HYDROBIOLOGICAL PARTICULARITIES OF THE AREA OF NATIONAL INTEREST BALTA CILIENI-BĂILEȘTI FROM THE OLTENIA PLAIN

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Abstract. Situated in the Oltenia Plain, the Cilieni pond is part of the network of natural protected areas of national interest that corresponds to IUCN category IV, being declared by HCJ 26/1994 and then re-confirmed by Law no. 5/2000 regarding the approval of the National Territorial Development Plan - Section III - Protected Areas. It has an area of 83.14 ha and is part of the Danube's lower hydrographic basin, the supply source being the Balasan stream and the springs that emerge from the bottom of the pond. Considering the structural particularities of the biocenoses dominated by the populations of aquatic and marsh macrophytes, the large amount of phytoplankton and the composition of the zoobenthos, the pond meets all the characteristics of eutrophic ecosystems. In the phytoplankton, the main groups that show intense development during the summer and that produce the water bloom process are: Cyanophyceae (*Microcystis aeruginosa, M. flos-aque),* Euglenophyceae (*Euglena acus*), Bacilariophyceae (*Achnanthes minutissima, A. microcephala, Cyclotella chaetoceras, Navicula cryptocephala, N. longirostris, Nitzschia acicularis, N. gracilis, Synedra acus*), Chlorophyceae (*Chlamydomonas* sp., *Chlorella vulgaris, Scenedesmus bicaudatus, S. granulatus, Spirogyra* sp., *Volvox aureus*). The benthic facies is composed of a thick layer of organic mud and plant detritus, which explains the tendency of clogging out the pond. The main groups of benthic invertebrates are: oligochaetes, chironomids, plecopterans, and bivalves. Gastropods represent the dominant group in the benthos, with 15 species identified. The most frequent and numerically dominant are: *Viviparus acerosus, Physella (Costatella) acuta, Radix balthica, Lymnaea stagnalis, Planorbis planorbis, Planorbarius corneus.* The analyzes carried out on the mineralization process illustrate the ability of the pulmonate snails species *Radix balthica, Lymnaea stagnalis* and *Planorbarius corneus* to accumulate metal ions such as Zn^{2+}, Ni^{2+}, Cu^{2+}, Pb^{2+} and Cr^{3+} in direct correlation with the chemical characteristics of the soil in the lacustrine ecosystem. The area was declared for the protection of 8 species of vertebrates: *Umbra krameri, Rana esculenta, Bombina bombina, Natrix tessellata, Lacerta viridis, Anas platyrhynchos, Larus minutus, Neomys anomalus.*

Keywords: Cilieni pond, eutrophication, gastropods, metal ions, Oltenia.

Rezumat. Particularități hidrobiologice ale ariei de interes național Balta Cilieni-Băilești din Câmpia Olteniei. Situată în Câmpia Olteniei, balta Cilieni face parte din categoria ariilor naturale protejate de interes naţional şi corespunde categoriei IV IUCN, fiind declarată prin HCJ 26/1994 şi apoi prin legea nr. 5/2000 privind aprobarea Planului de amenajare a teritoriului naţional – Secţiunea III – Zone protejate. Are o suprafaţă de 83,14 ha şi face parte din bazinul hidrografic inferior al Dunării, sursa de alimentare fiind pârâul Balasan şi izvoarele care debuşează pe fundul bălţii. Având în vedere particularităţile structurale ale biocenozelor dominate de populaţiile de macrofite acvatice şi palustre, de cantitatea mare de fitoplancton şi de componenţa zoobentosului, balta întruneşte toate caracteristicile ecosistemelor eutrofe. În fitoplancton principalele grupe care cunosc o dezvoltare intensă în timpul verii şi care produc procesul de înflorire a apei sunt: Cyanophyceae (*Microcystis aeruginosa, M. flos-aque),* Euglenophyceae (*Euglena acus*), Bacilariophyceae (*Achnanthes minutissima, A. microcephala, Cyclotella chaetoceras, Navicula cryptocephala, N. longirostris, Nitzschia acicularis, N. gracilis, Synedra acus*), Chlorophyceae (*Chlamydomonas* sp., *Chlorella vulgaris, Scenedesmus bicaudatus, S. granulatus, Spirogyra* sp., *Volvox aureus*). Faciesul bental este alcătuit dintr-un strat gros de mâl organic şi detritus vegetal ceea ce explică tendinţa de colmatare a bălţii. Principalele grupe de nevertebrate bentonice sunt: oligochetele, chironomidele, plecopterele, bivalvele. Gasteropodele constituie grupul dominant în bentos, fiind identificate 15 specii. Caracteristice prin frecvenţă şi densitate numerică sunt: *Viviparus acerosus, Physella (Costatella) acuta, Radix balthica, Lymnaea stagnalis, Planorbis planorbis, Planorbarius corneus*. Analizele realizate prin procesul de mineralizare ilustrează capacitatea speciilor de melci pulmonaţi *Radix balthica, Lymnaea stagnalis* și *Planorbarius corneus* de a acumula ioni metalici de tip Zn^{2+}, Ni^{2+}, Cu^{2+}, Pb^{2+} și Cr^{3+} în corelaţie directă cu particularităţile chimice ale solului din ecosistemul lacustru. Aria a fost declarată pentru protecţia a 8 specii de vertebrate: *Umbra krameri, Rana esculenta, Bombina bombina, Natrix tessellata, Lacerta viridis, Anas platyrhynchos, Larus minutus, Neomys anomalus*.

