PRELIMINARY DATA ON THE ECOLOGICAL STATUS OF HUMID AREAS IN BANAT

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Abstract*: The assessment of the ecological condition is one of the very important markers lately used in the assessment and analysis of vegetal biodiversity. In this paper are presented preliminary results on the assessment of the ecological status based on the physical-chemical quality standards, from two humid areas representative for Banat. It refers to the Natural Reserve „Satchinez Marshes" and part of the Natural Park Muresului Holm, known as the „water lily pond" Bezdin. The water samples were collected in the fall of 2010. On sampling, the standards in force were considered. The analysis of the samples was performed at the analysis laboratory of the Banat Water Branch. The interpretation of the results noted on the analysis report was carried out in keeping with norm 161 / 2007 (Chemical and Physical-Chemical Quality Elements and Standards to Establish the Ecological Condition of Surface Waters), issued by the Ministry of Environment and Water Administration. The following parameters were monitored: ammoniacal nitrogen, nitrites, azotates, phosphates, total phosphorous, dissolved oxygen, CCOMn/O_2, CCOCr, CBO_5, pH, zinc, copper, lead/cadmium. After processing the results, in the case of the humid area Satchinez, the classification by quality is the following: ammoniacal nitrogen, azotates, total nitrogen, CBO_5, copper, cadmium are grouped in quality class I; nitrites, total phosphorous, CCO-Mn/O_2 are grouped in quality class II; phosphates, CCOCr, zinc, lead are grouped in quality class III; dissolved oxygen is in quality class V. For the pond Bezdin, ammoniacal nitrogen, nitrites, azotates, CBO_5, zinc, cadmium are grouped in quality class I; lead is in quality class II, dissolved oxygen, CCO-Mn/O_2, CCOCr, are in quality class III; copper is in quality class IV, phosphates and total phosphorous are grouped in quality class V. From these data it can be noticed that higher values, therefore a classification in lower quality classes, are possessed by phosphates, CCOCr, dissolved oxygen, zinc and lead in the case of the humid area Satchinez, respectively the dissolved oxygen, CCO-Mn/O_2, CCOCr, phosphates, total phosphorous lead and copper, in the case of the pond Bezdin. An explanation for the higher values of the phosphorous compounds would be that they are influenced by the oxygen regime that is critical in both situations discussed, a fact due to the lack of water circulation (a phenomenon which occurs in spring and autumn). Another reason may be the appearance of large quantities of unwanted biomass, resulting from decomposing vegetation. Higher concentration of heavy metals can be attributed to specific human activities, industrial or agricultural. The subsequent sampling, the analyses and data processing shall allow us to find other explanations.*

Key words*: humid areas, water quality, chemical parameters*

INTRODUCTION

According to the European Directive 32000L0060, the ecological condition represents the expression of quality functioning and structure of aquatic ecosystems associated with surface waters. The assessment of aquatic ecosystems' ecological condition is performed based on the biological quality elements, on the hydro-morphological, chemical, physical-chemical markers and on the specific pollutants. In this paper the assessment is performed based on parameters of the

following physical-chemical markers: acidification, oxygen regime, nutrients and specific toxic pollutants of natural origin. Sampling was carried out in two locations, the Natural Reserve „Satchinez Marshes", the only natural humid area in Banat and the Bezdin pond, a part of the integral protection area Prundul Mare (located in the area of the Natural Park Muresului Holm – the only humid area in Banat included on the Ramsar list).

