THE IMPACT OF THE ANTROPIC ACTIVITIES ON THE WATER QUALITY OF THE RIVERS TIMIŞ AND BEGA IN THE INFERIOR SECTOR

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Abstract. *The study refers to the appreciation of surface water quality, respectively the Timiş and Bega streams, in the inferior sector. The qualitative evaluation of the two water streams, was carried out based on data from the Banat Water Basin Administration archive, from the upstream sections Timişoara and Otelec, the Bega river, respectively Şag and Grăniceri on the Timiş river, based on the analytical results of the following indices: pH, dissolved oxygen, CBO5, CCOCr, electric conductivity, ammonium, nitrates, nitrites, phosphates, sulphates, chlorine, manganese and iron. The analysed data are from the time interval 2011 – 2012. Data interpretation was carried out according to the regulations of Order no. 161 from 2006 for the approval of the Normative regarding surface water quality classification in order to establish the water bodies ecologic state. In parallel, the main anthropic activities were identified, which determine a depreciation of the surface water quality state. The research has shown some qualitative differentiations monitored in the control sections at the beginning of the study area and downstream, from the end of this area, qualitative differentiations determined by: the crossing of the agricultural area by the water, over-flowing of waste waters incompletely cleaned or raw waste waters (by accident), the carrying out of zootechnical activities present or past. With most monitored indices in the control entrance of the study area, respectively upstream Timişoara (on the Bega river) and Şag (on the Timiş river) show values corresponding to the 1st quality class, and downstream, on exiting this area, respectively Otelec (on the Bega) and Grăniceri (on the Timiş), one may notice the higher frequency of 2nd quality class indices. Among potential pollution sources, there are: SC Smithfield Ferme SRL, the Cinder Deposit Utvin, the Urban Waste Deposit Parţa etc. Considering the „communication" between surface water and underground water layers, the latter's quality may suffer negative changes under certain environmental conditions.*

Key words: *water stream, quality, pollution, impact*

INTRODUCTION

It is well known that water resources are the most important elements in constituting and developing human civilization, although, many times this fact seems to be overlooked, and resources are taken „for granted", as a permanent source, which we do not need to tend to for too long.

Studies and researches regarding water reserves, especially related to quality aspects, are constant concerns, taking into consideration the changes which occur in relation to the needs and requirements entailed by development and civilization.

The area analysed in the present paper is bordered by the Bega and Timiş rivers (Figure 1) and is mostly situated in the hydrographic basin of the Timiş river.

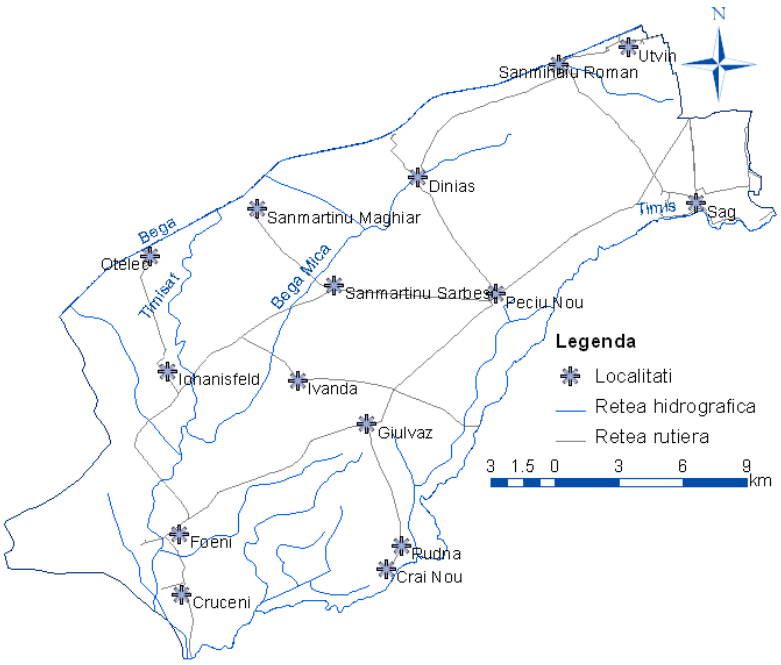

Figure 1 The Timiş-Bega interfluve – hydrographic network

The flowing direction is north-east – south-west, on the current maximum subsidence line (Posea Gr, 1997).

