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THE ECOLOGICAL FUNCTION OF A PROTECTED LACUSTRINE WITHIN THE OLTENIA PLAIN (ROMANIA)

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ABSTRACT. The lacustrine complex Valea Preajba, located within the plain in the hydrographical basin of the Jiu River, is included in the category of wet areas. The main ecological feature that defines the protected area consists in the fact that on an area not exceeding 30 hectares, there is grouped a great variety of ecosystems: unevenness of the ground in the shape of small hills, pastures and meadows, agricultural lands and a complex hydrographical structure: springs, streams, rivers, marshes, small reservoirs. All these are populated with a variety of plant and animal species that confers to the area a special ecological character for Oltenia Plain and even for Romania. In the lacustrine ecosystems, there have been identified 36 paludous and aquatic macrophytes species, dominated by: *Phragmites australis* (Cav.) Steud., *Typha angustifolia* L., *Scirpus lacustris* L., *Eleocharis palustris* (L.) Roem. & Schult., *Lemna minor* L., *Nymphaea alba* L., *Potamogeton natans* L., *Mentha aquatica* L., *Myriophyllum spicatum* L., *Ceratophyllum submersum* L.; 78 species of periphytic and planktonic algae; 13 large groups of benthonic invertebrates dominated by the larvae of: Chironomidae, Coleoptera, Ephemeroptera, Heteroptera and Gastropoda; 10 species of fish: *Cyprinus carpio* Linnaeus, 1758, *Carassius auratus gibelio* (Bloch, 1782), *Rutilus rutilus* (Linnaeus, 1758), *Abramis brama* (Linnaeus, 1758), *Pseudorasbora parva* (Temminck & Schlegel, 1846), *Perca fluviatilis* Linnaeus, 1758, *Sander lucioperca* (Linnaeus, 1758), *Lepomis gibbosus* (Linnaeus, 1758), *Alburnus alburnus* (Linnaeus, 1758).

Keywords: ecological function, lacustrine complex, Oltenia Plain, Romania.

REZUMAT. Funcția ecologică a unui complex lacustru protejat din Câmpia Olteniei (România). Complexul lacustru Valea Preajba, situat într-o zonă de câmpie din bazinul hidrografic al râului Jiu, face parte din categoria zonelor umede. Principala particularitate ecologică care definește aria protejată constă în faptul că, pe o suprafață care nu depășește 30 de hectare, este grupată o mare diversitate de ecosisteme: denivelări ale terenului sub formă de dealuri, pășuni și pajiști, terenuri agricole și o structură hidrografică complexă: izvoare, pârâuri, râuri, mlaștini, mici lacuri de baraj. Toate acestea sunt populate cu o varietate de specii de plante și animale care conferă zonei un caracter ecologic special pentru Câmpia Olteniei și chiar pentru teritoriul României. În ecosistemele lacustre, au fost identificate 36 de specii de macrofite palustre și acvatice, dominante fiind: *Phragmites australis* (Cav.) Steud., *Typha angustifolia* L., *Scirpus lacustris* L., *Eleocharis palustris* (L.) Roem. & Schult., *Lemna minor* L., *Nymphaea alba* L., *Potamogeton natans* L., *Mentha aquatica* L., *Myriophyllum spicatum* L., *Ceratophyllum submersum* L.; 78 specii de alge perifitice și planctonice; 13 mari grupe de nevertebrate bentonice, dominante fiind: larvele de chironomide, coleoptere, efmeroptere, heteroptere și gastropode; 10 specii de pești *Cyprinus carpio* Linnaeus, 1758, *Carassius auratus gibelio* (Bloch, 1782), *Rutilus rutilus* (Linnaeus, 1758), *Abramis brama* (Linnaeus, 1758),

Pseudorasbora parva (Temminck & Schlegel, 1846), *Perca fluviatilis* Linnaeus, 1758, *Sander lucioperca* (Linnaeus, 1758), *Lepomis gibbosus* (Linnaeus, 1758), *Alburnus alburnus* (Linnaeus, 1758).

Cuvinte cheie: funcție ecologică, complex lacustru, Câmpia Olteniei, România.

