EVALUATION OF THE WATER QUALITY INDICATOR PHYTOPLANKTON EXISTENT IN CRISUL REPEDE IN 2009

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Abstract

The purpose of this paper is to display aspects of monitoring the surface waters based on the phytoplankton biological indicator.

The phytoplankton was evaluated in 2009, in 15 different locations of the Crisul Repede river. In order to set up a list of the existent species, it has been taken into consideration different water quality parameters that favor the existence of the phytoplankton, influencing thus the quality of the water.

Key words : phytoplankton, water;

INTRODUCTION

For the purpose of realizing limnological researches and the monitoring of the surface waters quality, in accordance with the requirements stipulated within the Water Framework Directive, it turns out that the phytoplankton samples are necessary and representative (quantitative and qualitative researches). The phytoplankton samples provide information both concerning the taxonomic composition and the density of the phytoplankton taxa and their relative abundance. These specific data help us to evaluate the productivity and biomass of taxa and the phytoplankton total biomass. The growth and the development of the phytoplanktonic algae depend both on the abiotic factors of environment (light, temperature, nutrients) and the biotic factors (competition, pressure of the herbivorous animals and parasitism). The adjustment level of the algae when it comes to the environmental conditions can be very different: cosmopolitan, *euribiont species* display an important and large ecological plasticity, as their adaptability to the change manifested by the environmental conditions can be extremely significant, while the *stenobiont species* are defined by a very narrow-limited capacity to the change of the environmental factors.

Pursuant to the Water Framework Directive, the algae represent one of the main tropical divisions when it comes to evaluate the water quality displayed by the continental aquatic ecosystems, either natural or anthropized, either flowing or stagnant water. (Directiva Cadru a Uniunii Europene în domeniul politicii apei)

MATERIALS AND METHODS

In order to achieve our objectives, the following steps undertaken were to identify the representative sections, taking samples, performing laboratory analysis and data processing. There were used accredited methodologies of analysis and evaluation of the results.

The samples were taken during 2009, namely, in different campaigns organized (2-3): the frequency of the sampling activity depended on the type of the monitoring program (observation or operational) of every section, during the period of maximum growth of the phytoplankton. There were monitored 15 sections: Crisul Repede – am Alesd. Crisul Repede – am Oradea, Crisul Repede – Tarian, Cropanda – Tileagd, Uileac – Ineu de Cris, Tasad – Osorhei, Peta – am. Sanmartin, Peta – av. Oradea, Alceu – Toboliu, Secatura – Pestis, Corhana – CPE2 Padurea Radvani, Dobrinesti – Cacuciul Vechi, Alunis – Braisoru, Chijic – Sacadat, Mnierea – am. Galaseni. The act of taking phytoplankton samples was performed in accordance with the instructions mentioned by the standards (draft) *N 109 2008/04/15 – Water quality – Guide for quantitative and qualitative sampling of the phytoplankton from the internal waters*. For rivers, according to the above mentioned draft, the phytoplankton was taken only from the middle and inferior course of the big rivers, only from hill and plain regions; there were not taken samples from the superior course of the rivers, respectively from the alpine regions. In order to analyze the phytoplankton existent in the rivers, there were taken quantitative and qualitative samples. The phytoplankton samples were drawn out from the middle area of the river, namely, from a depth of 0.2 - 0.5 m. In cases when there were discovered floating algae (e.g. Microcystis) and/or the Secchi depth was situated below 1 m, it was taken a second sample directly from the water surface and it was mixed with the sample taken from 0.5 m (1:1).

For the analysis of the phytoplankton samples it was used the *Pantle-Buck method* (1955), but an improved method based on the saprobic system which reflects the capacity of some aquatic organisms to develop in the organically polluted waters. (Metode unificate de cercetare a calității apei. Partea a III-a. Metode de analiză biologică a apei. Anexa 2. Atlasul organismelor saprobe. Moscova, 1977). The Pantle-Buck method was standardized and it is generally used for the flowing waters. The authors set up a classification of waters based on the saprobic systems, by allotting to the biological indicators a numerical value corresponding to the saprobity degree. The water quality classes were established in accordance with the Order 161/2006 by classifying the saprobic index values.