MATERIAL AND METHODS

The physical-chemical analysis of the water samples collected was in keeping with the STASS in force, and data interpretation was according to the specifications of norm „*Chemical and Physical-Chemical Quality Elements and Standards to Establish the Ecological Condition of Surface Waters*" (no. 161/2006, issued by Ministry of Environment – Romanian Official Gazzette, part I, issue 511, June 13, 2006). According to it, the value obtained for each parameter can be classified within one of the five quality classes set for surface waters. The significance of the quality classes is the following: class I = very good quality; class II = good quality; class III = moderate quality; class IV = poor quality; class V = bad quality. The results of the analysis report supplied by the laboratory (see tables 1 and 2) are to be grouped per quality classes, indicating for each parameter monitored the value obtained, the corresponding class and the limit accepted for that class. Furtheron, we mentioned the parameters grouped in class I, the ones whose value allow the classification in class II, a.s.o., making these determinations for every parameter measured. The share per quality classes is graphically presented in figures 1 and 2. Also, explanations were offered for parameters determined with high values and that are classified in moderate or poor quality classes.

RESULTS AND DISCUSSIONS

In what follows the values obtained are presented, as well as the classification per quality classes, of the analyzed physical-chemical parameters from the water sample collected in the Satchinez humid area region (see table 1):

- for ammoniacal nitrogen ($N\text{-}NH_4^+$), the value obtained of 0.001 mg, is classified in quality class I (the class limit is of 0.4 mg);
- for nitrites ($N\text{-}NO_2^-$), the value obtained of 0.012 mg is classified in quality class II (the class limit is of 0.03 mg);
- for azotates ($N\text{-}NO_3^-$), the value obtained of 0.29 mg is classified in quality class I (the class limit is of 1 mg);
- for total nitrogen (N), the value obtained of 0.56 mg is classified in quality class I (the class limit is of 1.5 mg);
- for phosphates ($P\text{-}PO_4^{3-}$), the value obtained of 0.397 mg is classified in quality class III (the class limit is of 0.4 mg);
- for total phosphorous (P), the value obtained of 0.193 mg is classified in quality class II (the class limit is of 0.4 mg);
- for dissolved oxygen (O_2), the value obtained of 2.33 mg is classified in quality class V (the class limit is of < 4 mg);
- for CCO-Mn/O_2, the value obtained of 33.4 mg is classified in quality class II (the class limit is of 10 mg);

- for CCOCr, the value obtained of 34.56 mg is classified in quality class III (the class limit is of 50 mg);
- for CBO_5, the value obtained of 2.83 mg is classified in quality class I (the class limit is of 3 mg);
- for pH (25^0C), the value obtained of 8.0 unit. pH complies with the acceptable limit of 6.5-8.5;
- for zinc (Zn^{2+}), the value obtained of 230 μg is classified in quality class III (the class limit is of 500 μg);
- for copper (Cu^{2+})[5], the value obtained of 14 μg is classified in quality class I (the class limit is of 20 μg);
- for lead (Pb)[6]/cadmium (Cd), the value obtained of 11/0.2 μg is classified in quality class III/I (the class limit is of 25/0.5 μg).

Table 1.

Results of the physical-chemical analysis performed for the water sample collected in the Satchinez humid area region (acc. to analysis report AT 353 / 22.11.2010, issued by Banat Water Branch)

No.	Parameters analyzed	U/M	Analysis method	Value obtained	quality class – limits approved				
					I	II	III	IV	V
1.	ammonium nitrogen ($N\text{-}NH_4^+$)	mg N/l	SR ISO 7150-1/2001	0.001	0.4	0.8	1.2	3.2	> 3.2
2.	nitrites ($N\text{-}NO_2^-$)	mg N/l	SR ISO 26777/2000	0.012	0.01	0.03	0.06	0.3	> 0.3
3.	azotates ($N\text{-}NO_3^-$)	mg N/l	SR-7890/1-1998	0.29	1	3	5.6	11.2	> 11.2
4.	total nitrogen (N)	mg N/l	SR ISO 10048/2001	0.56	1.5	7	12	16	> 16
5.	phosphates ($P\text{-}PO_4^{3-}$)	mg P/l	SR EN 6878-2005	0.397	0.1	0.2	0.4	0.9	> 0.9
6.	total phosphorous (P)	mg P/l	SR EN 6878/2005	0.193	0.15	0.4	0.75	1.2	> 1.2
7.	dissolved oxygen (O_2)	mg O_2/l	SR EN 25813-2000	2.33	9	7	5	4	< 4
8.	CCO-Mn/O_2	mg O_2/l	STAS 9887/74	8.44	5	10	20	50	> 50
9.	CCOCr	mg O_2/l	SR ISO 6060/96	34.56	10	25	50	125	> 125
10.	CBO_5	mg O_2/l	SR ISO 1899-1,2/2003	2.83	3	5	7	20	> 20
11.	pH (25^0C)	unit. pH	SR ISO 10523-2009	8.0	6.5 – 8.5				
12.	Zinc (Zn^{2+})	μg /l	SR ISO 8288/01	230	100	200	500	1000	> 1000
13.	Copper (Cu^{2+})[5]	μg /l	SR ISO 8288/01	14	20	30	50	100	> 100
14.	Lead (Pb)[6]/ Cadmium (Cd)	μg /l	SR ISO 8288/01	11/0.2	5/0.5	10/1	25/2	50/5	> 50/> 5

