DETERMINANT ECOLOGICAL FACTORS TRIGGERING THE DISTRIBUTION OF GASTROPODS WITHIN THE LOWER BASIN OF THE DANUBE

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Abstract. The distribution of gastropods in inland water bodies is mainly determined by the zonality of the hydrographic network. 11 hydrological zones are defined within the territory of Romania, according to the altitude of the Carpathians. These influence and determine the character of the inland water bodies and, consequently, the distribution and diversity of gastropod populations. Under these circumstances, 107 species were identified within the lower basin of the Danube. The diversity of the ecosystems from this hydrographic basin imposes a specific structure and distribution of the gastropod populations: in the mountain torrents and streams – 14 species, in sub-mountain and hill sectors of the rivers – 6 species, in plain rivers – 2 species, in glacier lakes and alpine marshes – 1 species, in lakes from the hilly and the plain regions – 16 species, in salty and brackish lake ecosystems – 18 species, in the lower sector of the Danube from the Romanian territory – 83 species. The species *Theodoxus danubialis, Th.. fluviatilis, Viviparus acerosus, Esperiana esperi, Physa fontinalis, Physella (Costatella) acuta, Lymnaea stagnalis, Stagnicola palustris, S. corvus, Radix auricularia, R. balthica, Planorbis planorbis, Anisus spirorbis, A (Disculifer) vortex, Gyraulus albus, Planorbarius corneus* are ubiquist. The species *Viviparus contectus, Valvata (Cincina) piscinalis, V. (Tropidina) macrostoma, Bithynia (B.) tentaculata, Amphimelania holandri, Gyraulus (G.) acronicus* present a more limited distribution. Compared to the European malacofauna, the gastropods from the lower basin of the Danube represent 32 % of the total number of species, which highlights the importance of the Danubian – Carpathian space for the gastropod fauna. It is an updated list of the distribution of gastropods in the hydrographic network on the territory of Romania, which is a reference element for comparing the dynamics of the evolution of the distribution in conditions of anthropogenic impact on ecosystems. Water pollution is another factor that influences the structural characteristics of biocenoses in relation to the state of water quality and determines negative influences on the spread of gastropods in the hydrographic network.

Keywords: gastropods, biodiversity, Danube, Romania.

Rezumat. Factori ecologici determinanţi ai distribuţiei gasteropodelor în bazinul inferior al Dunării. Distribuţia gasteropodelor în apele continentale este determinată în primul rând de zonalitatea reţelei hidrografice. Pe teritoriul României sunt definite 11 zone hidrologice în raport cu factorii altitudinali ai Carpaţilor. Acestea influenţează şi determină caracterul apelor continentale şi în acest context distribuţia şi diversitatea populaţiilor de gasteropode. În aceste condiţii, în bazinul inferior al Dunării au fost identificate 107 specii. Diversitatea ecosistemelor din acest bazin imprimă o structură şi o repartiţie specifică populaţiilor de gasteropode: în torenţii şi pâraiele de munte – 14 specii, în sectoarele submontane şi de deal ale râurilor – 6 specii, în râurile de şes – 2 specii, în lacurile glaciare şi mlaştinile alpine – 1 specie, în lacurile colinare şi de câmpie – 16 specii, în ecosistemele lacustre sărate şi salmastre – 18 specii, în sectorul inferior al Dunării de pe teritoriul românesc – 83 specii. Speciile *Theodoxus danubialis, Th.. fluviatilis, Viviparus acerosus, Esperiana esperi, Physa fontinalis, Physella (Costatella) acuta, Lymnaea stagnalis, Stagnicola palustris, S. corvus, Radix auricularia, R. balthica, Planorbis planorbis, Anisus spirorbis, A (Disculifer) vortex, Gyraulus albus, Planorbarius corneus* sunt ubicviste. O răspândire mai limitată au speciile *Viviparus contectus, Valvata (Cincina) piscinalis, V. (Tropidina) macrostoma, Bithynia (B.) tentaculata, Amphimelania holandri, Gyraulus (G.) acronicus*. În raport cu malacofauna europeană, gasteropodele din bazinul inferior al Dunării reprezintă 32 % din numărul total de specii ceea ce reflectă importanţa spaţiului danubiano-carpatic pentru fauna de gasteropode. Este o listă actualizată a răspândirii gasteropodelor în rețeaua hidrografică de pe teritoriul României fapt ce constituie un element de referință pentru compararea dinamicii evoluției distribuției în condițiile impactului antropic asupra ecosistemelor. Poluarea apelor reprezintă un alt factor care influențează caracteristicile structurale ale biocenozelor în raport cu starea de calitate a apelor și determină influențe negative asupra răspândirii gasteropodelor în rețeaua hidrografică.

Cuvinte cheie: gasteropode, biodiversitate, Dunăre, România.

INTRODUCTION

The paper is a synthesis on the distribution of aquatic gastropods in the Romanian hydrographic network. The ecological framing of ecosystems is one of the decisive factors on which the distribution and location of aquatic gastropods depend (GROSSU, 1993). In the lower sector of the Danube basin, we find all types of ecosystems that represent areas for the distribution of gastropods. Springs, streams and mountain rivers, hilly and lowland sectors of the rivers, the Danube and the Delta, lakes, ponds and swamps are home to species characteristic of these ecosystems that determine their spread (BREZEANU et al., 2011).