RESULTS AND DISCUSSION

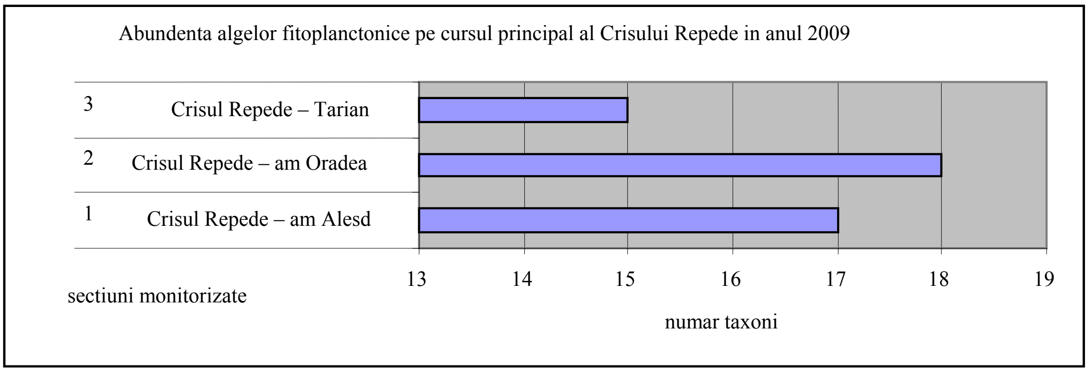
The existence of the phytoplankton provides valuable information in what concerns the qualitative condition of the water. The analysis of the phytoplankton samples offers us results referring to the taxonomic composition, to the density of the phytoplankton taxa and to their relative abundance. These data allow us to evaluate the taxa productivity and biomass and the phytoplankton total biomass.

Now, in the areas that were analyzed there were determined the following phytoplankton species: Cymbella ventricosa, Diatoma vulgare, Synedra ulna, Closterium aciculare, Pinnularia viridis, Navicula cryptocephala, Melosira varians, Navicula viridula, Gomphonema olivaceum, Caloneis silicula, Ceratoneis arcus, Didymosphenia geminata, Cymbella lanceolata, Hantzschia amphioxys, Amphora ovalis, Oscillatoria tenuis, Scenedesmus bijuga, Rhoicosphenia curvata, Cymatopleura elliptica, Euglena acus, Nitzschia acicularis, Fragilaria crotonensis, Scenedesmus quadricauda, Dinobryon sertularia, Euglena viridis, Cymatopleura solea, Stephanodiscus hantzschii, Caloneis amphisbaena, Cymbella lanceolata, Oscillatoria tenuis, Pediastrum simplex , Navicula radiosa, Cosmarium formulosum, Gonium sociale, Closterium cornu, Navicula dicephala, Melosira granulata, Cymbella tumida, Merismopedia tenuissima, Cymatopleura solea, cryptocephala, Fragillaria construens, Trachelomonas hispida, Gyrosigma acuminatum, Pinnularia viridis, Didymosphenia geminate, Anabaena spiroides, Scenedesmus bijuga, Gomphonema constrictum, Diatoma egrenbergii, Cyclotella menenghiniana, Surirella ovata, Anabaena circinalis, Crucigenia rectangularis, Scenedesmus arcuatus, Pediastrum boryanum, Actinastrum hantzschii, Closterium acerosum, Cocconeis placentula, Tabellaria fenestrata, Stauroneis phoenicenteron, Attheya zachariasii, Nitzschia sigmoidea, Merismopedia elegans, Spiroghyra porticalis, Cosmarium subcostatum, Epithemia turgida, Oscillatoria subtilissima, Neidium productum, Pinnularia microstauron, Amphora veneta. (Antonescu, C. (1959))

The sub-basin of the Crisul Repede river was monitored on 15 different locations, out of which 2 locations were defined as CBSD (Crisul Repede – upstream Alesd and Peta – upstream Sanmartin). CBSD means “the best available location”.

Figure no. 1

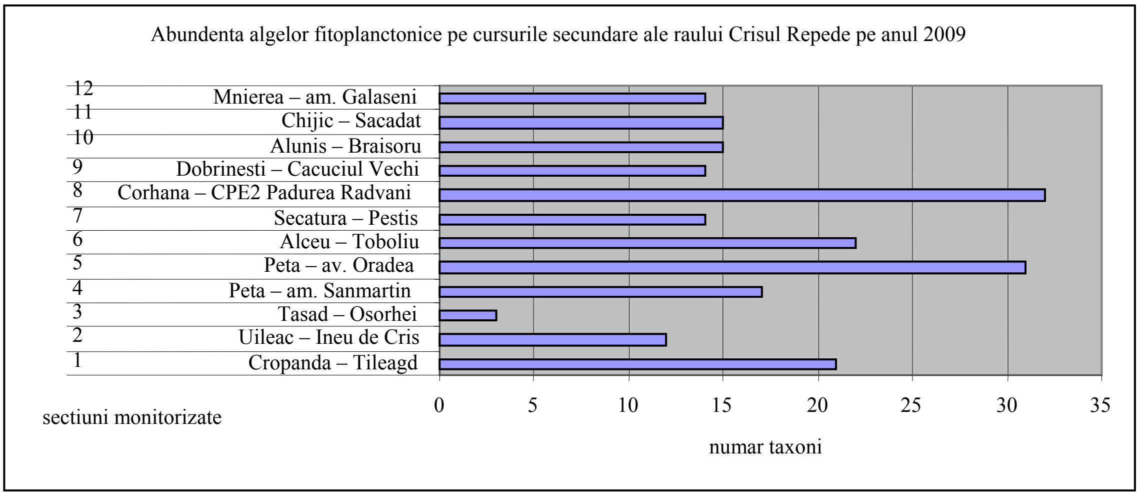
Abundance of phytoplankton algae on the main course of Crisul Repede river in 2009