Out of the 14 (15) parameters monitored, it is noticed that 6 are grouped in quality class I, 3 in class II, 4 in class III, and 1 in quality class V, as follows (figure 1):

- ammoniacal nitrogen, azotates, total nitrogen, CBO_5, copper, cadmium are grouped in

quality class I;

- nitrites, total phosphorous, CCO-Mn/O_2 are grouped in quality class II;
- phosphates, CCOCr, zinc and lead are grouped in quality class III;
- dissolved oxygen is grouped in quality class V;
- the pH value complies with the acceptable limits for all quality classes.

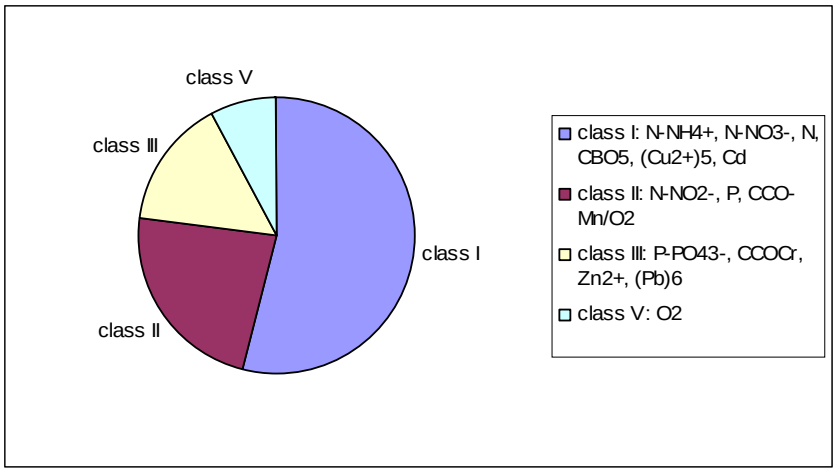

Figure 1. The distribution of parameters analyzed by quality classes – humid area Satchinez

In what follows the values obtained are presented, as well as the classification per quality classes, of the analyzed physical-chemical parameters from the water sample collected in the humid area Muresului Holm region – Bezdin pond (see table 2):

- for ammoniacal nitrogen ($N\text{-}NH_4^+$), the obtained value of 0.008 mg is classified in quality class I (the class limit is of 0.4 mg);
- for nitrites ($N\text{-}NO_2^-$), the obtained value of 0.006 mg is classified in quality class I (the class limit is of 0.01 mg);
- for azotates ($N\text{-}NO_3^-$), the obtained value of 0.613 mg is classified in quality class I (the class limit is of 1 mg);
- for phosphates ($P\text{-}PO_4^{3-}$), the obtained value of 3.80 mg is classified in quality class V (the class limit is of > 0.9 mg);
- for total phosphorous (P), the obtained value of 1.69 mg is classified in quality class V (the class limit is of > 1.2 mg);
- for dissolved oxygen (O_2), the obtained value of 4.1 mg is classified in quality class III (the class limit is of < 4 mg);
- for CCO-Mn/O_2, the obtained value of 16.0 mg is classified in quality class III (the class limit is of 20 mg);
- for CCOCr, the obtained value of 40.96 mg is classified in quality class III (the class limit is of 50 mg);
- for CBO_5, the obtained value of 2.43 mg is classified in quality class I (the class limit is of 3 mg);

