NYMPHEA LOTUS VAR. THERMALIS-PRESENT AND PERSPECTIVE

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Abstract

The purpose of the present study is to quantify and interpret correlatively the effect of the anthropic pressure and of the meteorological-climatic factors on the evolution of the habitat and the natural balance in the Peţea River natural reservation.

In the period 2010-2013 sample from Ochiul Mare one monitored the physical indicators, the thermal condition, the acidification, the oxygen condition, the nutrients, the salinity and biological.

The obtained results have allowed the identification of some measures intended to diminish the impact of the anthropic activities on the hydro-geo-ecosystem.In the same time The results confirm the direct determinism between the meteorological-climatic factors (rainfall) and the geothermal water source.

Key words: hydrogeoecosystem, protected natural area, byological cycle

INTRODUCTION

Bihor County has 67 natural areas of national importance: Category III and IV IUCN - International Union for Conservation of Nature, 60 mentioned in Law. 5/2000, on approving the National Land Management Plan - Section III protected areas and three natural areas mentioned in HG No. 2.151/2004, on setting the protected natural area regime for new zones.

Peţea Brook Nature Reserve was established in 1932, the nature reserve status being reconfirmed in 1985 by Decision no. 22 of the Council of Ministers.

According to the Decision no. 19/1995 of the Council of Bihor County, in terms of biological representation it is a mixed reserve: botanic and zoologic one, having also a landscape value due to its location.(Danciu, 2005)

By Order no. 1964 of December 13, 2007 concerning the setting of protected area for sites of Community importance, as part of the European ecological network Natura 2000 in Romania, the protected natural area regime as a site of Community importance for Peţea Lake is established.

ROSCI0098- Peţea Lake Natura 2000 site with an area of 51 ha includes Peţea Brook a nationally declared protected area(Formular Standard Natura 2000).(Ord.57/2007) (Gafta, 2008).

Peţea Brook, a national interest natural reserve with code 2177, IUCN IVb category, with an area of 4 ha is located on the territory of Sînmartin commune, Rontau village.(Posea,1997)

It is bounded on the upper stream of Petea Brook, from its historical source (Ochiul Ţiganului) to downstream, up to Venus Swimming-pools.

The natural environment has allowed delineation and identification of three areas:

- Zone I, from Ochiul Ţiganului to Ochiul Mare;

- Zone II, Ochiul Mare, from Tiganilor footbridge to Rontau footbridge;
- Zone III, from Rontau footbridge to Venus Swimming-pools;

The site is the only place in Romania where there naturally exists a priority habitat of 31A0 type - thermal waters in Transylvania covered with lotus. The natural thermal ecosystem, unique in Romania, hosts endemic or rare species:

- *Nymphaea lotus L. var. thermalis* is the only case in which a tropical plant species spontaneous grows in a temperate climate. Thermophilic coenoses of Nymphaea lotus var. thermalis grows in warm waters with temperatures of 20-30 ° C.(Burescu P.,2002).The dominant species *Nymphaea lotus var. thermalis* is considered a tertiary relic.

The thermal habitat is "a tropical oasis in the middle of a eurosiberian vegetation" (Borza, 1924). Within the phytocoenosis composition there are also: *Ceratophyllum demersum, Sparganium erectum, ssp neglectum, Butomus umbellatus, Alisma plantago-aquatica*, and rare specimens of *Phragmites australis*.

- *Melanopsis parreysii Mühlfeld* - relict endemic species, gastropods group;
- *Scardinius erythrophtalmus racovitzai* - rudd, endemic species of fish;
- *Sabanejewia aurata* and *Cobitis taenia*, fish species listed in Annex II of Council Directive 92/43/EEC
- *Unio crassus* and *Chilostoma Banaticum*, invertebrate species listed in Annex II of Directive 92/43/EEC.

Nympheae lotus var thermalis, *Melanopsis pareysi* and *Scardinius erythrophtalmus var racovitzai* species -Tertiary relicts require special conservation measures, given their scientific value.(Dihoru G.,1994)

From an ecological perspective, in time, between these and other species of flora and fauna and biota, some trophic and habitat relationships were formed and strengthened, whose disruption can jeopardize their existence.(Dalea A.,2003) *Nympheae lotus var thermalis* exploits mineral and organic substrate of hydrogeoecosystem, Petea Brook ensuring utmost, as the main photosynthesizing agent, the biological productivity of the ecosystem.(Şoldea V.,2003) In the same time, it represents the microhabitat for the larval and juvenile stages of Melanopsis pareysi and Scardinius erythrophtalmus var racovitzai species.(Mintaş O.,2012).The organic substrate generated by the thermal nufarrul and the other vegetal hydrobionts lily plant is harnessed by the phyto and zooplankton of the ecosystem and constitutes the trophic basis for the heterotrophic species composing the biodiversity of the ecosystem (insects, fish, amphibians, ophidians and birds).

The determining factor that defines and provides the functional point of view the whole ecosystem is the geothermal water reservoir,(Doniță N.,2005) which allowed the development of the 1 May spa resort.