As it is displayed within Figure no. 1, there was discovered on the main water-course a high number of phytoplankton algae. The majority of taxa were found out on the region Crisul Repede – upstream Oradea. In this section, the samples were taken twice, namely in June and November. The anthropogenic impact displaying the highest ponderosity is the storage lake of Tileagd.

Figure no. 2

Abundance of phytoplankton algae on the seccondary proccess water of Crisul Repede river in 2009

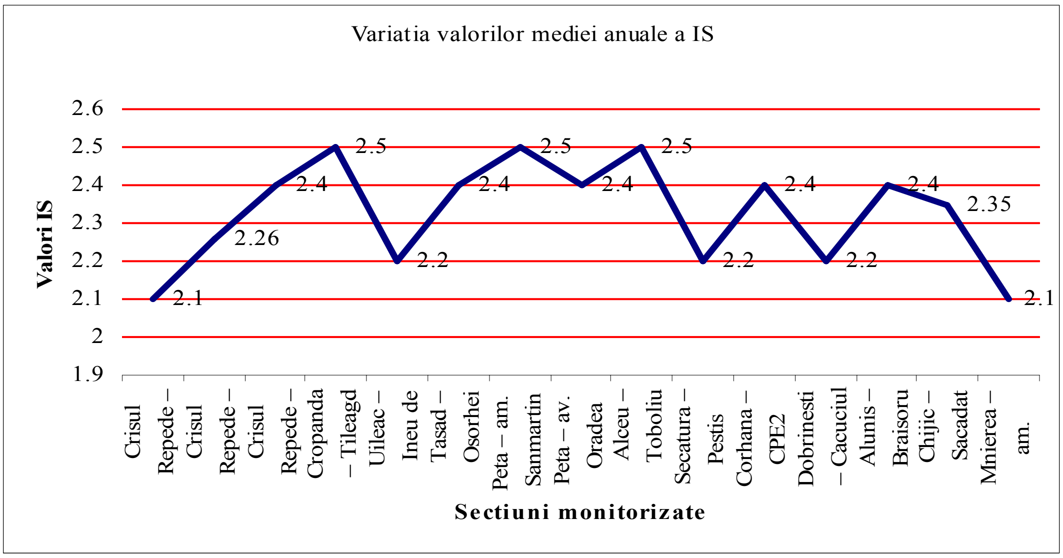


In Figure no. 2, one can notice a significant existence of the phytoplankton algae on secondary watercourses, on the tributary streams.

The most diverse phytoplankton is discovered in the following regions: Corhana – CPE2 Radvani Wood and Peta – downstream Oradea.

Figure no. 3

Variation of the average values of IS



According to the Order 161/2006, (Ordinul 161/2006, Ministerul Mediului şi Gospodăririi Apelor) the annual average values of the saprobic index depending on the phytoplankton, were situated between the limits 2,1 and 2,5. These values classify the water quality of the monitored regions in the quality class II and III.

Figure no. 4

Framing sections monitored by phytoplankton in quality classes

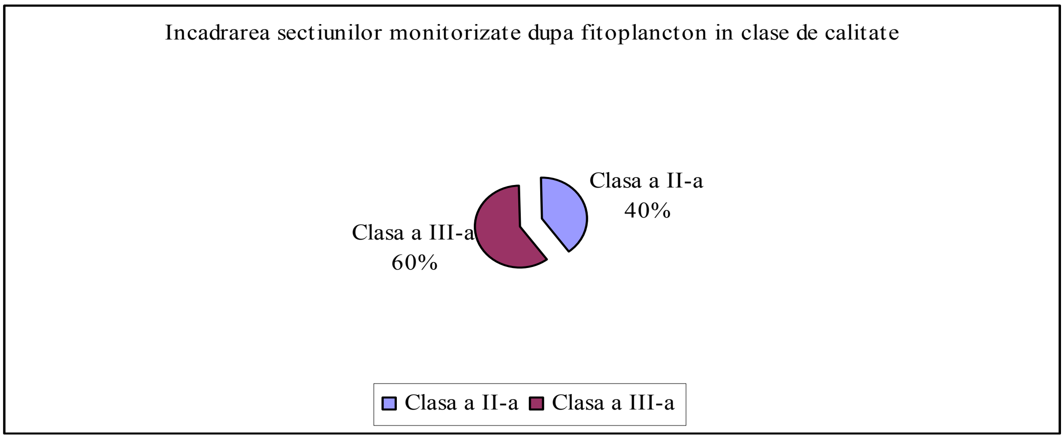


Figure no. 4 comes to underline that out of the total areas that were studied based on their phytoplankton in 2009, 40% of the sections belong to water quality class II, while 60% of them were placed in the class III. Now, in what concerns the areas placed in the quality class II, the value of the saprobic index is situated between the limits 1,8 and 2,3, while as for those situated in the quality class III, the saprobic index value is situated between the limits 2,3 and 2,7.

