

The influence on flora and vegetation of the water quality in Liebling accumulation lake

Neacșu Alina^{1*}, Arsene G.G.¹, Arsene Alina², Stroia C.¹, Faur F.¹, Tabuc Cristina³

¹Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Agriculture, Department of Biology, Timișoara, Romania; ²Monsanto Romania; ³The National Research – Development for Biology and Animal Nutrition Institute, Bucharest, Romania

*Corresponding author. Email: alne76@yahoo.com

Abstract Located in Timis County, the Liebling accumulation is one of the most important accumulation lakes of the area. At present it is administered by the Association of Sport Fishermen Timisoara. Our research (2005-2009) followed water sampling, analysis and interpretation of the results and the study of the flora and vegetation, making several observations regarding the influence of the water quality on the latter. The chemical analysis of the water samples was performed in keeping with the quality standards included in *norm 161/2006* issued by the Ministry of Environment and Water Usage, in the laboratory of the National Administration „Romanian Waters” Banat – Timisoara and consisted in determining the oxygen level, the nutrients, the pH, the suspensions and the water total hardness. The study of the flora implied creating the list of species and their analysis phytogeographically, biologically and ecologically. The study of the vegetation implied the establishment and the description of plant associations (according to the methodology of the Central-European phytocoenologic school). Water analysis indicates the moderate quality, with negative impact on the plant diversity: only 47 % of species are aquatic and paludicolous; concerning vegetation, we observed an excessive development of plant associations that lead to the clogging of water.

Key words

Liebling, chemical parameters, water quality, flora, vegetation

Located in Timis county, near Timisoara, the Liebling accumulation lake is situated on the stream Lanca Birda, at 94 m altitude, an area of 60 ha. Now it is administered by the Association of Sport Fishermen in Timisoara (A.P.S.) mainly for fishing and entertainment. Land Code, cadastre as *Atlas of water in Romania. Part I – Morpho-hydrographic data on the surface of the river system*, issued by Ministry of Environment (1992), is for the lake Liebling V 2.36. The landscape beauty and its distinct flora and vegetation determined us to study more deeply this reservoir.

Material and Method

Our studies considered water analysis and the study of flora and vegetation. For water sampling there were taken into account the recommendations comprised in series SR ISO 5667/2002 (see *norm no. 161/2006* issued by the Ministry of Environment and Water Administration). The chemical analysis of the water samples collected was performed according to the quality standards included in *norm no. 161/2006*.

This analysis took place in the laboratory of the National Administration „Romanian Waters” Banat Waters Division – Timisoara and consisted in determining the oxygen level, the nutrients, the pH, suspensions and total hardness of the water. The study of the flora implied creating the flora summary and its analysis phytogeographically, biologically and ecologically. We have used for determining *Flora R.S.R. (1952 – 1976)* and *Flora ilustrată a României. Pterydophyta et Spermatophyta* (CIOCÂRLAN, 2009). For the notation and analysis of indexes we used the study „*Caracterizarea ecologică și fitocenologică a speciilor spontane din flora României*” (SANDA *et al.*, 1983).

The study of the vegetation is based on the principles of the Central-European phytocoenologic school, which is considering the plants association as fundamental unit in the study of the vegetation. We have thus performed phytocoenologic sampling and after the data processing, examining the specialized references, we established the vegetal associations. We had in view the accomplishment of the summary of cenoetaxonomic units and the analysis of the vegetal associations from various points of view. The study we

used for the vegetation analysis: SANDA, V., POPESCU, A., BARABAŞ, N., 1998 – *Cenotaxonomia și caracterizarea grupărilor vegetale din România*; SANDA, V., 2002 – *Vademecum cenostructural privind covorul vegetal din România*; DONIȚĂ, I., IVAN, D., SANDA, V., POPESCU, A., 1992 – *Vegetația României*; GRIGORE, S., 1971 – *Flora și vegetația din interfluviul Timiș – Bega etc.*

Results and Discussions

Following the analysis of the water samples collected from the Liebling accumulation, we have obtained the following results (presented in table 1):

- *ammonium nitrogen* (N-NH_4^+) was determined with the value of 0,76 mg N/l, value which is classified in the 2nd quality class. The method of analysis used was in keeping with SR ISO 7150/2. The value accepted for the 2nd class is of 0,8 mg N/l.

- *azotites* (N-NO_2^-) in the water were established in keeping with SR ISO 6777/96. The concentration of 0,04 mg N/l obtained corresponds to 3rd quality class, which has an accepted value of 0,06 mg N/l.