Increased consumption of geothermal water, combined with the evolution of weather-related factors determined in time the clogging of, Gypsy Eye and Pompei Eye streams, located upstream of the Great Eye, the only currently active.

Since 1999 the Faculty of Environmental Protection, along with other institutions involved in the study of Peţea Brook ecosystem. We mention in this regard the sanitation works, having in view the removal of adventitious species, made by the teachers and students of our faculty in the perimeter of Ochiul Mare.

MATERIAL AND METHODS

Correlative quantifying and interpreting of the human pressure effect and evolution of weather-related factors upon the habitat and the natural balance of this area have been our object of study since 2010.(Vicaş G.,2012)

Monitoring the quality of Ochiul Mare water body, was done by field observations, physical-chemical and biological analyses. (Varduca A.,2000)(Rojanschi V.,2004)

The monitored parameters were: physical indices, temperature, acidification, oxygen, nutrients, salinity, etc. (Nicoară M.,2009)

Some samples of water have been collected from Ochiul Mare in spring when phenomena of explosive growth of diatoms forms (bacylariophyceae) manifest, and in autumn, when the thermal regime determines the dominance of lower forms (cyanophyficeae). (Mălăcea I., 1969)

The analytical methods that have been used are shown in Table. 1. The analyses were partially implemented in the water quality laboratory Oradea belonging to Apă Crișuri Basin Administration and partly in the Hydrobiology Laboratory within the Faculty of Environmental Protection.

Table 1

Methods of analysis

Indicator	A/ N	MU	Reference document	Method principle
pH (at measuring temperature)	A	pH units	SR ISO 10523: 2009	Potentiometry
Conductivity (25ºC)	N	µS/cm	SR EN 27888:1997	Electrochemistry
Dissolved Oxygen (DO)	A	mg/l O_2	SR EN 25813:2000 ISO 5813	Titrimetry
Chemical consumption of oxygen through the method with K2Cr2O7 (CCO-Cr)	A	mg/l O_2	SR ISO 6060:1996 DIN 38409:1992 P.44	Titrimetry
Oxygen biochemical consumption (OBC5)	A	mg/l O_2	SR EN 1899-2:2002 SR EN 1899-1:2003	Titrimetry
Ammonium (NH4)	A	mg/l	SR ISO 7150-1:2001	SAM
Nitrite(NO2)	A	mg/l	SR EN 26777:2002 /C91:2006	SAM
Nitrate (NO3)	A	mg/l	SR ISO 7890-3:2000	SAM
Total nitrogen (N tot.)	N	mg/l	SR EN ISO 11905-1:2003	SAM
Kjeldahl nitrogen (N Kj)	N	mg/l	SR EN 25663:2000	SAM
Ortho-phosphates (PO4)	A	mg/l	SR EN ISO 6878:2005	SAM
Total phosphate (P tot.)	A	mg/l	SR EN ISO 6878:2005	Mineralisation and SAM
Fix residue	A	mg/l	STAS 9187:1984	gravimetry
Calcium (Ca)	N	mg/l	SR ISO 6058:2008	titrimetry
Magnesium (Mg)	N	mg/l	*Calculus from Ca and hardness*	-
Suspended matter	A	mg/l	SR EN 872:2005	gravimetry
Alcalinity	N	mmol/l	SR EN ISO 9963-1:2002	titrimetry
Bicarbonates (HCO3)	N	mg/l	*Calculus from alcalinity*	-
Zink (Zn)	A	µg/l	SR ISO 8288:2001	SAA-flame
Sodium (Na)	N	mg/l	ISO 9964-3:1993	Flamphotometry

To determine the bioindicators, the field and laboratory research was based on:

- observation method for macroscopic species identification (Godeanu S., 2002);
- counting to estimate their number;
- reporting their number per area unit for density and coverage degree.

