



CONSIDERATIONS ON THE SURFACE WATER QUALITY CONDITION IN THE SIRET HYDROGRAPHIC BASIN

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ABSTRACT. – **Considerations on the surface water quality condition in the Siret hydrographic basin.** The surface water resources in the Siret river basin are about 17% of total water resources of the country and consist mainly of the Siret River, its tributaries and in a very small extent, from lakes and ponds. The study of the water quality variation of Siret River is done according to the organoleptic, physical, chemical, biological and bacteriological characteristics which are determined by analysis of groups of qualitative and quantitative indicators that vary with specific environmental conditions. Thus, the authors follow, through studies on the evolution of state parameters of the Siret river water quality in different sections of monitoring, to assess the degree of pollution and its impact on river.

Keywords: water quality, monitoring, specific indicators, Siret river, degree of pollution.

1. INTRODUCTION

The water quality is a major objective in water management, where the monitoring activity plays a decisive role, representing the instrument in water policy development. The assessment of water quality is performed using quality indicators which are variable sizes, the number of items within each category of indicators was determined according to specific conditions, the intended purpose and nature of pollution sources.

In Romania, the water quality is monitored according to the structure and methodological principles of Integrated Monitoring System in Romania, restructured in accordance with the requirements of European Directives.

The elaboration of water quality synthesis is based on processing a large volume of information obtained through knowledge work out by local units of the Romanian Waters National Administration.

The rivers water quality is variable from one sector to another and is influenced by natural and the anthropogenic factors. The characterization of ecological status and ecological potential of the surface water consist in monitoring of biological, physical-chemical and hydromorphological parameters and is based on a classification system into five classes, thus: class I – “very good”, class II – “good”, class III – “moderate condition”, class IV – “poor”, class V – “bad”.

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In this paper the authors follow, through studies on the evolution of state parameters of water quality Siret River, to evaluate the degree of pollution and its impact on river.

2. RISK FACTORS ON THE SURFACE WATER OF SIRET HYDROGRAPHIC BASIN

Since 2007, over a length of 26,506 km, was organized the supervision of water quality on middle courses and lower courses of rivers from Romania as a result of apparition the human activities impact on water quality.

For the evaluation, from physico-chemical point of view, the overall water quality, in each section of the surveillance, were calculated separately for each indicator, with insurance values of 90% and 10% for dissolved oxygen and they were compared with the limit values of quality classes stipulated by the normative with five quality classes. The biological quality of watercourses has been carried out based on monitoring of the following elements: macroinvertebrates, microfitobentos, phytoplankton, aquatic macrophytes and fish.

The surface water resources in the Siret catchment are about 17% of total water resources of the country and consist mainly of the Siret River, its tributaries and in a very small extent, from lakes and ponds. After the evaluation of water quality from the hydrographic basin have been identified 43 significant pollution sources, the most important categories of pressures being: punctiform pressure, diffuse and hydromorphological.

The punctiform sources of significant pollution are domestic, industrial and agricultural and the diffuse sources of pollution are represented mainly by chemical fertilizers used in agriculture (which vary between 1.61 kg P / ha and 10.01 kg N / ha), pesticides used to control pests (0.9 kg / ha), domestic animals, rural agglomerations and urban areas. Regarding the significant hidromorfolgice pressures from Siret River area, they consist of hydrotechnical and management works realized in cascade.

The evaluation of the risk on water bodies, take into account the criteria for identifying pressures and the criteria for evaluating their impact. Thus, in the study has been taken into account of the pollutions by organic matter, nutrients pollution, pollution from priority substances / dangerous and hydro-morphological alterations.