Cuvinte cheie: balta Cilieni, eutrofizare, gasteropode, ioni metalici, Oltenia.

INTRODUCTION

Environmental protection, as a branch of applied ecology, aims to preserve and conserve natural ecosystems in order to ensure biological balance and the necessary resources for humans in the process of sustainable development. The concerns of scientists to protect the environment at country level have determined decision-makers to issue a series of programs and adopt a series of laws regarding environmental protection. Protected areas, due to their natural value and low degree of human intervention on their territory, are the best examples of natural and semi-natural ecological systems. Dolj County has a rich natural heritage, the basic areas being able to constitute, through their natural and anthropic framework, a true and attractive offer for ecological tourism.

The research carried out in the natural protected area „Balta Cilieni-Băilești" (2.395) is part of a national program to understand the biodiversity structure of some ecosystems specific to wetlands in southern Romania. Located in the Oltenia Plain, it has an area of 83.14 ha and is part of the lower Danube river basin. The source of supply is the Balasan stream and springs that flow into the bottom of the pond (Fig. 1). It is a natural protected area of national interest and corresponds to IUCN category IV, being declared by HCJ 26/1994 (Dolj County Council) and then by Law no. 5/2000 on the approval of the National Land Management Plan – Section III – Protected Areas, due to some fish species: *Petricola kessleri* (pond goby), *Alburnus*

alburnus (common bleak), *Misgurnus fossilis* (European weatherfish), *Tinca tinca* (tench), *Leucaspius delineates* (sunbleak). It is not part of any Natura 2000 site and does not overlap with other protected areas.

