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THE INFLUENCE OF ANTHROPIC ACTIVITY ON SOMES RIVER WATER QUALITY

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Abstract

Under current conditions, the water resource at planetary level has become increasingly expensive because of human pressure. Therefore, maintaining drinking water quality is increasingly important. In this paper, the authors present the influence of human activities on the River Somes (Romania). It has been studied mainly as water quality indices. Within the Somes-Tisa basin, the authors identified 41 potentially polluting industrial sources in the following fields of activity: mining (decantation ponds, mining dumps) and urban and industrial waste management. Thus, the authors analysed the best pollution parameters such as pH, dissolved oxygen, biochemical oxygen consumption, ammonia, nitrates, nitrites, total nitrogen, chromium, calcium, and magnesium. As a result of effected analyses, it can be observed a charge of nitrites and chlorides, and the presence of pollution phenomenon is showed by the high values of nitrites and biochemical oxygen consumption. Analyses were carried out over three years, 2014-2016. Quality classes increased from 2014 to 2016 because pollution decreased due to the lack of connection of the households to the waste water system in 2013-2014. Research analyses show that the water from the River Somes tends to maintain its quality; however, surface waters tend to be polluted and they are slightly influenced by human activities.

Key words*: anthropic activities, pH, oxygen regime, nutrients, water quality.*

INTRODUCTION

Development of industrial activity, increasing the intensification of water use in agriculture, increasing the population and the degree of civilization are asking for water requirements, worldwide (Șmuleac et al., 2012; Pișota et al., 2010).

Humanity has come to ask, whether we succeed in increasing water resources, both levies for different uses, and for use as an emissary for discharges.

At this stage it has reached a finding that water is intimately linked to the terrestrial ecological system and to maintaining this system and the very survival of humanity need conservation and protection of hydrosphere, worldwide (Ienciu et al., 2013, 2015; Marica et al., 2016).

Direct discharge of waste waters into rivers could contribute to microbial and chemical pollution and can have negative effects on the quality of water (Ciobotaru, 2015; Sofrenie, 2000). Studies about sources of water pollution (Chiorescu, 2013), especially in Somes Basin (Corodan, 2016; Pompei, 2012) shows that the water of Somes is not so polluted, but require good measurements to protect it. Corodan et al. (2016) shows that the basin Someș-Tisa gets an negative anthropogenic pollution because of agriculture, industry and human settlements. That study was made using model MONERIS (Modelling Nutrient Emissions in River Systems) for estimating emissions coming from diffuse and local pollution sources. That research conclude that the industrial and agricultural pollution sources contributes to the discharge of pollutants specific to the type of activities performed as follows: fertilizers, nutrients from food industry, chemical industry, organics, animal farms, pulp and paper, and heavy metals by the extractive industry and manufacturing, chemical and hazardous organic micro pollutants.

MATERIALS AND METHODS

Data analysis was carried out at the research platform of the Satu-Mare Romanian Water Agency in the Somes-Tisa Basin, according to Official Journal of Romania, Part I, No 161/ 2006.

The location of water sampling was established about 20 km south-west from Satu-Mare between the Commune of Lipau and the village of Potau (Figure 1). Water was sampled on the 1st day of each month between 8 and 11 a.m.

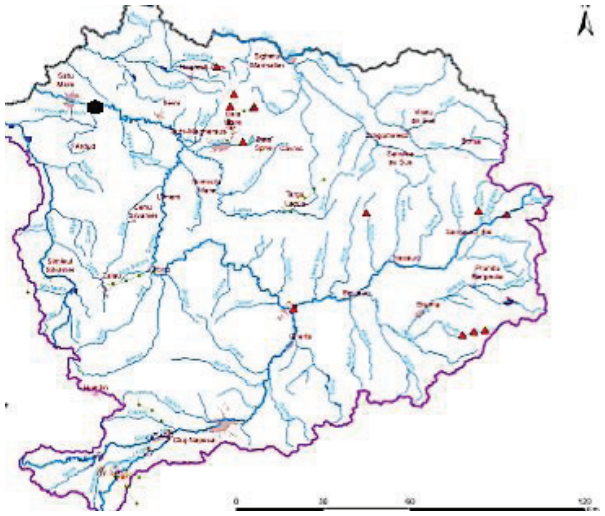

Figure 1. The point of water sampling

RESULTS AND DISCUSSIONS

We determined general physical and chemical indices such as dissolved oxygen, biochemical oxygen consumption over 5 days (CBO_5), temperature and pH. We noted that, the cooler the water, the higher dissolved oxygen concentration. For 2014, temperature in January was 6.5°C, dissolved oxygen reached 13.5 mg/l compared to June, when the highest temperature was 23.2°C, and dissolved oxygen reached only 9 mg/l.