The status of surface water body in the hydrographic basin, in terms of risk, is as follows:

- From a point of view of organic substances, 20 (5.88%) of water bodies are subject to risk, 10 (2.94%) possible risk and 310 (91.18%) without risk;
- From a nutrient point of view of 16 (4.7%) water bodies are subject to risk, 12 (3.53%) possible risk and 312 (91.77%) without risk;
- From a point of view of priority hazardous substances, 0 water bodies are subject to risk, 4 (1.17%) possible risk, 336 (98.83%) without risk;

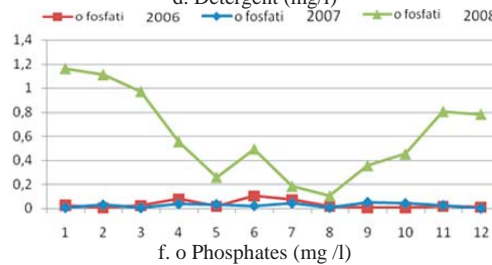
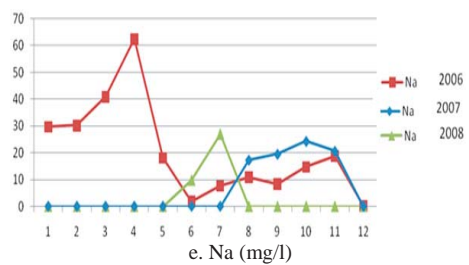
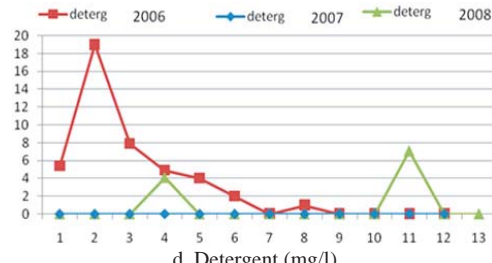
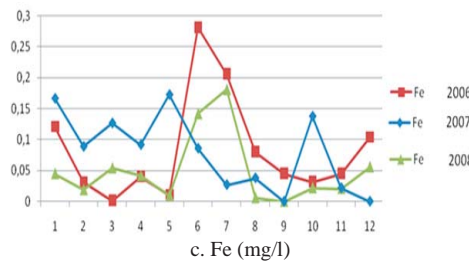
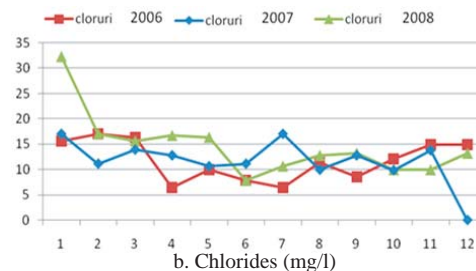
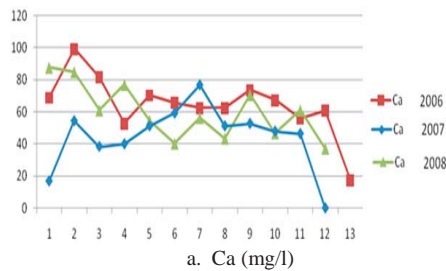


- From a point of view of hydromorphological alterations, 34 (10%) water bodies are subject to risk, 29 (8.53%) possible risk and 277 (81.47%) without risk.

3. THE WATER QUALITY ANALYSIS IN THE SIRET RIVER IN THE 2006-2008

The Siret River is analyzed of water quality by recorded values in the different control sections positioned along the River (Siret, Hutani and Lespezi) and main tributaries (Suceava, Bistrita, Moldova, Șomuzului Mare, etc.) in the period 2006-2008.

The samples were collected once a month for three years. Among the main monitored indicators with the impact on the Siret river water quality, emphasize: Ca^{2+} , Chlorides, Fe, Detergent, Na, O phosphates, Phosphorus, Mg, N-NO^{2-} , N-NO^{3-} , sulfate and residue (Fig.1).