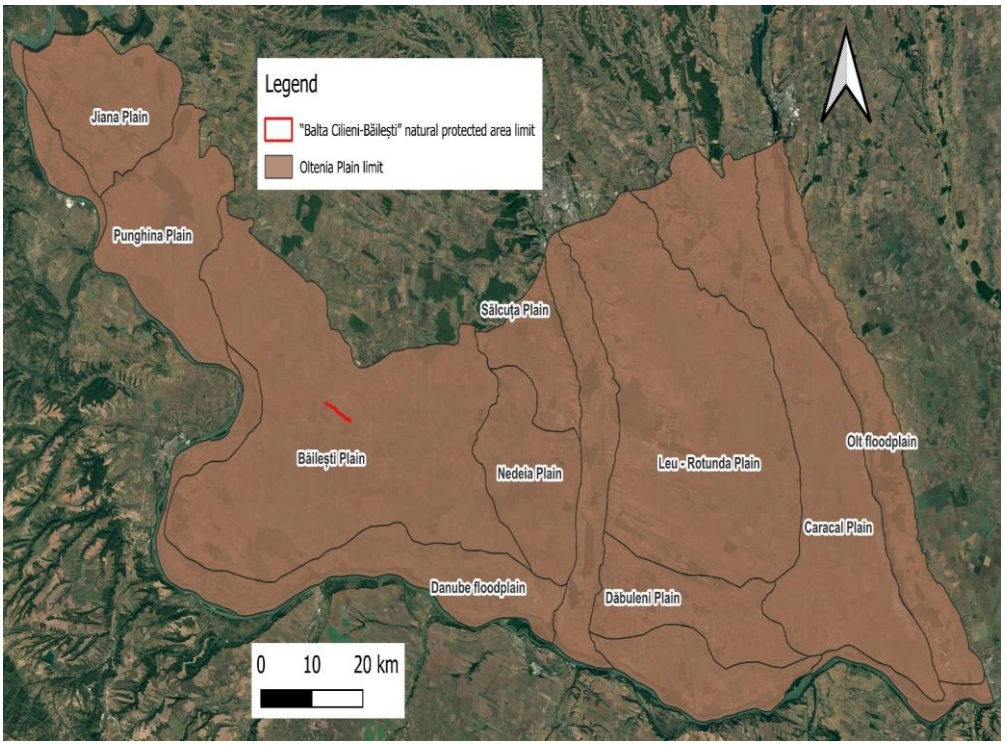

Figure 1. Location of „Balta Cilieni-Băilești" natural protected area within the Oltenia Plain (source: author's processing).

Formed by the regularization of the Balasan stream, which flows into Strâmba and Călugăreni ponds (Băilești Plain), on fluvial terraces resulted from the sedimentation of alluvial deposits of the Upper Pleistocene, as the Danube waters retreated, the lacustrine ecosystem is represented by ponds and marshy areas due to the low water level, with agricultural crops and pastures in the vicinity (Fig. 2).

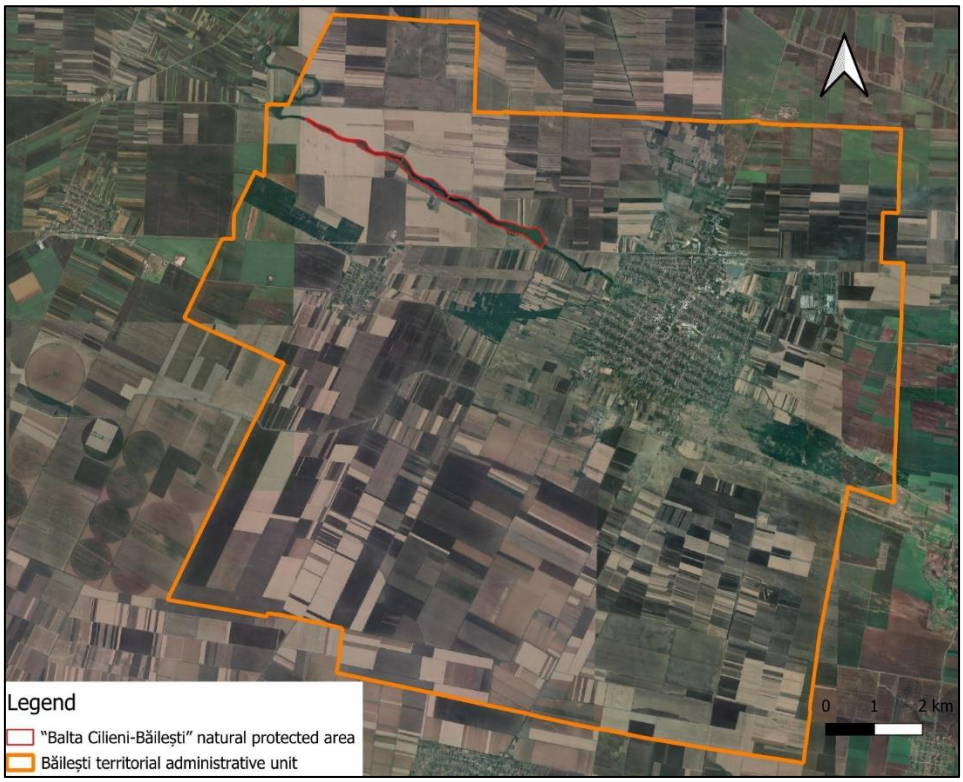

Figure 2. Limit of „Balta Cilieni-Băilești" national protected area in the lower Danube river basin (source: source: author's processing).

The groundwater is found between 2-4 m on the terrace, and the multiannual average temperature is 11.7 ºC, the climate being temperate-continental with weak Mediterranean influences. Surface erosion and pond clogging are geomorphological processes that negatively influence biological diversity by decreasing the water depth and subsequently the disappearance of some water surfaces.

Climatic, hydrological, geomorphological and biological factors give the lake a special ecological character for the Băileşti Plain, respectively the Oltenia Plain. Under these conditions, the floristic and faunistic structure of the area has also changed due to anthropogenic intervention (PLENICEANU, 2003; CIOBOIU, 2007; CIOCÂRLAN, 2009).