INTRODUCTION

The area where the research took place was not well studied from the ecological point of view. Geographically located within a plain, this protected area includes more than 50 springs, a large number of small stream, tributaries of the main river, the Preajba Valley and basins. Thus, it can be included in the category of wet areas (Fig. 1).

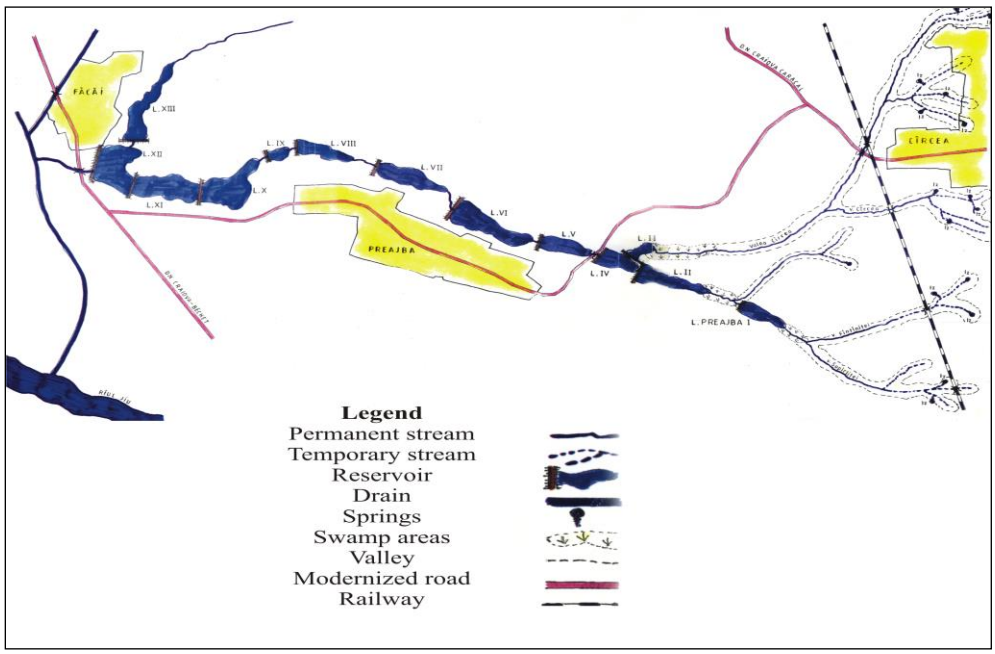

Figure 1 - The plan of the lacustrine complex Valea Preajba within the Oltenia Plain (after Cioboiu, 2014).

The main ecological feature of the area is that within a small geographical space, which does not exceed 30 sq km, there appears a great variety of ecosystems: springs, streams, rivers, basins and swamps (Fig. 2). Each type of ecosystem imposes its own features to the biocoenosis and the plants and animals' populations (Brezeanu et al., 2011, Cioboiu, 2014).

MATERIAL AND METHOD

In order to evaluate the hydrobiological features of the area in question, we established a research program covering a period of five years. There have been established the qualitative and quantitative structure of the planktonic and benthonic populations during characteristic seasonal stages. The basins were periodically populated with fish species supplied from fisheries and natural lakes.