- for pH (25^0C), the obtained value of 7.9 unit. pH complies with the acceptable limit of 6.5 - 8.5;
- for zinc (Zn^{2+}), the obtained value of 24 μg is classified in quality class I (the class limit is of 100 μg);
- for copper (Cu^{2+})[5], the obtained value of 80 μg is classified in quality class IV (the class limit is of 100 μg);
- for lead (Pb)[6]/cadmium (Cd), the obtained value of 9/0.3 μg is classified in quality class II/I (the class limit is of 10/0.5 μg).

Table 2.

Results of the physical-chemical analysis performed for the water sample collected in the humid area Muresului Holm region – Bezdin pond (acc. to analysis report AT 362 / 29.11.2010, issued by Banat Water Branch)

No.	Parameters analyzed	U/M	Analysis method	Value obtained	quality class – limits approved				
					I	II	III	IV	V
1.	ammonium nitrogen ($N\text{-}NH_4^+$)	mg N/l	SR ISO 7150-1/2001	0.008	0.4	0.8	1.2	3.2	> 3.2
2.	nitrites ($N\text{-}NO_2^-$)	mg N/l	SR ISO 26777/2000	0.006	0,01	0.03	0.06	0.3	> 0.3
3.	azotates ($N\text{-}NO_3^-$)	mg N/l	SR-7890/1-1998	0.613	1	3	5.6	11.2	> 11.2
4.	phosphates ($P\text{-}PO_4^{3-}$)	mg P/l	SR EN 6878-2005	3.80	0.1	0.2	0.4	0.9	> 0.9
5.	total phosphorous (P)	mg P/l	SR EN 6878/2005	1.69	0.15	0.4	0.75	1.2	> 1.2
6.	dissolved oxygen (O_2)	mg O_2/l	SR EN 25813-2000	4.1	9	7	5	4	< 4
7.	CCO-Mn/O_2	mg O_2/l	STAS 9887/74	16.0	5	10	20	50	> 50
8.	CCOCr	mg O_2/l	SR ISO 6060/96	40.96	10	25	50	125	> 125
9.	CBO_5	mg O_2/l	SR ISO 1899-1,2/2003	2.43	3	5	7	20	> 20
10.	pH (25^0C)	unit. pH	SR ISO 10523-2009	7.9	6.5 – 8.5				
11.	Zinc (Zn^{2+})	μg /l	SR ISO 8288/01	24	100	200	500	1000	> 1000
12.	Copper (Cu^{2+})[5]	μg /l	SR ISO 8288/01	80	20	30	50	100	> 100
13.	Lead (Pb)[6]/Cadmium (Cd)	μg /l	SR ISO 8288/01	9 / 0.3	5/0.5	10/1	25/2	50/5	> 50/> 5

Out of the 13 (14) parameters analyzed, 6 are grouped in quality class I, 1 in quality class II, 3 in quality class III, 1 in quality class IV and 2 in quality class V, as follows (fig. 2):

- ammoniacal nitrogen, nitrites, azotates, CBO_5, zinc, cadmium are grouped in quality class I;
- lead is grouped in quality class II;
- dissolved oxygen, CCO-Mn/O_2 and CCOCr are grouped in quality class III;
- copper is grouped in quality class IV;
- phosphates and total phosphorous are grouped in quality class V;
- the pH value complies with the acceptable limits for all quality classes.