MATERIAL AND METHOD

In order to evaluate the hydrobiological peculiarities, an extensive research program was carried out (period 2008 – 2023). Based on the data available in literature and our own research, a synthesis was carried out that allowed monitoring the biodiversity of the lake's ecosystem in the natural protected area (CIOBOIU, 2015; CIOBOIU et al., 2020). Qualitative samples were taken to analyse the physico-chemical characteristics of water, the planktonic and benthic communities, as well as concentration of heavy metals in sediment and *Lymnaea stagnalis* shells, a common species in the pond, using the Avanta GBC, SN A 5378, flame atomic absorption spectrophotometer, in order to reveal the levels of chromium, nickel, zinc, lead, cadmium and copper accumulated through the mineralization process (CIOBOIU & CISMAȘIU, 2016; 2018; CIOBOIU et al., 2020; 2023; DUDĂU et al., 2024). Gastropods, being the dominant group in the benthos, were collected seasonally to establish numerical density and morphometric characteristics.

RESULTS AN DISCUSSIONS

Being located in an agricultural plain, the pond is indirectly influenced by anthropogenic factors. The nearby crops are the source of nutrients that dictate the eutrophic character through the runoff of organic nutrients into the pond, due to precipitation (Table 1). Water chemistry is characterized by high nutrient values (NO_3^-, PO_4^{3-}), which explains the mass development of aquatic and paludous macrophytes and phytoplankton (DINU & BREZEANU, 2014; MARIAN et al., 2024).

Table 1. Physico-chemical composition of water in Cilieni pond (mean values).

	Indicators	**Measured values**		**Allowed values**	**Analysis method**	**Equipment**
		Băileşti Cilieni 1	**Băileşti Cilieni 2**	**Order no. 161/2006 - IInd quality class**		
1	Hydrogen ion concentration (pH), unit.pH	7,2	8,4	6,5 – 8,5	STAS 6325-75	pH-meter WTW 330, series 08090178
2	Electrical conductivity µS/cm, max.	760	720	-	STAS 7722-84	Cond WTW 340, series 08082507
3	Dissolved oxygen (O_2), mg/dm^3, min.	7,4	8,0	-	STAS 6536-87	-
4	Oxidizable organic substances CCOCr mgO_2/dm^3,max	11,1	12,0	-	STAS 3002-85	-
5	Total hardness, German degrees, max.	16,5	16,7	-	STAS 3026-76	-
6	Fixed residue, mg/dm^3, min/max.	424	474	750	STAS 3638-76	KERN type analytical balance 770 Series 17308244
7	Ammonia (NH_4^+), mg/dm^3, max.	2,937	3,498	1,0	STAS 6328-85	Spectrophotometer DR 2000, no. series 930700025411
8	Calcium (Ca^{2+}), mg/dm^3, max.	40	38	100	STAS 3662-62	-
9	Magnesium (Mg^{2+}), mg/dm^3, max.	47	49	50	STAS 6674-77	-
10	Nitrites (NO_2), mg/dm^3, max.	16,7	14,1	0,1	STAS 3048- 77 571 method	Spectrophotometer Lovibond PC spectro Series 100510
11	Nitrates (NO_3^-), mg/dm^3, max.	0,201	0,177	13	STAS 3048-90 355 method	Spectrophotometer DR 2000, no. series 930700025411
12	Chloride (Cl^-), mg/dm^3, max.	21	25	50	STAS 3049-86	-
13	Sodium (Na^+), mg/dm^3, max.	58,5	59,5	50	STAS 3223-52 Apparatus method	Jenway PFP Falme photometer
14	Potassium (K^+), mg/dm^3, max.	9,5	9,0	-		
15	Sulfates(SO_4^{2-}), mg/dm^3, max.	25	24	25	STAS 3002-87 680 method	Spectrophotometer DR 2000, no. series 930700025411
16	Phosphates (PO_4^{3-}),mg/dm^3, max	0,13	0,12	-	STAS 3265-66	-

The main phytoplankton groups that experience an intense development during summer and that produce water blooming process (Fig. 3) are: Cyanobacteria (*Microcystis aeruginosa, M. flos-aque),* Euglenophyceae (*Euglena acus*), Bacilariophyceae (*Achnanthes minutissima, A. microcephala, Cyclotella chaetoceras, Navicula cryptocephala, N. longirostris, Nitzschia acicularis, N. gracilis, Synedra acus*), Chlorophyceae (*Chlamydomonas* sp., *Chlorella vulgaris, Scenedesmus bicaudatus, S. granulatus, Spirogyra* sp., *Volvox aureus*).