In time, the Timiş and Bega rivers have caused numerous floods with catastrophic effects on the geographic space, on the natural environment as wells as on the human settlements close by.

MATERIALS AND METHODS

For the qualitative appreciation of surface waters, respectively the Timiş and Bega rivers, analytical data from the Banat Water Basin Administration were used, from the upstream sections Timişoara and Otelec, on the Bega river, respectively Şag and Grăniceri on the Timiş river.

Qualitative surface water evaluation was carried out according to the current legislation, 13 indices being used, namely: pH, dissolved oxygen, CBO5, CCOCr, electric conductivity, ammonium, nitrates, nitrites, phosphates, sulphates, chlorine, manganese and iron. The data obtained while analysing the water samples were interpreted according to the current legislation, by relating them to values specified in the legislation, respectively Order no. 161 from 2006 for the approval of the Normative regarding surface water quality classification in order to establish the water bodies ecologic state.

Following up field „visits", as well as based on data from the specialty literature, the main anthropic activities determining surface water quality depreciation were identified.

RESULTS AND DISCUSSIONS

Processing analytical data from the period 2000 – 2005, Alina Costescu (Costescu Ioana, Alina, Rogobete Gh., 2006) achieved the evaluation of the Bega river quality, on indices groups, obtaining, for the downstream control stations Timişoara and Otelec the following results:

- Oxygen regime, in upstream section Timişoara belongs to the 1st quality class, and in the Otelec section, to 2nd and 3rd classes, in various years
- Depending on the nutrient regime, the two monitored sections are classified differently, from 1st class upstream Timişoara to 3rd and 4th class, downstream to Otelec
- Metal presence is insignificant in the upstream section Timişoara (1st class); no high concentrations are observed in the Otelec section as well (after Timisoara used waters overflowing)
- From the point of view of organic and inorganic micro-pollutants, the upstream section Timişoara belongs to the 1st quality class, and the Otelec section, to the 2nd class.

Based on the information presented, one may claim that the Bega river quality state suffers a slight depreciation downstream, due to industrial and urban used water overflowing, and agricultural activities.

More recent analytical data taken over from ABA Banat, processed and interpreted by us in this paper, allow more recent appreciations of the Timiş and Bega rivers water quality, in the studied area.

For the evaluation of *the Timiş river quality* 13 indices were taken into consideration, nominated in the specific legislation, whose analytical results are presented in Tables 1 and 2.

Table 1

Water quality of the Timiş river in 2011

Indices	MU	Control section							
		Timiş – Şag				**Timiş – Grăniceri**			
		2011							
		Apr.	Jul.	Oct.	Dec.	Apr.	Jul.	Oct.	Dec.
pH	pH units	7.2	7.3	7.,2	7.4	7.1	7.6	7.3	7.6
OD	mg/l	10.5	9.5	8.3	8.9	8.9	8.1	9.8	11.3
CBO_5	mg/l	1.5	2.1	2.3	1.8	1.5	1.2	1.2	2.6
CCOCr	mg/l	8.2	9.3	10.2	8.7	14.5	13.2	21.6	10.7
Electr cond	$\mu S.cm^{-1}$	-	235	-	295	233	305	261	215
Ammonium	mg/l	0.11	0.09	0.07	0.10	0.04	0.03	0.05	0.12
Nitrates	mg/l	0.9	1.2	1.5	1.3	3.7	3.9	2.6	5.3
Nitrites	mg/l	0.008	0.011	0.012	0.007	0.045	0.037	0.033	0.052
Phosphates	mg/l	-	0.41	-	0.36	0.01	0.19	0.10	0.07
Sulphates	mg/l	-	6.2	-	5.5	28.0	30.7	42.0	11.8
Chlorine	mg/l	-	7.5	-	6.8	7.0	11.6	15.6	14.5
Manganese	mg/l	-	0.07	-	0.10	0.04	0.09	0.10	0.09
Iron	mg/l	-	0.09	-	0.11	0.12	0.23	0.14	0.15
1st class 2nd class 3rd class 4th class 5th class									