- by determining the *azotates* (N-NO_3^-), it was obtained the value of 0,63 mg/l, this value being accepted for the 1st quality class (the limit accepted for

the 1st class is of 1 mg N/l). For the determination it was used SR-7890/3-2000.

- *phosphor* (P-PO_4^{3-}) is encountered in a concentration of 0,05 mg P/l, value which corresponds to the first quality class (the limit accepted for the 1st class is of 0,1 mg P/l). The method of analysis used was in accordance with SR EN 1189-2000.

- *dissolved oxygen* (O_2) was determined according to SR EN 25813-2000, having the value of 9,52 mg O_2 /l, being classified in the 1st quality class (whose accepted limit is of 9 mg O_2 /l).

- *chemical oxygen consumption* (CCO – Mn) determined through the potassium permanganate method according to SR ISO 5815/89, has the value of 12,4 mg O_2 /l. This value is classified within the limits of 3rd quality class, for which it is accepted the concentration of 20 mg O_2 /l.

- CBO_5 was established according to SR ISO 5815/89, as 0,12 mg O_2 /l. The value corresponds to the 1st quality class, whose limit is of 3 mg O_2 /l.

- the water *pH* is of 8,17. The water has a slightly basic reaction and a higher concentration of the cations in the water, but it is classified within the limits accepted for the 5 quality classes.

- *suspensions* (according to STAS 6953-81) have a value of 30 mg/l. The total water hardness (according to STAS 3026-76) was established at the value of 10,1⁰ Ge (8 – 12 dH^0 – middle waters).

Table 1

The results of the chemical analysis performed for the water sample collected from the Liebling accumulation (acc. to Test Report AT 405, 30.10.2005)

No.	Analyzed parameters	U/M	Method of analysis	Value obtained	Quality Class – accepted limits				
					I	II	III	IV	V
1.	Ammonium Nitrogen (N-NH_4^+)	mg N/l	SR ISO 7150/2	0,76	0,4	0,8*	1,2	3,2	> 3,2
2.	Azotites (N-NO_2^-)	mg N/l	SR ISO 6777/96	0,04	0,01	0,03	0,06*	0,3	> 0,3
3.	Azotates (N-NO_3^-)	mg N/l	SR-7890/3-2000	0,63	1*	3	5,6	11,2	> 11,2
4.	Phosphates/ Phosphor (P-PO_4^{3-})	mg P/l	SR EN 1189-2000	0,05	0,1*	0,2	0,4	0,9	> 0,9
5.	Dissolved Oxygen (O_2)	mg O_2 /l	SR EN 25813-2000	9,52	9*	7	5	4	< 4
6.	Permanganate Index (CCO-Mn)	mg O_2 /l	STAS 9887-74 SR EN ISO 8467/01	12,4	5	10	20*	50	> 50
7.	CBO_5	mg O_2 /l	SR ISO 5815/89	0,12	3*	5	7	20	> 20
8.	pH	-	SR ISO 10523-97	8,17	6,5 – 8,5				
9.	suspensions	mg/l	STAS 6953-81	30	-				
10.	Total hardness	⁰ Ge	STAS 3026-76	10,1	-				

The chemical analysis of the water samples collected revealed the fact that the water in the Liebling accumulation has moderate quality, meaning it is classified in the 3rd quality class. The azotites are those which influence water quality, the other parameters having values that correspond to the first two quality classes. The higher values recorded by azotites are explained by the fact that in the near vicinity of the accumulation there are cereal cultures on which chemical fertilization is applied.

The statistical study of the flora in the accumulation area shows the existence of a number of 138 species, belonging to 38 botanical families. From the biological, phytogeographical analysis and of the ecological indexes (humidity, temperature, soil reaction – UTR) of the flora, results that it is edified mainly by hemicryptophil, Eurasian, mesophil, mesothermic, and amphotolerant species.

The analysis of the flora per biological categories shows that most species are hemicryptophytes – 46,37 % (perennial chormophytes, with basal leaves bow, that grow in clumps with erect or clinging stalks, in winter being only represented by the bud at the lower part of the stalk), followed by annual terophytes - 21,01 % (species with straight stalks, creeping or voluble, which spend the critical winter season as seeds) and by helohidatophytes – 15,94 % (plants which live in the aquatic environment; natant, fixed and rooted species).

Concerning the phytogeographical elements, the Eurasian species (which are in fact beset represented in the cormoflora of our country) are predominant, representing 57,24 % of all the flora.