Zooplankton represents an important part of the biological production, its development being correlated with that of phytoplankton, the latter constituting the main food source of zooplankton. The dominant groups are rotifers, cladocerans and ciliates (BREZEANU et al., 2011). In the case of rotifers, the dominant species are: *Polyarthra remata, P. dolichoptera, P. major, Brachionus calyciflorus. Asplanchna priodonta, Keratella cochlearis.* Cladocera are a group with a large share in the zooplankton of eutrophic lakes. The dominant and common species are: *Bosmina longirostris, Leptodora kindi, Sida cristalina, Daphnia cucullata, Chydorus sphaericus, Leydigia acanthoscelidis*. Ciliates are frequently represented by: *Colpoda cucullus*, *Epystilis plicatilis* or *Vorticella convallaria* species. Also, zooplankton, together with phytoplankton and bacterioplankton, are the main source of food for fry and tadpoles, species of conservation interest in the lake ecosystem. From an ecological point of view, it's known that the presence of different species is linked to the structural characteristics of ecosystems. Cilieni pond is especially representative by the fact that macrophytes are the dominant element, a major factor explaining the presence of phytophilic species. The main species are: *Thypha angustifolia* L., *Phragmites australis* Trin., *Nymphaea alba* L., *Ceratophyllum submersum* L., *Alisma plantago aquatica* L., *Sagittaria sagittifolia* L., *Lemna minor* L., *Iris pseudacorus* L., *Schoenoplectus lacustris* L. (Fig. 4).

The benthic facies is composed of a thick layer of organic mud and plant detritus, which explains the tendency of the pond to become clogged. The main groups of benthic invertebrates are: oligochaetes (*Peloscolex ferox, Stylaria lacustris*), chironomids (*Chironomus plumosus, Tendipes semireductus, Polypedilum* sp.), plecoptera (*Amphinemura standfussi, Capnia bifrons, Leuctra fusca, L. nigra, Nemoura cambica, N. cinerea*), bivalves (*Anodonta cygnea, Sphaerium lacustre, Unio pictorum, Unio crassus, Dreissena polymorpha*), and among crustaceans *Astacus leptodactylus*. Gastropods represent the dominant group of benthic assemblage, with 15 identified species (Table 2).

Figure 3. Heavy cyanobacterial bloom (original).

Figure 4. Large areas covered with macrophytes (original).

Table 2. Taxonomic diversity of gastropods.

CLASS GASTROPODA Cuvier 1798	
SUBCLASS PROSOBRANCHIA Milne Edward 1848	
ORDER MESOGASTROPODA (Thiele 1925)	
Family Viviparidae Gray 1847	*Viviparus acerosus* Bourguignat 1870 *Viviparus viviparus* Linnaeus 1758
Family Valvatidae Thomson 1840	*Valvata (Cincina) piscinalis* O. F. Muller 1774
Family Lithoglyphidae Troschel 1857	*Lithoglyphus naticoides* C. Pfeiffer 1828
Family Bithyniidae Gray 1849	*Bithynia tentaculata* Linnaeus 1758
Family Thiaridae Troschel 1857	*Esperiana esperi* (Ferussac 1829) *Esperiana (Microcolpia) daudebardii acicularis* Ferussac 1823
SUBCLASS PULMONATA Cuvier 1817	
ORDER BASOMMATOPHORA A. Schmidt 1855	
Family Physidae Fitzinger 1833	*Physa fontinalis* (Linnaeus 1758) *Physella (Costatella) acuta* (Draparnaud 1805)
Family Lymnaeidae Rafinesque 1815	*Lymnaea stagnalis* (Linnaeus 1758) *Stagnicola palustris* (O. F. Muller 1774) *Stagnicola corvus* Gmelin 1788 *Radix balthica* (Linnaeus 1758)
Family Planorbidae Rafinesque 1815	*Planorbis planorbis* (Linnaeus 1758) *Planorbarius corneus* (Linnaeus 1758)