source: ABA Banat

Table 2

Water quality of the Timiş river in 2012

Indices	MU	Control									
		Timiş - Şag					**Timiş – Grăniceri**				
		2012									
		Jan.	Apr.	Jul.	Oct.	Dec.	Jan.	Apr.	Jul.	Oct.	Dec.
pH	pH unites	7.1	7.3	7.4	-	7.3	7.7	7.3	7.2	7.0	7.1
OD	mg/l	10.1	9.3	9.0	-	8.5	10.3	10.2	6.7	8.1	10.6
CBO_5	mg/l	2.30	2.20	1.80	-	1.70	0.55	1.70	0.95	3.10	1.77
CCOCr	mg/l	9.3	11.4	12.1	-	10.5	7.62	13.2	6.85	15.5	11.5
Electr cond	$\mu S.cm^{-1}$	-	320	-	-	291	228	161	211	255	214
Ammonium	mg/l	0.11	0.12	0.09	-	0.07	0.04	0.06	0.03	0.02	0.02
Nitrates	mg/l	0.9	1.4	1.7	-	1.2	4.4	3.6	2.2	1.8	1.2
Nitrites	mg/l	0.008	0.010	0.008	-	0.011	0.033	0.040	0.040	0.060	0.020
Phosphates	mg/l	-	0.27	-	-	0.45	0.01	0.023	0.026	0.160	0.036
Sulphates	mg/l	-	7.5	-	-	8.3	18.8	31.0	27.7	23.0	22.0
Chlorine	mg/l	-	8.2	-	-	7.5	8.5	4.0	5.7	7.4	5.1
Manganese	mg/l	-	0.12	-	-	0.07	0.06	0.14	0.08	0.03	0.01
Iron	mg/l	-	0.15	-	-	0.10	0.03	0.15	0.05	0.18	0.04
1st class 2nd class 3rd class 4th class 5th class											

source: ABA Banat

Analysis of the data presented in the above tables highlights the following aspects:

- In the Şag section, in 2011, as well as in 2012, most parameters correspond to the 1st quality class; values slightly higher, corresponding to the 2nd class, are noticed with oxygen regime and nutrient indices
- In the Grăniceri section, during the two analysed years, a higher frequency of 2nd class indices is noticed with the same indices groups mentioned before
- From upstream to downstream, the Timiş river quality depreciates due to nitrate and nitrite concentration, as a result of anthropic pollutant activities (fig. 2)

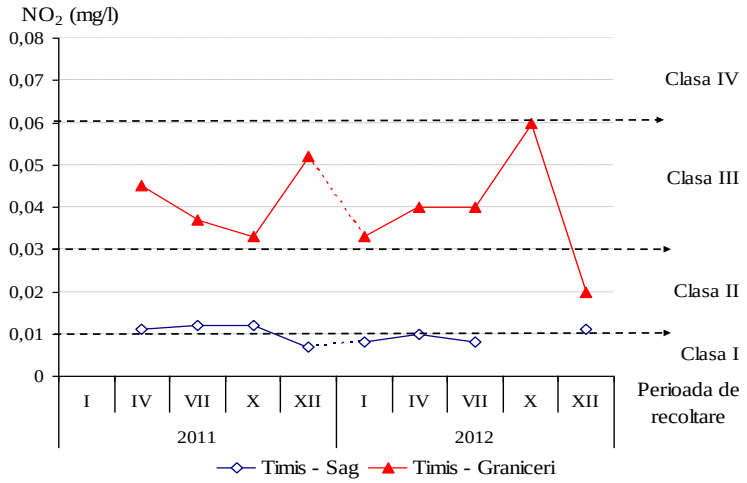

Fig.2 Timiş river nitrite concentration variation

- Regarding pH, electric conductivity, NH_4, sulphates, chlorines, Mn and Fe indices, the two analysed sections, in the two observation years, correspond to the 1st quality class.

In order to evaluate the *Bega river quality state* in the sector belonging to the study area, in 2011 and 2012, analytical data taken over from ABA Banat were used, from the control sections upstream Timişoara and downstream Otelec (Tables 3 and 4).