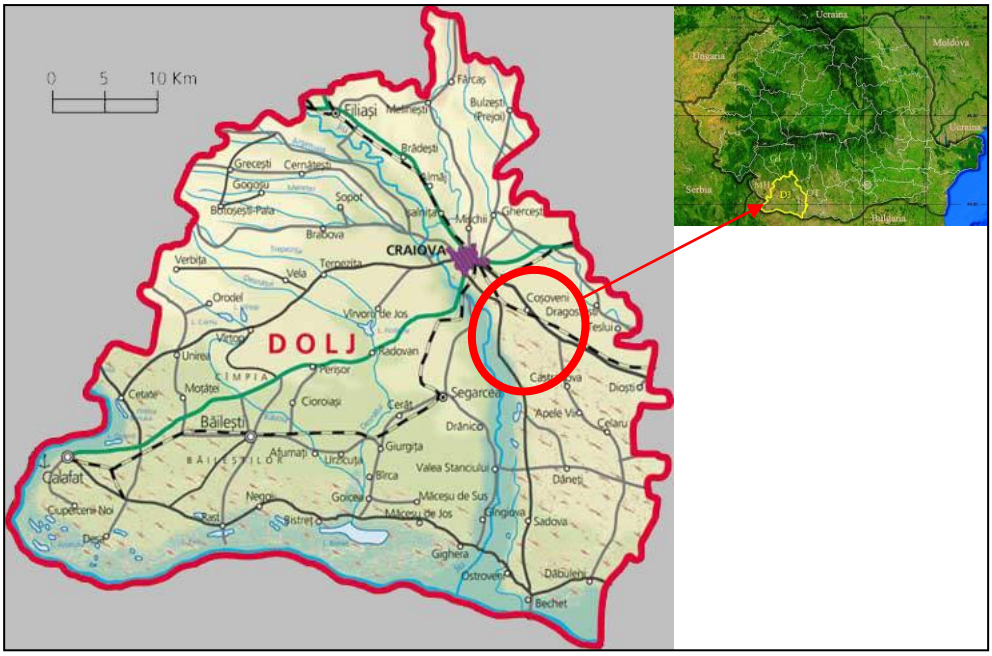

Figure 2 - Location of the lacustrine complex within the Oltenia Plain (from Google Earth).

RESULTS AND DISCUSSION

The climatic, hydrological, geomorphologic, and biodiversity factors impose a particular ecological character to the lacustrine complex within Oltenia Plain.

The **climate** is continental with sub-Mediterranean influences. The area can be exposed to the invasion of extremely cold air in winter (-10, -20 ^{o}C) and to the invasion of hot air in summer (30-35 ^{o}C); thus, the thermal amplitude can be quite high in some of the years. The sub-Mediterranean influences are obvious when we analyses the precipitation regime. The highest quantities are registered in May-June, while in November-December, even if the quantities are lower than in summer, there occur higher quantities as compared to the rest of the Romanian Plain due to the above-mentioned influences (Vlăduț, 2016).

Hydrological features. The hydrographical network is influenced by the lithological structure of the soil and by the climate. The main river is the Preajba Valley the length of which reaches 9.6 km and there can be also noticed more than 50 springs. The main river and its tributary are supplied by the 50 springs. An important role is played by the 12 small basins built along the course of the main river, the surface of which varies between 1.0 and 4.2 ha (Cioboiu & Cismașiu, 2016a, Cioboiu & Cismașiu, 2016b).

The water chemistry. The chemical composition of the water is characteristic to the eutrophic ecosystems. The clayish-sandy bottom, rich in organic substances, the development of the macrophytes and of the phytoplankton, the presence of the springs located on the banks and on the bottom of the basins, all these are factors that determine the water chemistry (Cioboiu & Pleniceanu, 2005).

The ionic balance makes the water of the lacustrine ecosystems be included in the bicarbonate-sulphurous-calcic-magnesian category. The values of the pH vary between 7.29 and 8.64 in accordance with the content of bicarbonates (414-695 mg/l).

The content of biogene elements represents a feature of the lacustrine ecosystems. The relatively high quantity of NO_3^- (18.5 mg/l) and PO_4^{3-} (7.9 mg/l) is due to the amount of nutrients resulted from the utilization of the mineral and organic fertilizers in the neighbouring agricultural fields.

The ions of Ca^{2+} and Mg^{2+} together with the bicarbonates and sulphates represent the main cause of the temporal and total hardness of the water (more than 30 German degrees). We mention that the water chemistry varies according to both the natural factors induced by springs and streams and to man-made factors, which mainly refer to the amounts of nutrients carried away by the rain water that wash the neighbouring agricultural fields sulphates (Cioboiu, 2014).

Features of the biocoenotic structures and functions. The geomorphologic, hydrological, and hydrochemical features represent important factors when it comes to determine the structures and functions of the plants and animals' populations characteristic to the lacustrine ecosystems (Cioboiu & Brezeanu, 2012).