The structure of gastropod populations reveals that the dominant species are: *Viviparus acerosus, V. viviparus, Physella (Costatella) acuta, Radix balthica, Lymnaea stagnalis, Stagnicola palustris, S. corvus, Planorbis planorbis, Planorbarius corneus* (CIOBOIU, 2014). The largest number of species belongs to *Lymnaeidae* family, frequent in coastal areas rich in reeds and cattails, which present ideal surfaces for feeding, reproduction and development of these species. Following the seasonal numerical dynamics reported at the same sampling effort (number of individuals/m^2/season), it results that the largest number of individuals belongs to *Viviparus acerosus* species with 189 individuals recorded in spring, 87 in summer and 72 in autumn. The other species also follow the same dynamics of the number of individuals, in the sense that the highest numerical densities are recorded in spring (Table 3).

A significant fact of seasonal numerical dynamics is that the *Physa fontinalis*, *Valvata (Cincina) piscinalis*, *Esperiana esperi*, *E. (Microcolpia) daudebardii acicularis, Lithoglyphus naticoides* and *Bithynia tentaculata* species were no longer encountered in autumn. In general, the highest number of individuals of other species was recorded in spring. The highest number of individuals recorded in spring can be explained by the fact that, during this period, the reproduction process takes place, and it is reflected by the dimensional values for different age categories (Table 4). The lower values of the number of individuals recorded in summer and especially in autumn, in most species, are due to the fact that the senescent individuals have disappeared, the young and adult individuals being dominant (CIOBOIU, 2009).

Table 3. Seasonal numerical dynamics of gastropod populations in Cilieni pond.

SPECIES	Number of individuals / Season		
	Spring	Summer	Autumn
Viviparus acerosus	189	87	72
Viviparus viviparus	152	68	42
Physella (Costatella) acuta	114	37	27
Lymnaea stagnalis	110	35	25
Stagnicola palustris	108	33	24
Stagnicola corvus	106	31	23
Planorbarius corneus	105	30	22
Radix balthica	100	26	17
Planorbis planorbis	10	25	20
Valvata (Cincina) piscinalis	17	3	-
Esperiana (Microcolpia) daudebardii acicularis	10	6	-
Physa fontinalis	6	5	-
Lithoglyphus naticoides	5	4	-
Bithynia tentaculata	4	7	-
Esperiana esperi	3	8	-

According to Bodenheimer (1958), in populations where physiological ages are not clearly marked, age is estimated based on body size, gastropod species being classified into three groups: pre-reproductive, reproductive and post-reproductive (BOTNARIUC & VĂDINEANU, 1982). For this purpose, measurements were made to determine the height (h) and width (l) of the shell, criterion that was the basis for establishing the reproductive maturity of the 15 studied species. Measurements showed that the sizes of pre-reproductive individuals of *Physa fontinalis*, *Physella acuta*, *Radix balthica*, *Valvata piscinalis*, *Planorbis planorbis* species are between h = 0,1 and 8-9 mm; l = 0,1 and 2-8 mm, the sizes of reproductive individuals are h = 5,1 and 8-18 mm; l = 1-18 mm, and those of the post-reproductive individuals are h = 1,4-15 mm; l = 5-18 mm. The dimensions of the other species are included: for pre-reproductive individuals between h = 5-15 mm; l = 19-22 mm, for reproductive individuals h = 10-42 mm; l = 15-30 mm, and for post-reproductive individuals h = 20-55 mm; l = over 40 mm (Table 4).

Table 4. Values for different age categories in pond gastropod populations.