Table 3

Water quality of the Bega river in 2011

Indices	MU	Control section							
		Bega – upstream Timişoara				**Bega – Otelec**			
		2011							
		Apr.	Jul.	Oct.	Dec.	Apr.	Jul.	Oct.	Dec.
pH	pH units	7.6	7.5	7.2	7.5	7.6	7.1	7.4	7.4
OD	mg/l	11.2	10.6	9.5	10.1	4.0	6.6	8.5	11.8
CBO_5	mg/l	1.9	2.1	2.0	1.8	3.3	3.7	2.6	2.1
CCOCr	mg/l	10.4	11.2	8.3	14.1	19.5	10.7	20.3	18.7
Electr cond	$\mu S.cm^{-1}$	239	310	296	320	308	261	307	335
Ammonium	mg/l	0.017	0.025	0.035	0.018	2.30	0.25	0.19	0.12
Nitrates	mg/l	1.2	0.9	1.5	1.3	3.1	1.3	4.4	4.2
Nitrites	mg/l	0.010	0.009	0.007	0.012	0.320	0.040	0.060	0.092
Phosphates	mg/l	0.26	0.36	0.09	0.16	0.50	0.25	0.62	0.50
Sulphates	mg/l	5.2	7.5	6.2	8.6	23.6	18.7	23.6	25.0
Chlorine	mg/l	8.6	9.3	9.7	8.8	14.0	15.6	17.0	23.0
Manganese	mg/l	0.09	0.06	0.08	0.11	0.22	0.13	0.08	0.05
Iron	mg/l	0.16	0.22	0.21	0.19	0.17	0.15	0.13	0.12
1st class 2nd class 3rd class 4th class 5th class									

source: ABA Banat

Table 4

Water quality of the Bega river in 2012

Indices	MU	Control section									
		Bega – upstream Timişoara					**Bega – Otelec**				
		2012									
		Jan.	Apr.	Jul.	Oct.	Dec.	Jan.	Apr.	Jul.	Oct.	Dec.
pH	pH units	7.6	7.3	7.4	-	7.5	8.1	7.5	7.2	7.3	7.7
OD	mg/l	12.2	10.4	9.7	-	10.7	12.8	9.5	8.6	7.6	10.6
CBO_5	mg/l	2.0	2.3	2.9	-	1.7	3.4	2.7	4.5	1.6	1.5
CCOCr	mg/l	12.4	10.6	11.2	-	9.5	27.9	16.9	13.1	9.3	10.9
Electr cond	$\mu S.cm^{-1}$	289	296	314	-	305	329	237	267	365	296
Ammonium	mg/l	0.012	0.021	0.017	-	0.026	0.20	0.25	0.11	0.12	0.14
Nitrates	mg/l	1.1	0.9	1.3	-	1.2	7.7	3.6	4.2	5.3	4.6
Nitrites	mg/l	0.012	0.006	0.009	-	0.008	0.036	0.042	0.380	0.090	0.080
Phosphates	mg/l	0.15	0.27	0.35	-	0.22	0.85	0.40	0.53	1.05	0.50
Sulphates	mg/l	6.6	7.3	6.2	-	6.9	22.0	16.2	18.0	23.0	22.0
Chlorine	mg/l	10.5	8.3	8.0	-	9.7	24.0	14.2	25.0	24.5	19.0
Manganese	mg/l	0.06	0.05	0.08	-	0.07	0.04	0.04	0.05	0.04	0.03
Iron	mg/l	0.15	0.11	0.20	-	0.19	0.05	0.18	0.01	0.01	0.04
1st class 2nd class 3rd class 4th class 5th class											

sursa: ABA Banat

The analysis of the data presented in the tables above highlight the following aspects:

- In the downstream Timişoara section, in 2011, as well as in 2012, most parameters belong the 1st quality class; values slightly higher, corresponding to the 2nd and 3rd class, are noticed with phosphates, CCOCr and nutrient indices
- In the Otelec section, during the two study years, a higher frequency of 2nd and 3rd class indices is noticed with the same indices groups mentioned before
- From upstream to downstream, the Bega river quality depreciates due to nitrate and nitrite concentration (fig. 3) and phosphates, the 4th and 5th quality class values, resulting from anthropic pollutant activities