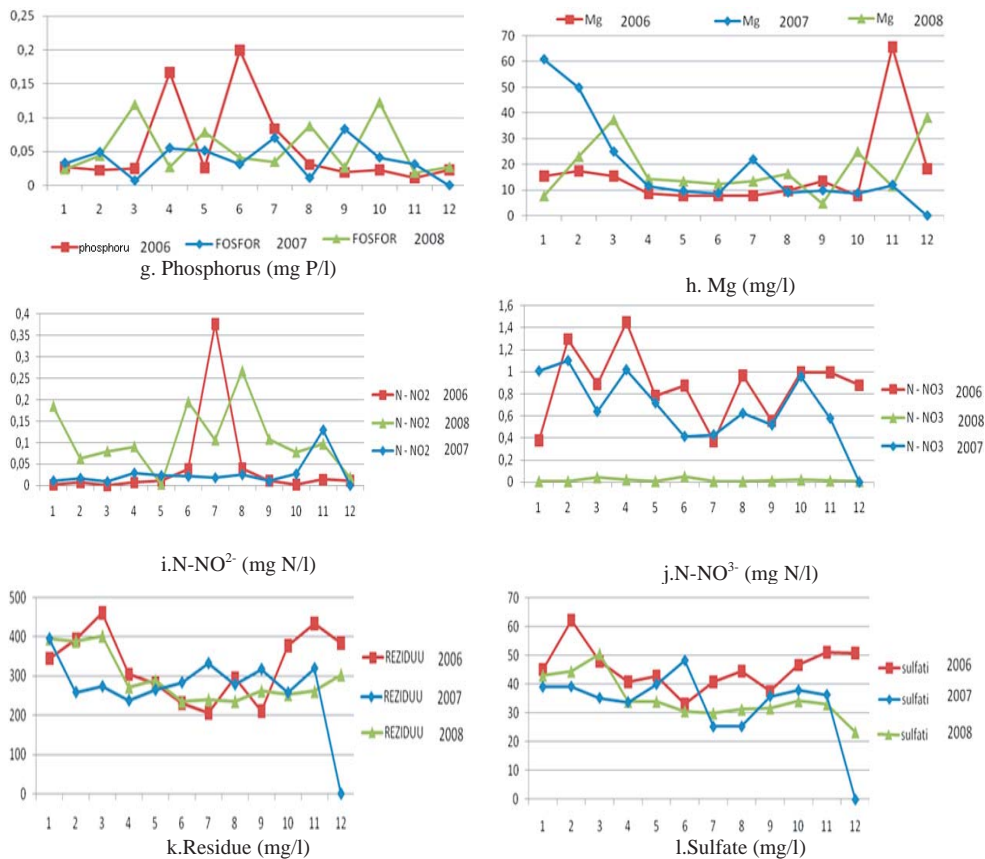


Fig. 1. The leading indicators monitored in the period 2006-2008, with the impact on Siret river water quality.

After analyzing these indicators the Siret river water quality, in 2006, in Siret section, in terms of annual averages is "very good", except the Ca^{2+} indicator that induces the quality of "good".

It noted the "very good" quality water in terms of indicators of dissolved oxygen and sulfate, exceeding, during the 12 months monitoring, the values above normal. At the same register at the "very good" state is included and the filterable residue indicator, for which was recorded an exit of this class only in a single month (January 2006). In terms of indicators of ammonium ion $N-NH_4^+$ and nitrite $N-NO_2^-$ only in July were recorded values of the "good" status.

In Hutani section, the water of Siret River loses of quality, three indicators of lowering at the "good" state: $N-NO_2^-$, Ca^{2+} and Magnesium Mg^{2+} and in Lespezi section the water quality to descend at "good" status under the influence of five indicators (nitrite $N-NO_2^-$, nitrogen $N-NO_3^-$, sulfates, Ca^{2+} and magnesium Mg^{2+}).



During 2007 and 2008, Siret River water quality is better than that recorded in 2006. Were recorded only two indicators that induce water quality, the "good" status ($N-NH^4+$ and Ca^{2+}), against three indicators registered in 2006 in section Hutani. In the Siret section the $N-NO^2-$ indicator lead to good quality status, the others demonstrating the "very good" status, and in the Lespezi section all of indicators fit the water quality in "very good" status.

The water quality of the tributaries will influence both negative and positive the water quality of Siret receiver. Table 1 presents the water quality evolution of the Siret River tributaries in 2006. It can be seen as the main indicators that change the status of water quality in this region are: $N-NO^2-$, Ca^{2+} , $N-NO^3-$, $N-NH^4+$, Mg^{2+} , phosphates and Sulfați.

The Bistrita River has a beneficial influence on the Siret river water quality due to its water quality "very good" in terms of all indicators.