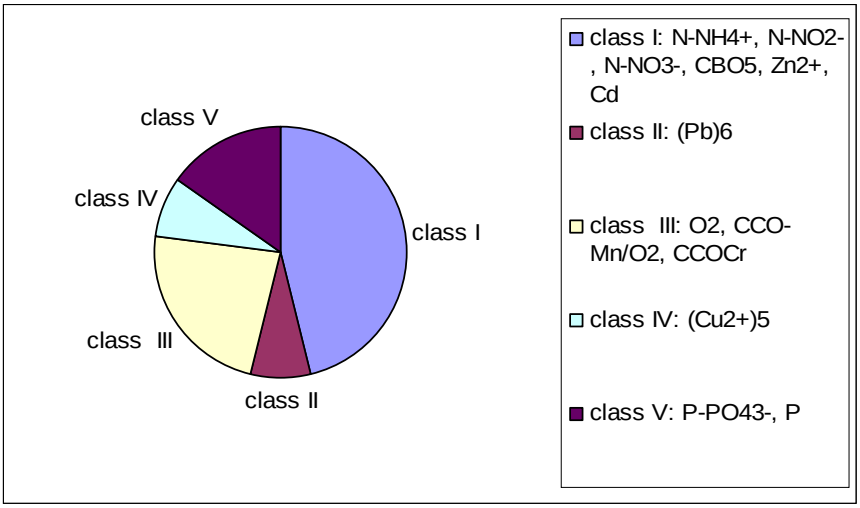

Figure 2. The distribution of the parameters analyzed per quality classes – Bezdin pond

From the above results that both humid areas studied from the perspective of water quality are grouped in quality class V, translated into bad water quality, due to high values recorded for phosphorous compounds and the oxygenation regime. We mention that these data are preliminary.

CONCLUSIONS

Our research show partial data on establishing the ecological condition of water in two humid areas representative for Banat (Satchinez Marshes and Muresului Holm – Bezdin Pond), based on monitoring physical-chemical markers uch as: degree of acidification, oxygen regime, nutrients, some specific toxic pollutants of natural origin. The water samples collected and analyzed in the above mentioned locations were intepreted in keeping with the regulations in force, then it was performed the clasification per quality classes. Thus, Satchinez Marshes, from the point of view of water quality, have the following classification of the parameters monitored: ammoniacal nitrogen, azotates, total nitrogen, CBO_5, copper, cadmium are grouped in quality class I; nitrites, total phosphorous, CCO-Mn/O_2 are grouped in quality class II; phosphates, CCOCr, zinc, lead are grouped in quality class III; dissolved oxygen is in quality class V. For the pond Bezdin, the following result were obtained: ammoniacal nitrogen, nitrites, azotates, CBO_5, zinc, cadmium are grouped in quality class I; lead is in quality class II, dissolved oxygen, CCO-Mn/O_2, CCOCr, are in quality class III; copper is in quality class IV, phosphates and total phosphorous are grouped in quality class V. Both situations discusses, high values, negatively influencing water quality, were recorded for phosphorous compounds, oxygenation regime and heavy metals. A possible explanation for the high values of the phosphorous compounds would be that they are influenced by the critical oxygenation regime, which, in its turn, may be influenced by the lack of water circulation or because of decomposed vegetation. The higher heavy metals can be attributed to agriculture, industry or various human activities. Further data will help us to find other explanations.

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BIBLIOGRAPHY

1. BÂRA, C., CHIRILĂ, A., 1994 – *Ghidul hidroamelioratorului. Pământul şi apa – surse de prosperitate*, Ed. Ceres, Bucureşti
2. MĂNESCU, S., CUCU, M., DIACONESCU, M. L., 1994 – *Chimia sanitară a mediului*, Ed. Medicală, Bucureşti.
3. *** *Order no. 161/2006*, issued by the Ministry of Environment and Water Administration – Romanian Official Gazzette, part I, no. 511, June 13, 2006
4. *** *32000L0060 Directive of the European Parliament and of the Council 2000/60/CE* of October 23, 2000 to establish a community policy framework in the field of water