

DATA CONCERNING THE HYDRO BIOLOGICAL CHARACTERISTICS OF DUNĂRENI LAKE (CONSTANȚA COUNTY)

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INRODUCTION

The Dunăreni (Mârleanu) Lake is situated in the Danube's holm, the Ostrov-Cernavodă sector, on the territory of the locality Dunăreni (commune Aliman), 35 km from the town Cernavodă (km 319-323 on the Danube). It occupies a surface of 657 ha, from which 450 ha of water lustre. Its hydrographic basin (522 km²) collects the precipitation waters from the Dubromir Valley. The main water supply sources of the lake are: the Danube's spring high floods which reach 7 hg, the high flood flows formed in the receiving basin in summer time and its owns springs.

Regarding the genesis and the evolution, the lake is framed in the category of *the fluvial lakes* formed on secondary valley which, following the processes of fluvial erosion and accumulation, joined by anastomosis at the confluence with the Danube. The lake has the configuration of a creek-depression with high and abrupt banks and the bottom relatively level on approximately 75% of its surface (GÂȘTESCU, 1971).

Following the hydrotechnic arrangements made in 1970, the lake became a fishery. Being an important habitat for the aquatic birds, the lake was declared *natural reserve* by the Governmental Resolution nr.2151/2004 (the reserve surface of 702,66 ha including also the perimetrical meadows adjacent to the lake).

MATERIAL AND METHOD

The study of the Dunăreni Lake was initiated in 1999, when a first evaluation of the natural patrimony (flora, fauna and landscape) was made. The data presented in this work represent the results of the investigations made between 2001 and 2004, 3 campaigns for each year (April-October).

The biological material – object of investigation was drawn in accordance with the specific methods for each studied group of organisms. The specific structure of the lake fish fauna was established on the base of the commercial captures and the questionnaires - interview with the fishermen team. To determine the physical and chemical parameters of the water the following devices were used: MultiLine P3 pH/Oxi - Set (pH, O₂, T⁰) and PhotoLab S6 (NO₂-, NO₃-, PO₄, Ca/Mg).

The phytoplankton samples were collected according to methodology for shallow waters of 2-3 m depth, subsurface samples collected at 0.5m. The samples of 1 litre were preserved with 3 ml Lugol's solution. The abundance and diversity of diatoms were carried out using a light microscope (Laborlux) at high magnification (100X). The other groups of algae were analyzed by using Hloubka 0,10mm – 100 mm² chamber using a light microscope (Laborlux) at low magnification (40X). Filaments, colonies and coenobies were counted individually. A minimum of 400 cells were enumerated to assure that the count is representative of the samples.

The community structure of phytoplankton was established by recording the species and by Shannon-Weaver. The value of the Shannon-Weaver index was established by using the following formula:

$$H' = - \sum p_i \ln p_i$$

The quantity p_i is the proportion of individuals found in the its species. The value of p_i was estimated as n_i / N where n_i is the average abundance of every species and N is the average of total abundance.

The quantitative samples of zooplankton have been obtained by filtering 100 l water from the surface through a silk net with mesh size of 100 μ m. The samples were preserved directly on a field with 4% formaldehyde solution. The zooplankton samples have been examined on a microscope and stereomicroscope. For the species identification we used mainly the prestigious identification guides published by the Romanian Academy in the series "Romanian Fauna" and other, well known, international books (DAMIAN-GEORGESCU, Andriana, 1963, DUSSART, B., H., DEFAYE, D., 1995, HARDING, Fr., SMITH, W., A., KIEFER, Fr., 1960, NEGREA, St., 1983, RUDESCU, L., 1960).

RESULTS AND DISCUSSIONS

The physical and chemical characterization of the water. The physical and chemical parameters of the lake water are situated, with few exceptions, between the limits admitted in pisciculture and they are influenced by the following factors: *the lithological structure* of the lacustrine depression and the receiving basin, *the hydrologic factors* (the Danube's level, the suspensions' quantity), *the climatic factors*

(the quantity of precipitations, the air temperature, the intensity of the evaporation, the intensity of the wind) and the biological factors (the development of the planktonic and macrophyte organisms). The minimal and maximal values of these parameters which were registered are presented in the table 1.