Table 1. The water quality evolution of the Siret River tributaries in 2006

Monitoring section	Suceava river		Bistrita river		Moldova river		Somuzul Mare river				
	Quality class	The physical and chemical indicator that determines the water quality	Monitoring section	Quality class	The physical and chemical indicator that determines the water quality	Monitoring section	Quality class	The physical and chemical indicator that determines the water quality			
Brodina	Very good	$N-NO^3-$, Ca^{2+} (indicators whit induced the "good" status)	Cărlibaba	Very good	All analyzed indicators	Fundu Moldavei	Very good	All analyze indicators	Am. Conf. Pr. Târgului	Very good	All analyzed indicators
Milișăuți	Very good	All analyzed indicators	Argestru	Very good	All analyzed indicators	Amonie Clung.	Very good	All analyzed indicators	Vorniceni	Moderate	Ca^{2+}
Iteani	Good	$N-NO^2-$, $N-NO^3-$, chlorides and Ca^{2+}	Barnar	Very good	All analyzed indicators	Av al G. Humorului	Good	Ca^{2+} and Mg^{2+} indicators	Dolhești	Moderate /Poor	Ca^{2+} / $N-NH^4+$ and $N-NO^2-$
Liteni	Poor	$N-NO^2-$				Baia	Good / Moderate	Ca^{2+} and Mg^{2+} indicators / Azotați $N-NO^2-$ (quality class III)			
Țișăuți	Poor	$N-NH^4+$	<p>The others tributaries of the Siret River, taken in the analysis, make a beneficial contribution on its water quality. In the „Doma”, „Pr. Bărnăre”, „Ciumami”, „Pr. Călimănel” și „Brăteasa” sections, the water quality is within the very good state after all the indicators analyzed.</p> <p>The pollution problems are recorded in the Pozen section where the nitrite $N-NO^2-$ indicator, phosphorus indicator and sulfur indicators leads the moderate state and the indicator Ion ammonium $N-NH^4+$ leads to the classification in the poor state.</p>								

During 2007 and 2008, the Suceava river status is improved maintaining the "very good" quality in most monitored sections (Brodina, Milisauti, Itcani, Liteni and Dragomirna) and in the Mihoveni and Tisa sections only the $N-NO^2-$ indicator induce the status of "good".



The Bistrita river suffer a slight degradation of the water quality in 2007, due to the fact that the chloride and Mg^{2+} indicators, lead to lower quality from “very good” to “good”. In 2008 he returns to "very good" status quality.

The Moldova River in 2007 has improved water quality compared to 2006 as having a status of "very good" in the Fundu Moldovei control section and as "good" in the av.Gura Humorului control section due to the Mg^{2+} indicator and in the Baia control section due to the $N-NO^2-$, $N-NO^3-$ and Ca^{2+} indicators . In 2008, this tributary recorded a positive evolution in terms of water quality over the previous year.

The Water quality of the other tributaries have the same regim in 2008, as in previous years. The poor state are recorded in Pozen where the water quality drops to the level of “bad”.

The status of the rivers water quality in the biologically point of view in the Siret river basin was evaluated based on analysis phytobenthos,ichthyofauna and macrozoobenthic . In table 2 is shown the situation of the lengths (2809 km) of river assessed, cumulate on the quality classes, depending on the ecological status.

Table 2. Total lengths of river analyzed which dependent on the ecological status according to the Siret River Basin.

Nr. crt	Hydrographic basin	Total lengths of river	Ecological status Very good		Ecological status Good		Ecological status Moderate		Ecological status Poor	
			km	%	km	%	km	%	km	%
1.	Siret	2809	947	33,70	1730,5	61,60	98,5	3,50	33	1,20

As a conclusion we find that in the Siret River Basin, during 2006-2008, the surface water quality, assessed over a length of 4228 km, according to data from devices made by the University "Stefan cel Mare" Suceava, was distributed as follows: 1499 km of river (35.5%) - class I, 1658 km of river (39.2 %) - class II, 681 km of river (16.1 %) - class III, 172 km of river (4.1 %) - class IV-, 218 km of river (5.2%) - class V (Fig.2).