Oxygen regime is shown in Figure 2.

Figure 2 below shows a decrease of oxygen from 8.1 mg/l in 2014 to 7.1 in 2016. This means that, in 2014 and 2015, water ranked 1st in quality, while in 2016, it ranked 2nd. Dissolved oxygen is the most important feature of water quality: therefore, 1st quality water means self-purge is normal, while 2nd quality water asks for river monitoring.

Biochemical consumption of oxygen over 5 days (Figure 3) ranked 2nd in 2014 and 5th in June-September of the same year. In January 2015, water quality ranked 3rd (12.7 mg/l), in June it ranked 1st (1.1 mg/l), and in September it ranked 2nd (4.9 mg/l). In 2016, water quality ranked 1st (3 mg/l). Due to water quality, fish farming activities play a role in establishing and monitoring of possible pollution sources.

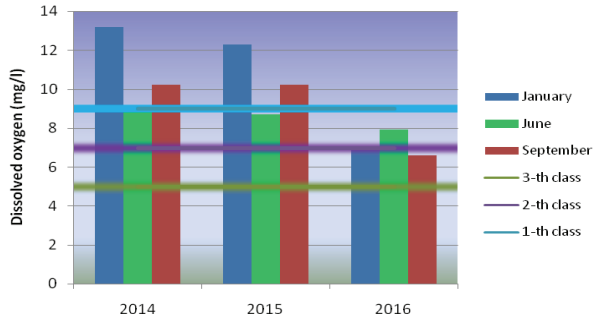

Figure 2. Dissolved oxygen in Somes River

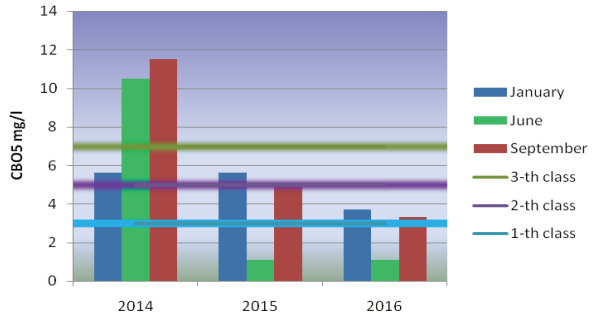

Figure 3. Biochemical consumption of oxygen

Saturation of dissolved oxygen was 1st in 2014 and 2015. In 2014, saturation of dissolved oxygen was 108.2% in January, 108.2% in June, and 115.0% in September. In 2015, it reached 97.0% in January, 103.1% in June, and 101.4% in September. In 2016, it reached 0% in January, 87.0% in June and 67.2% in September. Therefore, water quality was in balance with water temperature for the period 2014-2015, while in 2016 water quality ranked 3rd.

Nutrients. Aquatic bodies need chemical elements to grow and develop normally such as ammonia ($N\text{-}NH_4^+$), nitrites ($N\text{-}NO_2^-$), nitrates ($N\text{-}NO_3^-$), total nitrate (N) and total phosphorus (P). In 23014, ammonia ranked water 2nd quality, i.e. it was 0.71 mg/dm³ in January, 0.80 mg/dm³ in June and 0.61 mg/dm³ in September. In 2015, ammonia reached 0.77 mg/dm³ in January, making water 2nd quality, compared to June, when it reached 0.027 mg/dm³ making water 1st quality, just like in September, when it reached 0.02 mg/dm³.

In 2016, ammonia levels in January was higher because of the rainfalls (Figure 4).

Nitrites (Figure 5) in January 2014 reached 0.065 mg/dm³ making water 3rd quality, in June it reached 0.007 gm/dm³, and in September, it reached 0.012 making water 1st quality.