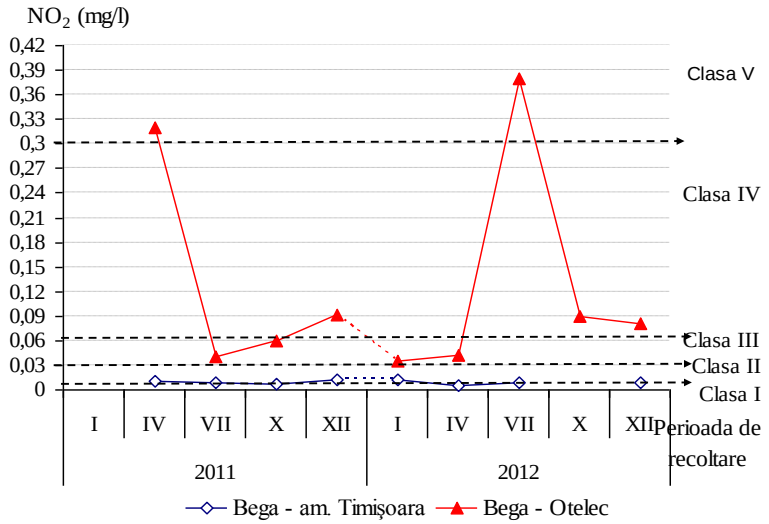

Fig.3 Bega river nitrite concentration variation

- regarding the pH, electric conductivity, sulphates, chlorines, Mn and Fe indices, the two analysed sections, during the two observation years, correspond to the 1st class.

In the area represented by the Timiş-Bega interfluve, downstream from Timişoara, the main economic activities are the ones with agricultural character, land cultivation, and zootechnical activities. In the following we will briefly present, based on data from the specialty literature, some of the potential pollution sources in the studied area.

COMTIM, currently **S.C. SMITHFIELD FERME S.R.L,** activates in the swine breeding field. In time, epuration stations proved insufficient in number and, ulterior, the mechanical stage was partially and the biological stage totally abandoned, thus adopting the facilitation system for fertilizing limitrophe agricultural lands; unclean or partially cleaned used waters were evacuated either in deposit basins, or in drainage channels in the area, from where they penetrated the surface or underground waters deteriorating their qualitative state (Nedelcu R, 2008).

In the analysed area, a negative influence on environment factors was carried out in the past by **SC COLTERM SA TIMISOARA – The Cinder and Ashes Deposit UTVIN.** Activity **c**ategory: Waste management – Waste deposits of over 10 tons wastes/day or having a total capacity higher than 25 000 tons of waste, except for inert waste deposits (Both I, 2013).

Another source, which endangers the surface water quality, may be considered the **Waste Deposit Parţa**, which does not have environment factor protection equipment (Nedelcu R, 2008). The Waste Deposit Parţa is situated on the north-west side of the City of Timişoara, at the intersection of DN Timişoara-Moraviţa with DJ Timişoara-Foeni. The waste deposit functions since 1973, being shut down at present. Due to the fact that the deposit has not been equipped, it may, while functioning and in the future as well, lead to the pollution of surface and underground waters in the area (Both I, 2013).

CONCLUSIONS

The Bega water stream in the control section upstream Timişoara, during the two analysed years, with most analysed parameters, shows 1st quality class values; donwnstream, the water quality suffers a slight change, the pollutant load, coming from various sources, its main cause, so that, in the Otelec section, one may observe the predominance of 2nd and 3rd quality class. 2nd class values are noticed with the oxygen regime (OD, CBO_5, CCOCr) and nutrient category (nitrates, nitrites and phosphates) indices. Regarding the pH, electric conductivity, ammonium, sulphates, chlorines, manganese and iron indices, in the two analysed sections, in 2011and 2012, the values belong to the 1st quality class.

For the Timiş water stream in the Şag control section, during the two study years, most analysed parameters show values belonging to the 1st quality class; downstream, the Timiş river quality depreciates due to nitrate and nitrite concentration, resulting from anthropic pollutant activities. For the Grăniceri control section, 2nd quality class values are observed with the oxygen regime and nutrient indices.

Based on the information presented above, one may draw the conclusion that there are some qualitative differences between control sections placed at the study area entrance, namely upstream Timişoara (on the Bega) and Şag (on the Timiş) and those downstream, when exiting the area, namely Otelec (on the Bega) and Grăniceri (on the Timiş), determined by:

- the crossing of the waters of an agricultural area, where a chemicalized agriculture is practiced (chemical fertilizers and pesticides)
- overflowing of partially cleaned or raw used waters (accidentally)
- past or current zootechnical activities in the study area (farms and bovine and swine complexes)
- used waters from the Direction for Water and Sewage Timişoara (Nedelcu R, 2008).

Taking the „communication" between surface and underground water layers into account, the quality of the latter may suffer negative changes, under certain environmental conditions.

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