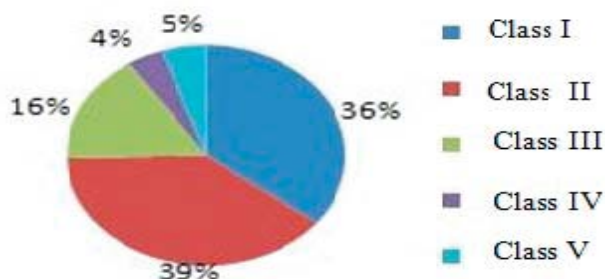


Fig. 2. The water quality along the rivers in the Siret River Basin



4. THE PROTECTION AND RESTORATION MEASURES OF THE SURFACE WATER QUALITY.

One of the important measures for maintaining quality of water resources is the activity of prevention and control of accidental pollution. In accordance with the Water Law no.107/1996, modified and supplemented by OUG No. 3 of 5 February 2010, the prevention and control of accidental pollution is organized by the National Administration "Romanian Waters" through its Watershed, based on by:

- the plans developed for each river basin organization for to approve of the organization and operating rules of the alarm system in case of accidental pollution of waters in Romania;
- the own plans for water users which are potential polluters;
- the units that use water, will develop a program to combat the accidental pollution effects produced by units located in the upstream;
- monthly is prepared the Bulletin of Water Quality, which presents the status surface water quality, groundwater, surface water intended for abstraction for drinking water production and the situation of the main sources of pollution etc.

The increasing and maintaining a river water quality is achieved through structural techniques (stop the pollution, changes in legislation and water quality standards, education, machining regime change in hydropower plants, preventing the discharge of toxic substances, wetland restoration) and structural techniques (fences, security, handling of vegetation and organic substances etc.).

The prevention of water pollution is safer than treatment. In the case when preventive measures were applied too late or have not had the desired effect is made to treatment which is extremely costly, complicated and always with the risks and unwanted side effects.

The water protection is not only by avoiding certain pollutants reaching the waters, but also by maintaining a more natural and healthy form with an intact capacity of natural purification.

5. CONCLUSIONS

The paper aims the monitoring, for a period of three years, of the evolution of surface water quality in the Siret hydrographic basin and determining the degree of pollution at the water.

The study of the water quality variation of Siret River is done according to the organoleptic, physical, chemical, biological and bacteriological characteristics which are determined by analysis of groups of qualitative and quantitative indicators that vary with specific environmental conditions.

The Siret River is analyzed of water quality by recorded values in the different control sections positioned along the River (Siret, Hutani and Lespezi)



and main tributaries (Suceava, Bistrita, Moldova, Șomuzului Mare, etc.) in the period 2006-2008.

Using the samples collected it was determined that the main indicators with the impact in water quality, during the period analyzed (2006-2008), were: Ca^{2+} , Chlorides, Fe, Detergents, Na, 0 phosphate, Phosphorus, Mg, N-NO^2 , N-NO^3 , sulfate and residues.

S-a constatat ca in bazinul hidrografic Siret calitatea apelor de suprafata, evaluate pe o lungime de 4228 km, a fost distribuita pe urmatoarele clase de calitate: 1499 km (35.5%) - class I, 1658 km (39.2 %) - class II, 681 km (16.1 %) - class III, 172 km (4.1 %) - class IV, 218 km (5.2%) - class V.

The water protection is not only by avoiding certain pollutants reaching the waters, but also by maintaining a more natural and healthy form with an intact capacity of natural purification.

REFERENCES

1. Aristica Balaban (2008) „ *Studii fizico-chimice și biologice referitoare la poluarea apelor Dunării*”, Teză de doctorat, București.
2. Irina Elena Florea (2010) „ *Geochimia mediului în aria de prelucrare a petrolului din Bazinul Troțușului*”, Teză de doctorat, Iași.
3. Marilena Diaconu (2008) „ *Calitatea apei din bazinul superior al râului Argeș-Amonte de Golești*”, IWM Conferences.
4. *** *Legea apelor nr.107/1996 modificată și completată prin OUG nr.3 din 5 Februarie 2010.*
5. <http://www.apesiret.usv.ro>
6. http://www.mmediu.ro/gospodarirea_apelor/calitatea_apelor/raport_2009.pdf
7. <http://www.scribd.com/doc/19475537/Probleme-Generale-Privind-Poluarea-Apelor>.