The structure of the phytoplankton, periphyton and macrophites. The research made with regard to the structure of the phytoplankton led to the identification of 78 species belonging to the following taxonomic groups: Cyanophyceae, Euglenophyceae, Pyrrophyceae, Heterokontae, Bacillaryophyceae și Chlorophyceae (Tab. 1).

The highest number of species belongs to the groups Bacillaryophyceae and Chlorophyceae. The constant and most numerous species are: *Achnanthes minutissima* Kützing 1833, *Cyclotella chaetoceras* Lemmermann 1900, *Navicula cryptocephala* Kützing 1844, *Nitzschia recta* Hantzsch ex Rabenhorst 1862, *Nitzschia palea* (Kützing) W. Smith 1856, *Synedra acus* Kützing 1844 (as Diatomae), *Pediastrum simplex* Meyen 1829 and *Scenedesmus quadricauda* Chodat, 1926 (Chlorophyceae) and *Microcystis aeruginosa* Kützing 1846 (Cyanophyceae). The highest values of the numerical density and biomass belong

to the groups Bacillaryophyceae and Chlorophyceae (Nicolescu et al., 1999; Cioboiu, 2014).

Table 1 - The numerical density (ind./l) and the biomass (mg/l) on taxonomic groups of the phytoplankton (mean values).

Taxonomic groups	**Numerical density thousands of individuals/l**	**Biomass mg/l wet surface**
Cyanophyceae	76	0.335
Euglenophyceae	51	0.144
Pyrrophyceae	1	0.003
Heterokontae	7	0.045
Bacillaryophyceae	543.5	1,142
Chlorophyceae	394.5	0.841
TOTAL	1,073	2,510

A special part in the structure of the biocoenosis is played by the periphyton as there were identified 78 taxa (Tab. 2). In this case, as well, the highest number of species belongs to the same groups Bacillaryophyceae and Chlorophyceae.

Table 2 - The number of species belonging to the taxonomic groups of the periphyton.

Taxonomic groups	**Number of species**	**%**
Cyanophyceae	3	4.16
Euglenophyceae	2	2.77
Heterokontae	2	2.77
Bacillaryophyceae	47	65.27
Chlorophyceae	18	25.00

Besides the primary phytoplanktonic producers, the macrophites represent an important part of the biological production of the studied ecosystems. 20 up to 30 per cent of the surface of the basins is covered by paludous and aquatic macrophites. There were identified 34 species, among which we mention: *Phragmites australis* (Cav.) Steud., *Typha angustifolia* L., *Scirpus lacustris* L., *Mentha aquatica* L., *Carex riparia* Curtis, *Lemna minor* L., *Nuphar luteum* (L.) Sm., *Potamogeton crispus* L., *Potamogeton natans* L., *Myriophyllum spicatum* L. A global evaluation of the biomass production of the macrophites proved that there could be obtained 85,200 kg/h/year of wet biomass.

By taking into account the values of the numerical density and of the biomass of the phytoplankton, periphyton, and of the macrophites quantities, we consider that the studied lacustrine ecosystems belong to the eutrophic water category (Cioboiu, 2011).

The structure of the zooplankton. The qualitative and quantitative structure of the zooplankton entirely illustrates the eutrophic character of the basins. From the trophic relations point of view, the primary zooplanktonic

consumers (the phytoplankton eaters) are 7 times more numerous than the secondary consumers (carnivorous-predators).

There were identified 65 species belonging to the following taxonomic groups: Ciliata, Testacea, Rotifera, Cladocera, Copepoda; dominant species: *Vorticella convallaria* Linnaeus, 1758, *Arcella arenaria* Greeff, 1866, *Difflugia globulosa* (Dujardin, 1837), *Asplanchna priodonta* Gosse, 1850, *Brachionus angularis* Gosse, 1851, *Brachionus calyciflorus* Pallas, 1766, *Brachionus urceolaris* O. F. Müller, 1773, *Filinia longiseta* (Ehrenberg, 1834), *Euchlanis dilatata* Ehrenberg, 1832, *Keratella quadrata* Müller, 1786, *Synchaeta pectinate* Ehrenberg, 1832, *Bosmina longirostris* (O. F. Müller 1785), *Chydorus sphaericus* (O. F. Müller 1785), *Acanthocyclops vernalis* (Fischer, 1853), *Eucyclops serrulatus* (Fischer, 1851), *Mesocyclops crassus* (Fischer, 1853).

