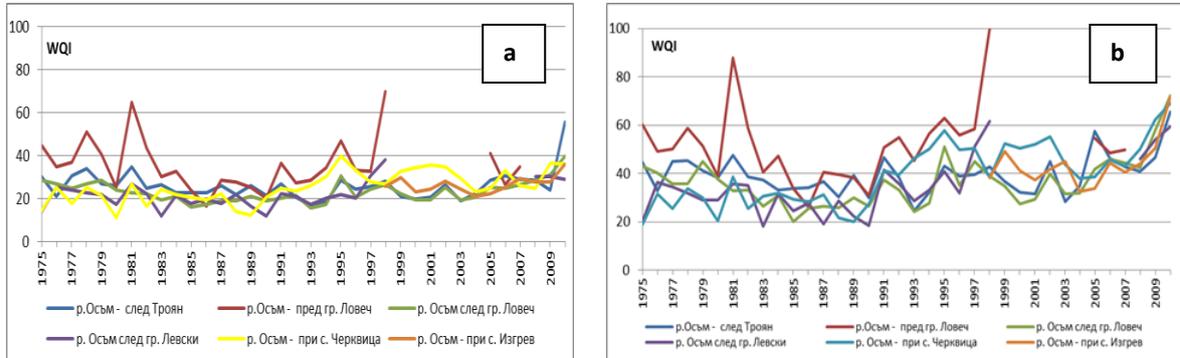


Figure 3a,b. Water quality index of the Osam river for trout and carp species

*Comparative assessment of water quality in the Osam river basin according to the requirements of Regulation NoH-4/2000*

As a result of the analysis the following generalizations are made:

With regard to the requirements of Regulation NoH-4/2012 found that during most of the period river water is defined as "heavily contaminated" and they do not answer the requirements of the "fair" status (Fig. 4). "Slightly polluted" water which corresponds to the category of "Fair" quality is defined at all points except the one after Lovche. "Good" and "excellent" quality of the river water is not registered at any point of the whole time period. This is due to the higher criteria and ecological approach to river water quality laid down in Regulation NoH-4/2012. Since 1989 or 1990, slight tendency of improving the water quality has been registered (Fig. 4).

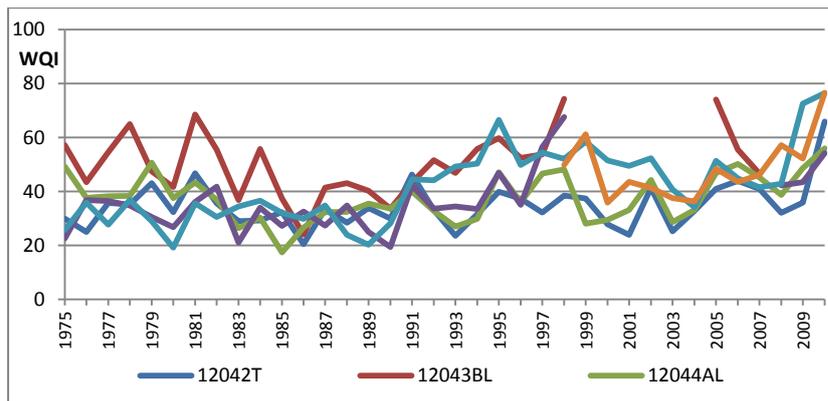


Figure. 4. Water quality index of the Osam river calculated according to the requirements of Regulation NoH-4/2012

## CONCLUSIONS

This study on the water quality of the Osam river based on the Water Quality Index calculated

according to the criteria of Ordinance №7/1986, Ordinance №4/2000, and Ordinance NoH 4/2012 led to the following conclusions.

During the period of the study, the quality of the river water is defined as "good" and "excellent" in accordance with the stream categorization and the requirements of the Ordinance №7/1986, where as second stream category is considered the section before Lovech and all the rest are considered third category.

Because of the high requirements of Regulation №4/2000 in most cases the water quality of the Osam river receives "marginal" or "poor" status. The water is unsuitable for fish farming and normal functioning of aquatic ecosystems cannot be granted.

The river waters quality evaluated according to the requirements of Regulation NoH-4/2012 in terms of their physicochemical state in most cases receives a "highly polluted" status. The waters are under continuous anthropogenic load and do not satisfy the conditions for "fair" quality category.

The index values for the quality of the river waters calculated according to the standards of Ordinance №7/1986 are significantly higher than values obtained in accordance with the criteria set out in the other two regulations.

It is noteworthy that the value of the complex index calculated according to Ordinance №4/2000 for carp species and Ordinance NoH-4/2012 on the "fair" quality status of the river water are almost the same.

Index values established about requirements for trout species (Ordinance №4/ 2000) during the period were significantly lower than the values registered according to Ordinance № H-4/2012 (for "fair" category of the river water quality).

All along the river the values of the Water Quality Index according the requierments of Ordinance №7/1986 and Ordinance №4/2000 reveal that better water quality during the period is indicated in upstream part of the Osam river. Up to the outfall the quality of the river water deteriorates. This is due to the increase in discharged pollutants from industrial and agricultural activities and the water that comes from other utilities and dumpsites.

The water quality assessment according to the requirements of Regulation No.H-4/2012 ("fair" water category) reveals improvement in the downstream part of the river. Possible reasons for this are more stringent requirements on maximum permissible concentrations for lowland rivers.

Through the whole period the water quality of the Osam river is higher before Troyan and Lovech, due to the absence of large pollutants (industrial and agricultural) and lots of small settlements. The "hot spots" (sections with "poor" water quality) are located after Troyan, Lovech, Levski, and in the outfall to Cherkvitsa.

For the period of time when the monitoring was performed a slight trend of improvement of the water quality of the Osam river is registered after 1989. This trend is best represented at the post at Cherkvitsa.

This improvement was caused by the suspension of a number of industrial enterprises, the sharp reduction of application of mineral fertilizers in agricultural areas, the destruction of large livestock complexes. The construction of urban sewage networks and waste water treatment plants (local and district) has a positive effect of the river water quality.

**REFERENCES**

- Varbanov M. Complex assessment of river water quality by using combinatorial index. Bulaqua, I., Sofia, 2007.
- Ordinance №7 of 08.08.1986 for indicators and standards for determining the quality of flowing surface water, OG. 96 of 12.12.1986
- Ordinance No.H-4 from 09.14.2012 on characterization of surface water OG. 22 on 03/05/2013
- Ordinance №4 of 20.10.2000 water quality for fish and shellfish
- CCME. (2001). Canadian water quality guidelines for the protection of aquatic life: Canadian water quality Index 1.0 Technical report. Canadian council of Ministers of the Environment.