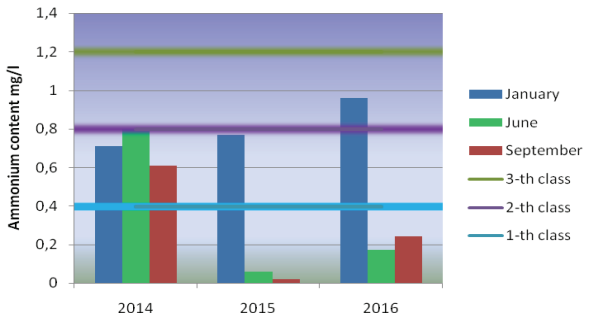

Figure 4. Ammonium content

In 2015, it reached in January 0.018 mg/dm³, in June 0.003 and in September, 0.03 mg/dm³. Therefore, in January and June, water ranked 2nd in quality. In 2016, water samples were the same as in 2015, i.e. 0.012 mg/dm³ in January, 0.027 in June, and 0.045 in September, making water quality 1st quality in the first two months and 2nd quality in the third sampling month.

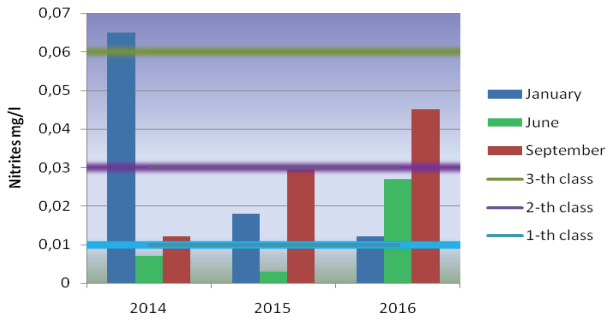

Figure 5. Nitrites in Somes River

Total nitrogen (Figure 6), in all three years, ranked water 1st quality. In 2014, total nitrogen reached 1.8 mg/dm³ in January, 1.01 mg/dm³ in June, and 1.17 mg/dm³ in September. In 2015, it reached 2 mg/dm³ in January, 4.8 mg/dm³ in June and 4 mg/dm³ in September. In 2016, it reached 2 mg/dm³ in January, 2 mg/dm³ in June and 2 mg/dm³ in September.

Figure 6 below shows total nitrogen. Total nitrogen had normal concentrations, which makes it 1st quality water.

Nitrates (Figure 7) made water 1st quality in all three years, reaching values below 1 mg/dm³ or slightly above. In January 2014, nitrates reached 0.25 mg/dm³, in June they reached 0.29 mg/dm³ and in September 0.36 mg/dm³. In January 2015, they reached 1.13 mg/dm³, in June they reached 0.29 mg/dm³ and in September 0.42 mg/dm³. In January 2016, they reached 0.95 mg/dm³, in June, they reached 0.29 mg/dm³, and in September, they reached 0.36 mg/dm³.

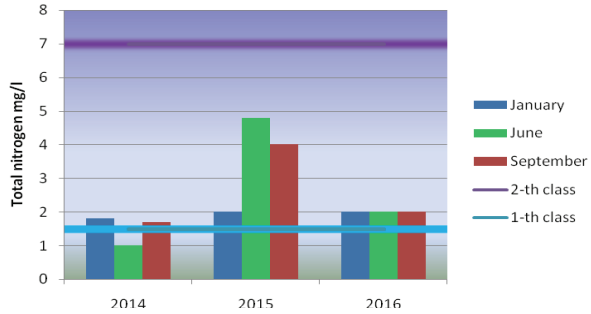

Figure 6. Total nitrogen

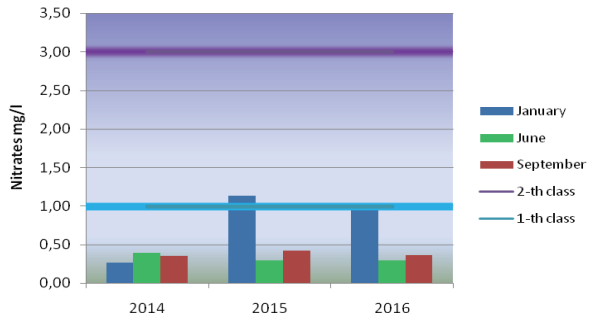

Figure 7. Nitrates content in Somes River

Water electric conductivity is that water feature that conducts electrical current: the higher the conductivity, the higher the quality. In 2014, water conductivity increased during the hot season up to 575 µS/cm compared to January, when it was 470 µS/cm and September, when it was 540 µS/cm. In 2015, conductivity increased from 550 µS/cm to 980 µS/cm in 2016.