Table 1 The water parameters

Parameters/period	2001- 2004
Water depth (m)	0,45 (Sept.2001)-1,53 (April 2003)
Temp. (°C)	10,9 (April 2003)- 28,7 (July 20001)
Transparency (cm)	3 (August 2003) – 42 (June 2002)
pH	8,32 (June 2002) – 9,70 (August 2003)
DO (mg/l)	5,57 (June 2002) – 14,6 (October 2002)
P-PO ₄ (mg/l)	0,09 (June 2002) – 0,37 (October 2002)
N-NO ₃ (mg/l)	1,7 (Septembrie 2001) – 2,4 (June, October 2002)
N-NO ₂ (mg/l)	0,02 (June 2002) – 0,207 (September 2001)
NH ₄ (mg/l)	0,093 (June 2002) – 0,276 (October 2002)
Ca/Mg (mg/l)	95/71-145/112 (June 2002)

Plant communities: The distribution of the hydrophilic and paludal vegetation on the surface of the lake is conditioned by the level differences created by the Danube's waters dynamics, by the duration and the altitude of the flooding and also by the ecological conditions which exist in this aquatic ecosystem.

The hydrophytic vegetation is represented by a single plant community *Nymphoidetum peltatae* (Allorge 1922) Bellot 1951(fig.4), consisting in nine species, the dominant one being *Nymphoides peltata* (Gmelin). It is a rare species that can be met in the western part of the lake. The protected species *Trapa natans*, dispersed in solitary individuals close by the association *Scirpo-Phragmitetum*, was identified as very rare, too.

The paludal vegetation is represented by three plant communities: *Scirpo-Phragmitetum* W. Koch 1926, *Typhaetum angustifoliae* Pignatti 1953 and *Schoenoplectetum tabernaemontanii* Soo 1947 where 30 species were identified. The first association is the most frequent and it forms a belt with variable width around the lake. The dominant species, *Phragmites australis* (Cav.)Trin. et Stendel, forms frequently bunches on the free surface of the lake, too. Although rare, the plant community *Typhaetum angustifoliae* Pignatti 1953 has the biggest number of species, respectively 21 (DINU *et al.* 2000). The reed thicket formed by these two vegetal associations forms an excellent refuge places – for resting and nestling – for many species of water birds and not only for them.

Phytoplankton. During the investigation period a total number of 90 species of algae (KRAMMER *et. al.*, 1991; KOMÁRKOVÁ-LEGNEROVÁ, 1983; NAGY-TÓTH *et.al*, 1998; UHERKOVICH, 1995) were recorded: *Actinastrum*

hantzschii; *Amphora* (*ovalis*, sp.); *Anabaena circinalis*; *Ankistodesmus acicularis*; *Aphanizomenon (flos-aqua, issenschatkoi)*; *Aulacoseira (granulate, granulata var. angustissima, sp.)*; *Bacillaria paradoxa*; *Chlamydomonas reinhardii*; *Chlorella vulgaris*; *Chroococcus (disperses, distans, microscopicus, turgidus)*; *Coelastrum sphaericum*; *Cosmarium (phaseolus, sp. (cf C. crenelatum), sp.)*; *Crucigenia (quadrata, tetrapedia)*; *Cyclotella (meneghiniana, sp.)*; *Cymatopleura solea*; *Dictyosphaerium pulchellum*; *Elakathotrix gelatinosa*; *Euglena (ehrenbergi, oxyuris, sanguinea)*; *Fragilaria sp*; *Golenkinia radiata*; *Gomphonema sp*; *Gyrosigma (macrum, parkerii sp.)*; *Kirchneriella (lunaris, sp. (cf K. subcapitata)*; *Lyngbya limnetica*; *Merismopedia (glauc, minima, tenuissima)*; *Microcystis (aeruginosa, viridis)*; *Monoraphidium (arcuatum, contortum, irregulare)*; *Fallacia pygmaea*; *Hippodonta capitata*; *Navicula (menisculus, sp.)*; *Nitzschia (acicularis, dissipata, gracilis, hungarica, intermedia, levidenisis, linearis, nana, palea, reversa, sp. (cf N. hamburgeinsis) sp.)*; *Oscillatoria (formosa, limnetica, sp. (cf O. redekei), tenuis)*; *Pediastrum (boryanum, simplex, strumii, tetras)*; *Scenedesmus (acuminatus, ecornis, protuberans, quadricauda, spinosus)*; *Selenastrum gracile*; *Snowella lacustris*; *Staurostrum paradoxum*; *Staurosira construens*; *Stephanodiscus sp.*; *Surirella minuta*; *Tertraedron (trigonum, caudatum, minimum)*, *Tetrastrum (glabrum, staurogeniforme)*; *Ulnaria ulna*.