As for humidity, most species are mesophytes, (*Oenanthe aquatica* (L.) Poirlet, *Iris pseudacorus* L., *Festuca pratensis* Hudson, *Juncus tenuis* Willd. etc.) – 33,33 %. The presence of the ultrahydrophytes, hydrophyte and mesohydrophyte species (that edify the aquatic and paludicolous flora) is the following:

- ultrahydrophytes: 12,31 % (*Trapa natans* L., *Cyperus fuscus* L., *Polygonum amphibium* L., *Potamogeton natans* L. etc.);
- hydrophytes: 10,21 % (*Lysimachia vulgaris* L., *Myosotis scorpioides* L., *Lycopus europaeus* L., *Scutellaria hastifolia* L. etc.);
- mesohydrophytes: 18,84 % (*Bidens tripartita* L., *Cirsium palustre* (L.) Scop., *Dipsacus laciniatus* L., *Ranunculus repens* L. etc.).

Regarding temperature, mesothermals are clearly predominant – 64,49 % (*Inula britannica* L., *Lycopus europaeus* L., *Rubus caesius* L., *Stachys palustris* L. etc.).

As for soil reaction, most species are amphotolerant (eurionic), followed close-up by weakly acid neutrophilic species: 42,75 %. Among amphotolerant species, we mention: *Phalaris arundinacea* L., *Taraxacum officinale* Weber ex

Wiggers, *Scutellaria hastifolia* L., *Setaria pumila* (Poirlet) Schultes etc.

Out of all the flora, which means 138 species, the aquatic and paludicolous flora is represented by 60 species, i.e. 43,47 %. This floristic richness is strongly related to water quality, as to the size of the accumulation area and to the man's influence manifested in the area.

The high content of nutrients determinates the overgrowth of the species such as *Lemna minor* L., *Spirodela polyrhiza* (L.) Schleichen, *Potamogeton natans* L., *Trapa natans* L., sometimes even *Ceratophyllum demersum* L., that are actioning as a diaphragm on the water surface and the decomposition of the organic matter, alters the water chemistry, preventing the growth of other aquatic macrophytes, more sensitive to pollution. This fact is encouraging the explosion of the nitrophilic submerged species. Water quality has similar effects, on the vegetation.

From the point of view of vegetation, the Liebling accumulation shows a high cenotic diversity, 19 vegetal associations being described within the accumulation. The associations are mainly mesohigrophilic, higrophilic and hydrophilic, very few being mesophilic: *Lemnetum minoris* (Oberd. 1957) Müller et Görs 1960, *Lemno-Spirodeletum* W. Koch 1954, *Ceratophylletum demersi* (Soó 1927) Hild 1956, *Myriophyllo-Potametum* Soó 1934, *Trapetum natantis* Müller et Görs 1960, *Polygono – Potametum natantis* Soó 1964, *Scirpo – Phragmitetum* W. Koch 1926, *Typhaetum angustifoliae* Pignatti 1953, *Typhaetum latifoliae* G. Lang 1973, *Glycerietum maximae* Hueck 1931, *Schoenoplectetum lacustris* Eggler 1933, *Iretum pseudacori* Eggler 1933, *Phalaridetum arundinaceae* (Horvatič 1931) Libbert 1931, *Caricetum ripariae* Knapp et Stoffer 1962, *Conietum maculati* I. Pop 1968, *Rubo – Salicetum cinereae* Sonasak 1963, *Agrostidetum stoloniferae* (Ujvárosi 1941) Burduja et al. 1956, *Poëtum pratensis* Räv., Căzác. et Turenschi 1956, *Alopecuretum pratensis* Regel 1925.

As already was mentioned in the flora, the water quality has the same negative influence on the vegetation. The associations that tolerate better great amounts of nutrients, grow luxuriant, with negative effects on biodiversity, stopping fishing and endangering the existence of the fish. On the other hand, this vegetation, is producing large amounts of biomass, being directly involved in the water clogging.

From all these data, we consider as necessary a correct and careful monitoring of the activities carried out in the area, as they may influence negatively the water quality, flora and vegetation.

Conclusions

1. The Liebling accumulation is one of the most important accumulation lake from Timis county.

2. This accumulation is classified, from the point of view of water quality, in the 3rd quality class, meaning it is of moderate quality.
3. The flora is represented by 138 cormophyte species, of which 60 are aquatic and paludicolous, representing 43,47 % of all the flora.
4. The vegetation is rich, being comprised of 19 associations, most of which meso-hygrophilic, hygrophilic and hydrophilic.
5. The presence of aquatic and paludicolous plants and vegetation is strongly influenced by water quality. The moderate quality of the water causes an excessive development of plants and vegetation that is leading to the water clogging.

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