Chromium reached values below 50 µ/dm³, which ranks water 1st quality. We need to monitor the parameters, which allow water to be used in fish farming.

As for chlorine salts, in 2014 their concentration increased with 36 mg/dm³ until 2016, when they reached 110.4 mg/dm³, ranking water 2nd quality in 2016 and 1st quality in 2014.

Maximum sulphate amounts for 1st quality water are 60 mg/dm³; since no water sample had values above 40 mg/dm³, water ranks 1st quality.

Calcium concentrations increased from 2014 with 40 mg/dm³, making water 1st quality because this value was below 50 mg/dm³; in 2016, they reached 64 mg/dm³ making water

2nd quality. We need to monitor this perimeter on a constant basis.
As for magnesium, its concentration decreased from 2014 to 2016: in 2014, it was 15 mg/dm³ making water 2nd quality, compare to 2016, when it was 6 mg/dm³ making water 1st quality. We need to monitor the perimeter.
Copper concentration was below 20 µg/dm³ in all three years, making water 1st quality. Zinc had maximum concentration for 1st quality water (100 µg/dm³) and it kept constant. Arsenic had concentrations below 10 µg/dm³ making water 1st quality.

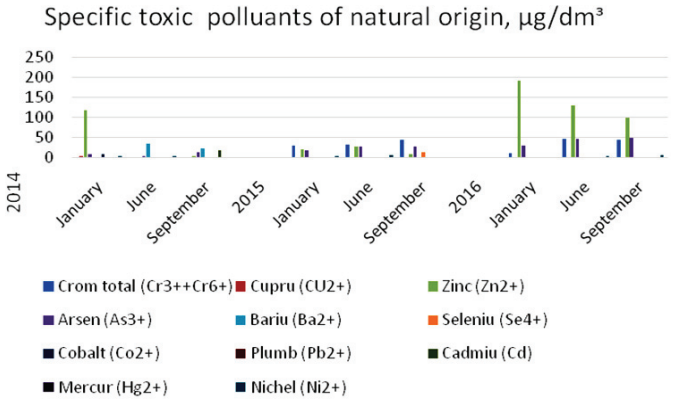

Figure 8. Specific toxic pollutants in Somes River

Barium made water 1st quality because its concentration was below 0.05 µg/dm³. Maximum concentration of selenium in 1st quality water is 1 µg/dm³, and this was the case in our water samples. Cobalt ranks water 1st class because its concentration was below 10 µg/dm³. Lead concentration for 1st quality water is 5 µg/dm³; in January 2014, lead concentration was 1.9 µg/dm³ and in June and September, it was below 1 µg/dm³; in 2015 lead concentration were 1.0 µg/dm³ in January, 1.5 µg/dm³ in June and 1.8 µg/dm³ in September. Cadmium ranked water 1st quality because it was below 0.5 µg/dm³ in either year. Mercury concentrations were below 0.1 µg/dm³ making water 1st quality. The same in nickel concentrations, in which maximum concentration for 1st quality water is 10 µg/dm³, as it was the case of our samples. Therefore, the River Somes is fit for the growth and development of aquatic bodies due to its concentration in chemical elements. However, these parameters need to be permanently monitored.

CONCLUSIONS

To determine water quality, we analysed water samples from three different years (2014, 2015 and 2016) from January, June and September.
As a conclusion, because of human activities, river water quality is decreasing in dissolved oxygen, biochemical consumption of oxygen over five days, oxygen saturation, nitrite and chlorine salt content, parameters that need constant monitoring. Quality classes increased from 2014 to 2016 because pollution decreased because of the lack of connection of the households to the waste water system in 2013-2014.
Nitrates are present in minimum concentrations and rank water quality 1st: therefore, water is fit for fish farming and as drinking water.
Therefore, total nitrogen ranks water as 1st quality water, which means that it has substances and chemical elements favourable to body development.
As a conclusion, most studied parameters make water 1st quality; the river is self-cleaning and self-maintaining, with balanced concentrations of dissolved oxygen and water temperature.
Toxic specific natural pollutants such as total chromium, copper, zinc, arsenic, barium, selenium, cobalt, cadmium, and mercury range are in 1st quality water. However, we need to continuously monitor the parameters.

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