The Shannon –Weaver index represent a more accurate evaluation of diversity. According with obtained value of the index there was a significantly fall down from 2.03 in 2003 to 1.7 in 2004.

In comparison with the total number of algae species recorded only four species (*Aphanizomenon issenschatkoi*, *Lyngbya limnetica*, *Oscillatoria formosa* and *Oscillatoria limnetica*) developed a high abundance during the investigation period. The results reveal also the dominance of *Oscillatoria formosa* (64%) a meso-saprobous algae species.

The abundance of cells/l was high during the whole period of prelevation. The rank of variation has been between 3646379 and 13798007cells/l. The abundance of different kinds of algae showed that during the sampling period the blue-green algae are the dominant species (table 2).

Table 2. Abundance (cells/l) of algae groups

Groups of algae	Diatoms	Green algae	Blue-green algae	Other algae
2003	874495.2	1004743	10639951	
2004	120243.2	615903.2	5323019	26359

Zooplankton: A number of 34 holoplanktonic species belonging to Rotatoria (59%), Bivalvia (3%), Cladocera (26%) and Copepoda (Cyclopida – 12%) were identified in the studied zone (Table 3).

Table 3. Qualitative composition of zooplankton population in Dunăreni Lake

Species	2001	2002	2003	2004
PRIMARY CONSUMERS	autumnal season	estival season	vernal season	autumnal season
ROTATORIA				
<i>Brachionus angularis</i>	*	*		*
<i>Br. calyciflorus</i> f. <i>amphiceros</i>	*			*
<i>Br. calyc.</i> var. <i>pala</i>				*
<i>Br. diversicornis</i>		*		*
<i>Br. quadridentatus</i>		*		
<i>Br. q.</i> var. <i>brevispinus</i>	*	*		
<i>Br. q.</i> var. <i>cluniorbicularis</i>	*			
<i>Br. q.</i> var. <i>rhenanus</i>		*		
<i>Br. urceolaris</i>		*		
<i>Euchlanis parva</i>		*	*	*
<i>Filinia passa</i>				*
<i>Keratella cochlearis</i>	*	*	*	*
<i>K. cochlearis</i> var. <i>tecta</i>		*	*	*
<i>Polyarthra vulgaris</i>			*	*
<i>Rotaria</i> sp.	*	*		
<i>Synchaeta pectinata</i>				*
<i>Testudinella patina</i>				*
<i>Trichocerca gracilis</i>	*			*
<i>Trichocerca similis</i>				*
BIVALVIA				
<i>Bivalvia larvae</i>				*
CLADOCERA				
<i>Bosmina longirostris</i>		*	*	*
<i>Chydorus sphaericus</i>		*	*	*
<i>Daphnia longispina</i>	*	*	*	
<i>Diaphanosoma orghidani</i>	*			
<i>Ilyochryptus agilis</i>			*	
<i>Macrothrix laticornis</i>			*	
<i>Moina micrura dubia</i>	*			
<i>Scapholeberis kingi</i>	*			
CYCLOPIDA				
Nauplii cyclopid	*	*		*
Juvenili - C1	*	*		
SECONDARY CONSUMERS				
ROTATORIA				
<i>Asplanchna herricki</i>		*	*	*
CLADOCERA				
<i>Leptodora kindtii</i>	*			
CYCLOPIDA				
<i>Acanthocyclops vernalis</i>	*	*		
<i>Cyclops vicinus</i>	*		*	*
<i>Eucyclops serrulatus</i>		*		
<i>Mesocyclops crassus</i>	*			

The taxonomical analysis showed the rotifer dominance, among primary consumers and copepod dominance in the case of secondary consumers.