Out of the total of phytoplanktonic algae found in Crisul Repede river in 2009, the majority is represented by the species that belong to the bacillariophyta group (Synedra ulna, Diatoma vulgare, Cymbella ventricosa, Amphora ovalis, etc).

The euglenophyceaelor group is scarcely represented in the Crisul Repede sub-basin.

Table no 1

Phytoplankton densities recorded

Denumire sectiune	iunie	septembrie	noiembrie
	Densitate (ex./l):	Densitate (ex./l):	Densitate (ex./l):
Crisul Repede – am Alesd	2012500	-	-
Crisul Repede – am Oradea	1062500	-	637500
Crisul Repede – Tarian	1262500	-	-
Cropanda – Tileagd	500000	160000	287500
Uileac – Ineu de Cris	675000	-	225000
Tasad – Osorhei	-	-	75000
Peta – am. Sanmartin	1750000	-	-
Peta – av. Oradea	1400000	-	812500
Alceu – Toboliu	2162500	-	462500
Secatura – Pestis	712500	-	225000
Corhana – CPE2 Padurea Radvani	1237500	1450000	-
Dobrinesti – Cacuciul Vechi	875000	-	450000
Alunis – Braisoru	1075000	-	500000
Chijic – Sacadat	650000	-	362500
Mnierea – am. Galaseni	625000	-	250000

From table no. 1 it results that the region with the highest phytoplankton density recorded in June 2009, is the section Alceu-Toboliu, while the section with the lowest phytoplankton density in June 2009 is section Mnierea – upstream Galaseni. It can be traced a high density of the phytoplankton species found on the section Corhana – CPE2 Radvani Wood, in September. Out of the monitored regions in November, the lowest phytoplankton density is recorded in the section Tasad – Osorhei.

CONCLUSIONS

The evaluation of the existent phytoplankton in Crisul Repede river, in 2009, was based on the analysis of the samples taken from 15 different locations. Based on the analysis referring to taxonomic composition, density and on the phytoplankton taxa and of their relative abundance, it was ascertained the existence of a high variety of taxa.

A rich number of phytoplankton algae was recorded on the main stream, namely in the section Crisul Repede – upstream Oradea. In what concerns the secondary streams, the tributary streams, the most diverse phytoplankton can be traced in the sections Corhana – CPE 2 Radvani Wood and Peta – downstream Oradea.

After having first determined the values of the saprobic index, we have obtained a classification of the watercourses, depending on the existent phytoplankton, namely a classification referring to the water quality classes, in accordance with the Order 161/2006: 6 sections belonged to the water quality class II, while 9 sections belonged to water quality class III. The water quality alteration does not necessarily imply a rise of the anthropological impact, as the cause of the phytoplankton component change is actually the unfavorable evolution of the hydro meteorological conditions (low debits). The analysis of densities in ex/l of the phytoplankton provides valuable information concerning its area of expansion.(Îndrumar "Metode de analiză biologică pentru urmărirea evoluției calității apelor", ICPGA,1978). The phytoplankton, from the quantitative point of view, was characterized by finding a number of organisms. This parameter, on the whole period when the samples were taken, had oscillatory values in all the watercourses that were analyzed. The maximum number of organisms was recorded during summer months. The most represented group is the bacillariophyceaelor group (Synedra ulna, Diatoma vulgare, Cymbella ventricosa, Amphora ovalis, etc.), while the least represented group was the euglenophyceaelor one. (Mălăcea, I., - Biologia apelor impurificate, Editura Academiei RSR, 1969) .The type of the impact on the Crisul Repede river was represented by the confluence of the Peta creek, by disposals of industrial plants from the city of Oradea (e.g. Sinteza SA), by discharge of wastewater treatment plant of Oradea, by industrial water disposals SC Mobil Tileagd SA, SC Sectia Impregnant Traverse Tileagd SA, geothermal water disposal from (locality) "1 Mai", disposal: geothermal water, plant of Sanmartin, RA Airport of Oradea, storage lake of Alceu and storage lake of Tileagd.

Although there exists a diverse anthropological impact upon Crisul Repede river, the taxonomic spectrum of the phytoplankton is pretty rich.

ACKNOWLEDGMENTS

The researches were carried out in the Laboratorul de Calitatea Apei of Administratia Bazinala de Apa Crisuri, Oradea.

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