SPECIES	BODY DIMENSIONS CHARACTERISTIC OF DIFFERENT AGE GROUPS (h, l = mm)		
	Pre-reproductive	Reproductive	Post-reproductive
Viviparus acerosus	h = 10-20; l = 7-15	h = 20,1-40; l = 15,1-30	h = over 40; l = over 30
Viviparus viviparus	h = 5-15; l = 3-10	h = 15,1-35; l = 10,1-25	h = over 35,1; l = over 25,1
Valvata (Cincina) piscinalis	h = 1,5-5; l = 1-3	h = 5,1-8; l = 3,1-5	h = over 8; l = over 5
Lithoglyphus naticoides	h = 6-7,5; l = 5-6,5	h = 8-9; l = 7-8,5	h = over 10; l = over 9
Bithynia tentaculata	h = 8-9,5; l = 3-4,5	h = 10-11; l = 5-7	h = over 11; l = over 7
Esperiana esperi	h = 11-14,5; l = 5-6,5	h = 15-20; l = 7-8	h = over 20; l = over 8
Esperiana (M.) daudebardii acicularis	h = 14,5-16; l = 3-4,5	h = 17-20; l = 5-7	h = over 20; l = over 7
Physa fontinalis	h = 0,1-5; l = 0,1-3	h = 5,1-9; l = 3,1-7,5	h = over 9; l = over 7,5
Physella (Costatella) acuta	h = 0,1-5; l = 0,1-4	h = 5,1-11; l = 4,1-6	h = over 11,1; l = over 6,1
Lymnaea stagnalis	h = 18-42; l = 9-22	h = 42,1-55; l = 18-22,1	h = over 55; l = over 22
Stagnicola palustris	h = 0,1-15; l = 0,1-8	h = 15,1-28; l = 8,1-15	h = over 28; l = over 15
Stagnicola corvus	h = 0,1-20; l = 0,1-10	h = 20,1-35; l = 10,1-18	h = over 35; l = over 18
Radix balthica	h = 0,1-15; l = 0,1-10	h = 15,1-20,9; l = 10,1-11,5	h = over 20; l = over 4
Planorbis planorbis	h = 0,1-1,5; l = 0,1-9	h = 1,6-3,5; l = 9,1-17	h = over 3,5; l = over 17
Planorbarius corneus	h = 5-10; l = 5-20	h = 11-14; l = 21-29	h = over 14; l = over 29

Regarding the distribution of individuals according to age categories (Table 5), it was found that for most species, the reproductive and pre-reproductive ages are dominant, which indicates that the gastropod populations in Cilieni pond are in numerical progress (CIOBOIU, 2009; CIOBOIU et al., 2023).

The proportion of young individuals (from the pre-reproductive category) and also of mature ones is eloquent. This demonstrates that the abiotic and biotic environmental factors (those related to food) are favourable for the development of gastropod populations. It is obvious that, although the category of young pre-reproductive individuals prevails, the difference from the other groups (reproductive and senescent) is not great, which can be characterized as a balance between the different age categories, an essential factor for a constant, weighted growth of the populations. It should be noted that the age structure was established based on the analysis of 1500 exemplares, the numerical and percentage distribution of ages being characteristic of each species.

Following the analysis of the numerical evolution of populations, as well as the seasonal dynamics of the age categories of individuals of each population, it results that gastropod populations are in a process of growth, both in terms of number of species and individuals, being a response to favourable environmental factors. It is known that gastropods have a high degree of specificity in relation to the environmental factors in which they live, the presence of some species being determined by their capacity to assimilate the ecological particularities of an eutrophic aquatic ecosystem: *Viviparus acerosus, Valvata (Cincina) piscinalis* are pelophilic; *Physa fontinalis, Physella acuta, Radix balthica, Esperiana esperi, E. (Microcolpia) daudebardii acicularis* are phytophilic; *Lymnaea stagnalis, Planorbis planorbis, Planobarius corneus* are psamo – pelophilic.

Table 5. Age distribution in gastropod populations (total and percentage values).

SPECIES	AGES					
	Pre-reproductive		Reproductive		Post-reproductive	
Viviparus acerosus	100	13.58 %	176	16.82 %	20	13.33 %
V. viviparus	104	14.13 %	165	15.77 %	21	14.00 %
Physella (Costatella) acuta	103	13.99 %	160	15.29 %	10	6.66 %
Lymnaea stagnalis	75	10.19 %	98	9.36 %	11	7.33 %
Stagnicola palustris	70	9.51 %	90	8.60 %	12	8.00 %
Stagnicola corvus	40	5.43 %	50	6.75 %	3	2.00 %
Planorbarius corneus	25	3.39 %	40	4.82 %	4	2.06 %
Radix balthica	16	2.58 %	27	4.66 %	7	2.17 %
Planorbis planorbis	15	2.43 %	20	3.33 %	5	2.11 %
Bithynia tentaculata	10	2.13 %	16	3.03 %	-	-
E. d. acicularis	11	2.27 %	12	2.25 %	-	-
Valvata (Cincina) piscinalis	7	1.64 %	9	1.94 %	-	-
Physa fontinalis	10	2.13 %	5	0.52 %	-	-
Esperiana esperi	3	0.41 %	5	0.52 %	-	-
Lithoglyphus naticoides	2	0.27 %	3	0.28 %	-	-

Studies on the presence of bivalent heavy metals in sediments and shells of freshwater snails have shown that they can accumulate higher levels of Zn^{2+}, Cd^{2+}, Cu^{2+}, Ni^{2+}, Cr^{2+} and Pb^{2+} than the permissible environmental values (0,001 – 0,01 mg/l), in accordance with Order no. 161/2006. The analysis carried out in Cilieni pond illustrate the ability of *Lymnaea stagnalis* to accumulate different types of metal ions like Zn^{2+}, Cd^{2+}, Cu^{2+}, Ni^{2+}, Cr^{2+} and Pb^{2+} in direct correlation with the concentration of those respective ions in soil (Table 6).