The total numerical density varies between 2.4 and 257.1 individuals/l (Tab. 3). The density of the biomass is relatively concordant with the dynamics of the numerical density (Parpală et al., 2002).

Table 3 - The numerical density (ind./l) and the biomass (µg/l) on taxonomic groups of the zooplankton (mean values).

Taxonomic group	Numerical density (ind./l)	Biomass (µ/l) wet surface
Ciliata	2.4	0.24
Testacea	16.6	9.54
Rotifera	257.1	121
Cladocera	13.04	170
Copepoda	156	689
TOTAL	445	991

It is worth mentioning that, even if, as compared to the Rotifers, the numerical density of the Cladocera and Copepoda is lower, these two groups highly contribute to the main production of the zooplanktonic biomass. There is registered the same situation as in the case of the numerical density, meaning that the primary consumers have the highest rate of the biomass (80 - 90 per cent).

The structure of the zoobenthos. There can be noticed three main types of facieses in the studied lacustrine ecosystems: sandy, muddy, and detritic. As they firstly depend on the nature of the facies, the benthonic biocoenosis are specific for the muddy facies (for most of the bottom of the basins), the pelophile biocoenosis also for the sandy facies, which are psamophile (on small surfaces). Between the two types of facieses there appear areas where they combine each other and the structure of the zoobenthos acquires a pelo-psamophilic character. Due to the diversity of the benthic biotope, the structure of the zoobenthos is represented by 13 large groups of invertebrates (Tab. 4).

A special character of this lacustrine complex is given by the areas with macrophytes. Here, the benthonic populations display high numerical densities and increased biomasses. The phytophile fauna is mainly dominated by the larvae of

Chironomidae, Coleoptera, Ephemeroptera, Heteroptera, Gastropoda (Cioboiu, 2002; Cioboiu, 2014).

Table 4 - The structure of the zoobenthos (mean values).

Taxonomic group	No. of individuals/sq. m	Abundance %	Frequency %
Chironomidae	2,746.5	38.35	100
Gamaridae	1,753	18.8	16.5
Ostracoda	353.5	8.65	66
Heteroptera	186.5	3.7	100
Gastropoda	293	5.35	66
Bivalvia	26.5	0.25	16.5
Cladocera	113.5	3.7	16.5
Copepoda	160	5.25	16.5
Efemeroptera	213.5	5.25	66
Plecoptera	226.5	7.45	16.5
Isopoda	53	1.45	49.5
Oligocheta	26.5	0.95	16.5
Hirudinea	20	0.85	33
TOTAL	6,172	100.0	

Another function of the lacustrine complex refers to the piscicultural capitalization. The basins are periodically populated with fish: *Cyprinus carpio* Linnaeus, 1758, *Carassius auratus gibelio* (Bloch, 1782), *Rutilus rutilus* (Linnaeus, 1758), *Abramis brama* (Linnaeus, 1758), *Pseudorasbora parva* (Temminck & Schlegel, 1846), *Perca fluviatilis* Linnaeus, 1758, *Sander lucioperca* (Linnaeus, 1758), *Lepomis gibbosus* (Linnaeus, 1758), *Alburnus alburnus* (Linnaeus, 1758) and sportive fishing is allowed (Cioboiu & Brezeanu, 2009).

CONCLUSIONS

The lacustrine complex Preajba Valley, located within a plain area in the hydrographical basin of the Jiu River, belongs to the category of wet areas.

The climatic, hydrological, geomorphologic, and biodiversity factors induce the lacustrine complex a ecological character special for the Oltenia Plain.

Taking into account that the lacustrine complex belongs to a hydrographical system located in the neighborhood of Craiova town, an important urban centre, it presents an increased tourist interest. This is why the local administration wants to ensure the proper conditions able to determine the development of the ecological functions, which mainly refers to the diversity of the ecosystemic structures and of biodiversity.

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