The analysis of zooplankton communities from the trophic point of view revealed the dominance of the microfilter-feeders (*Brachionus* sp., *Keratella cochlearis*, *Bosmina longirostris*, *Chydorus sphaericus*) following by macrofilter-feeders-raptators (*Acanthocyclops vernalis*, *Cyclops vicinus*, *Asplanchna herricki*).

Fish fauna: The data resulted from the analysis of the commercial captures of fish made in the fluvial sector which corresponds with the length of the fluvial lake, meaning identification of 16 species of fish, corroborated with the information referring to the fish fauna of the second fisher zone present in the specialty literature (BANU *et al.*, 1960, BĂNĂRESCU, 1964), determined the present fish fauna composition of the Dunăreni Lake. Thus, the studied lake actually fish fauna is represented by the wild species: *Carassius auratus gibelio*, *Abramis*

brama, *Rutilus rutilus carpathosicus* which, beside the predatory species - *Esox lucius*, *Stizostedion lucioperca*, *Aspius aspius* – comes from the Danube in the spring, at the same time with the lake water supply. The fish culture fauna is dominated by the fish culture species belonging to the Asian complex, introduced in 1970 after the lake arrangement for the fishculture purpose: *Hypophthalmichthys molitrix*, *Ctenopharyngodon idella*, *Aristichthys molitrix* (age classes 1 – 3 years) and by *Cyprinus carpio*. These species use as food exclusively the natural trophic base of the studied aquatic basin.

CONCLUSIONS

The high values of the nutrients content show an advanced state of eutrophication for the studied aquatic basin. This state is reflected by the high frequency of the algal flowering and also by the qualitative and quantitative structure of the zooplankton.

The change of the feeding regime of the Dunăreni Lake, as well as the realisation of the hydrotechnic and hydroamelioration arrangements led to the modification of the specific composition of the fish fauna, meaning the diminution of the wild species number and the population of the lake with fish culture species (carp and Asian cyprinids).

The following protected species, written on the Red List of the Superior Plants from Romania, were identified in the studied phytocenosis: *Trapa natans* (Br. I) and *Cyperus serotinus*.

The ecological importance of the fluvial lake Dunăreni, as an important habitat for the aquatic birds, results from the variety of the existing ecological conditions which offer them favorable conditions for feeding, resting and nestling.

REZUMAT

Lacul Dunăreni (Mârleanu) este amplasat pe teritoriul localității Dunăreni (com. Aliman), la 35 km de orașul Cernavodă (km 319 – 323 pe Dunăre). Ocupă suprafața de 657 ha și face parte din *Rezervația naturală Lacul Dunăreni*, declarată prin H.G. 2151/2004. Limnologic este încadrat la *limane fluviale*, având aceeași geneză și evoluție ca și lacurile situate între Ostrov și Cernavodă. În urma cercetărilor multidisciplinare efectuate între anii 2000-2004, în ceea ce privește condițiile hidrobiologice ce caracterizează acest ecosistem acvatic, au fost identificate și studiate următoarele grupe sistematice: vegetație palustră și hidrofilă (patru asociații cu 38 specii, din care două specii sunt incluse pe *Lista Roșie a Plantelor Superioare din România* și o specie protejată prin Br I), organisme fitoplanctonice (90 specii), organisme zooplanctonice (34 specii), pești (10 specii). Parametrii fizico-chimici ai apei din lac se încadrează, cu mici excepții, în limitele admise în piscicultură.

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