Table 6. Metal concentrations in soil and shells of *Lymnaea stagnalis* pulmonate snails.

	Analyzed indicator (mg/Kg/SU)	Cilieni (soil)	Snails (shells)	Analysis method	Equipment
1	Zinc	< SLD	0.47	Acid Mineralization AAS-GBS-Avanta apparatus recommended operating methods	Avanta GBC, SN A 5378 flame atomic absorption spectrometer
2	Cadmium	< SLD	0.31		
3	Copper	5.7	1.17		
4	Nickel	2.5	0.37		
5	Cromium	46.8	2.12		
6	Lead	15.3	4.87		

Note: SLD – below detection limit

Also, the research has highlighted the increased tolerance of these snail species (e.g. *Viviparus acerosus* gilled snails species and *Radix balthica*, *Stagnicola palustris, Planorbarius corneus* pulmonate snails) to the presence in the environment of bivalent metal ions originating from industrial solid waste processing activities results from the use of chemicals on neighboring agricultural lands. These species represent bioindicators of industrially contaminated environments in the area because they signal early the occurrence of negative changes within the lake ecosystem (CISMAȘIU et al., 2017; CIOBOIU et al., 2019).

It should be noted that in the structure of plant and animal populations in the pond, an important place belongs to the ichthyofauna, the identified species being: *Abramis brama, Alburnus alburnus, Carassius gibelio, Cyprinus carpio, Esox lucius, Umbra krameri, Leucaspius delineatus, Lepomis gibbosus, Perca fluviatilis, Scardinius erythrophthalmus, Silurus glanis, Sander lucioperca, Leuciscus idus, Ctenopharyngodon idella* (GOGA, 2006; 2007).

The amphibian and reptile fauna of „Balta Cilieni-Băileşti" natural protected area presents a high diversity, with high ecological plasticity species, such as *Pelophylax ridibundus (Rana ridibunda)* or *Lacerta agilis*, but also species that prefer higher temperatures (*Lacerta viridis* or *Natrix tessellata*). During fieldtrips other species were identified: *Pelophylax lessonae (Rana lessonae), Pelophylax esculentus (Rana esculenta), Bufo viridis, Bombina bombina, Natrix natrix, Emys orbicularis* (ALEXANDRU, 2022; 2024). Also, within the perimeter of the lake's ecosystem 30 species of birds (*Anas platyrhynchos, Fulica atra, Ciconia ciconia, Ardea cinerea, Podiceps cristatus, Larus minutus*) and 15 species of mammals (*Neomys anomalus, Talpa europaea, Lutra lutra, Microtus arvalis, Myotis myotis, Vulpes vulpes*) were identified.

CONCLUSIONS

Due to its geographical position, the Cilieni pond is representative for the Oltenia Plain, being included in the lower Danube river basin. Considering the structural peculiarities of the biocenoses dominated by the populations of aquatic and paludous macrophytes, the large amount of phytoplankton and the composition of the zoobenthos, the pond meets all the characteristics of eutrophic ecosystems.

The main groups of benthic invertebrates are: oligochaetes, chironomids, Plecoptera, bivalves, gastropods being the dominant group in benthic fauna, represented by 15 species. The dominance of individuals from the reproductive and pre-reproductive categories in most species demonstrates the tendency of increasing the population in the lake ecosystem. The research carried out has highlighted the increased tolerance of *Viviparus acerosus, Lymnaea stagnalis, Radix balthica, Stagnicola palustris, Planorbarius corneus* snail species to the presence in the environment of bivalent metal ions originating from industrial activities of solid waste processing, being bioindicators of industrially contaminated environments in the area.

The vertebrate fauna is well represented, with species of conservation interest having the decisive role in declaring the area as a natural protected area of national interest.

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