RESULTS AND DISCUSSION

The obtained results are shown in Table 2 and Table 3

Table 2

Parameter values determined

Parameter	Um	Recorded values 2010		Recorded values 2011		Recorded values 2012		Recorded values 2013	
		min	max	min	max	min	max	min	max
flow	mc/s	0.081	0.136	0.088	0.088	0.03	0.04	0.02	0.04
water temp.	°C	24	30.6	21.0	30.0	17	25	21	27
water depth	m	3.2	4.0	1.6	2	0.2	0.4	0.6	0.9
pH		7.1	8.3	7.3	8.0	7.39	7.60	7.34	7.69
MS	mg/l	3.0	26.0	4.0	43.0	15.0	46.0	8	32
OD	mg/l	2.00	7.30	1.50	5.40	4.6	5.7	5.3	7.9
CBO5	mg/l	0.70	3.00	0.50	3.00	<1	4.1	1.1	3.00
CCOCr	mg/l	5.00	26.00	5.00	30.00	<10	10.0	<10	18
NH_4	mg/l	0.008	0.091	0.020	0.048	<0.015	0.122	0.071	0.137
NO_2^-	mg/l	0.003	0.006	0.003	0.006	<0.003	0.008	0.077	0.081
NO_3^-	mg/l	0.210	1.920	0.110	0.230	0.07	0.22	0.12	0.35
Kjeldahl N	mg/l	0.057	0.575	0.0045	0.515	-	-	-	-
Organic N	mg/l	0.049	0.567	0.0014	0.488	-	-	-	-
Total N	mg/l	0.290	0.950	0.250	0.650	0.28	0.44	0.37	0.62
ortho phosphates	mg/l	0.0035	0.0240	0.0035	0.0220	0.004	0.010	0.021	0.026
Total P	mg/l	0.0065	0.0640	0.0160	0.0530	0.018	0.021	0.028	-
conductiv.		59400	62400	566.00	621.00	-	-	669	725
filterable residue	mg/l	381.0	400.0	36.30	398.0	-	-	429	465
Ca	mg/l	84.8	96.7	72.9	97.7	-	-	-	-
Mg	mg/l	16.5	29.5	17.9	29.9	-	-	-	-
Na	mg/l	9.6	13.0	-	-	-	-	-	-
alcalinity	mg/l	5.30	5.90	5.00	5.80	5.5	5.8	5.6	5.9
HCO_3	mg/l	323.3	359.9	305.0	353.8	-	-	-	-
Zn	mg/l	5.00	28.00	<10	<10	<10	<10	<10	<10

Table 3

Parameter values determined

indicator		2010		2011		2012		2013	
		April	August	April	August	April	August	April	August
air temp., °C		15.8	16.7	18	23	7	37	14	33
density(ex./l)		19250	549	736	785	910	950	1325	985
olygosaprobe bioindicators		1450	72	123	47	33	20	129	65
βmesosaprobe bioindicators		10350	343	420	467	608	680	1136	726
amesosaprobe bioindicators		5200	134	193	270	269	359	436	392
polysaprobe bioindicators		0	0	0	1	0	5	0	0
degree of cleanness,c%(Knoop)		77.09	75.18	73.24	71.12	69.05	50.42	78.36	69.23
Pantle-Buck	Saprobe index	2.23	2.11	2.10	2.29	2.26	1.80	2.2	2.15
	Saprobe area	β	β	β	β	β	β,α	β	β
Simpson	Simpson index(D)	0.05	0.09	0.06	0.09	0.07	-	0.05	0.08
	Diversity index (I-D)	0.95	0.91	0.94	0.91	0.93	-	0.93	0.92
	mutual index(I/D)	18.42	11.58	15.52	11.47	14.88	-	16.32	12.36

Analyzing the values obtained, continuous and steady decline in Ochiul Mare flow and water temperature is found:

- maximum flows decreased from 0.136 mc / s (2010) to 0.088 mc / s (2011) and 0.04 mc / s (2012), maintaining constant in 2013 ;
- minimum flows decreased from 0.081 mc / s (2010) to complete drying in the summer of 2011, 2012 and 2013;
- maximum temperature dropped to 30.6 ° C (2010), to 30 (2011), 25 ° C (2012) and 27 °C(2013) ;
- the minimum temperature decreased from 24 ° C (2010) to 21 ° C (2011),17 ° C (2012) and 21°C(2013) ;
- in the case of maintaining the air-water temperature gradient approximately constant, the depth of Ochiul Mare decreased for about eight times, from 3.2 m in April 2010 to 0.4 m in April 2012, that about 3, 6 times from 3.2 m in April 2010 to 0,9 m in April 2013 ;
- in terms of acidification, the oxygen, nutrients and salinity values remained approximately constant.
- measurements of phytoplankton and zooplankton highlight the abundance of bacylariophyceae in the samples examined in spring;
- in 2013 there was a numerical increase of β mesosaprobic forms, becoming dominant in August which suggests that the process of self-purification is advanced
- water surface and the number of water lilies decreases dramatically

CONCLUSIONS

The flow and temperature are basic physical indicators, whose relative constancy ensures minimal conditions necessary to conduct a normal biological cycle of the species protected in this area.

Period 2010-2013 was characterized by significant variations in terms of temperature and rainfall. (Cristea M., 2003)

The low levels of rainfall in 2011-2012 determined the decrease of Ochiul Mare flow, fact which led to the decrease of the water depth and water surface. The fact that during the same period, a significant decrease in water temperature in Ochiul Mare was noticed, confirms the direct determinism among the weather-related factors (precipitation) and the source of geothermal water.

Growing anthropogenic pressure correlated with the unfavorable evolution of weather and climatic factors had a direct impact on the habitat and biology of species of conservation interest from Pețea Brook Reserve.

The number of specimens of thermal water lily records a more pronounced decline.

The life cycle of the species Nymphaea lotus var thermalis and of the other protected species is strictly conditioned on the existence of a mud substrate and of a relatively constant level of geothermal water. The usage of geothermal water over the reservoir capacity of the source induces a direct impact upon the source, affecting the viability of the ecosystem. The essential condition for a normal development of hydrogeoecosystem is the rational exploitation of the geothermal reservoir.

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