Also, the distribution of gastropods in continental waters is determined primarily by the zonality of the hydrographic network. In this sense, 11 hydrological zones are defined on the Romanian territory in relation to the altitudinal factors of the Carpathians, which influence and determine the character of the continental waters. The hydrographic network, which includes 16 main rivers, is over 66,000 km long (BUŞNIŢĂ & BREZEANU, 1970; CIOBOIU, 2012; 2013; CIOBOIU et al., 2023).

The diversity of ecosystems in the hydrographic network (fast-flowing mountain and hill rivers, torrents, slow-flowing plain rivers and floodplains) imprints a structure and distribution specific to gastropod populations (Fig. 1).

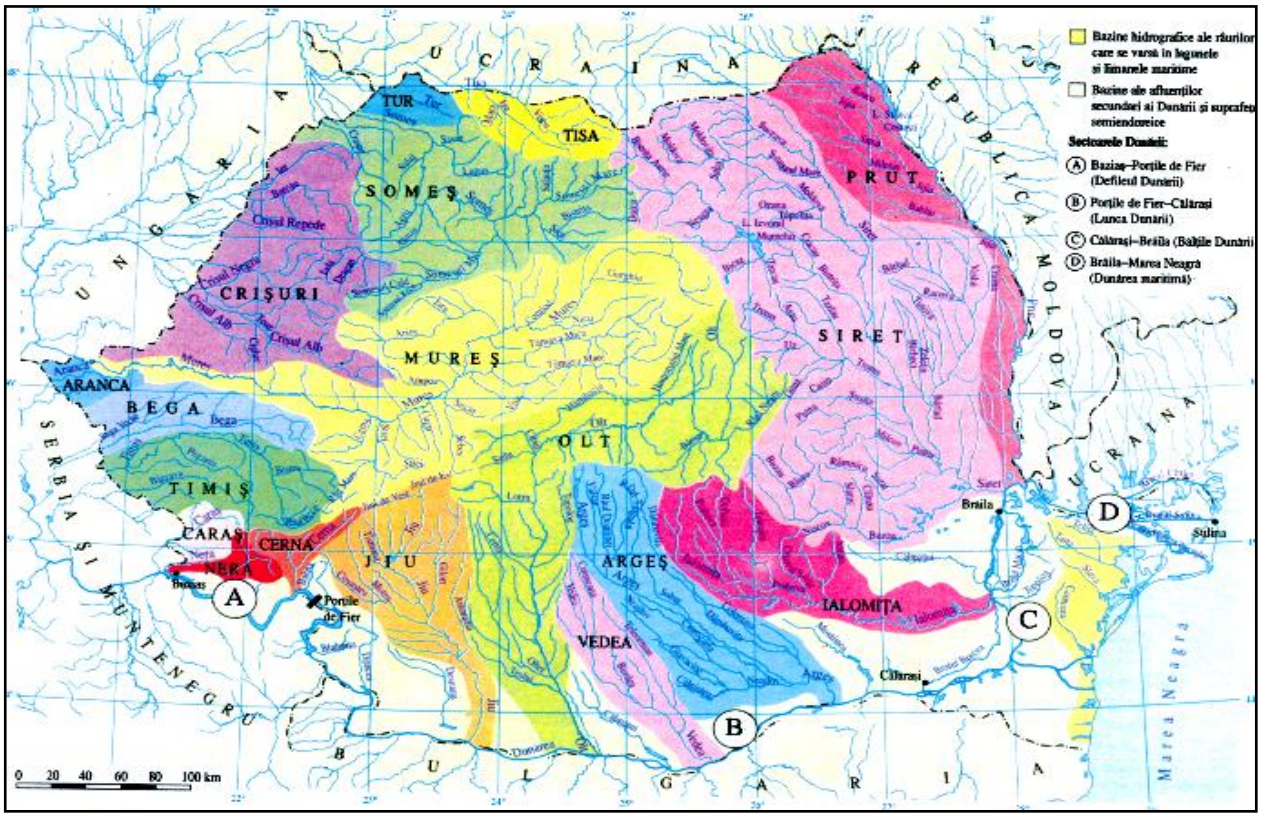

Figure 1. The hydrographic network of Romania (after BUȘNIȚĂ & BREZEANU, 1970).

It is an updated list of the distribution of gastropods in the hydrographic network on the territory of Romania, which is a reference element for comparing the dynamics of the evolution of the distribution in conditions of anthropogenic impact on ecosystems. Water pollution is another factor that influences the structural characteristics of biocenoses in relation to the state of water quality and determine negative influences on the spread of gastropods in the hydrographic network.

MATERIAL AND METHODS

According to the data rendered in the literature in the field (more than 150 studies published by different authors) and according to our own research, synthesis was made that allowed a global evaluation of the species from the lower basin of the Danube (ARDELEAN et al., 1964; BREZEANU & ENĂCEANU, 1969; FRANK, 1987; BOSCHE, 1990; GROSSU, 1993; CSANYI, 1996; CLANFANELLI & BODON, 2007; CIOBOIU, 2008, 2010; LIASHENKO et al., 2010; SÎRBU et al., 2010; BREZEANU et al., 2011; CUTTELOD et al., 2011; LIASHENKO & ZORINA-SAKHAROVA, 2012; CIOBOIU, 2013; KADLECIK, 2014; BOETERS et al., 2015; ZANFIR et al., 2019; CIOBOIU et al., 2019a, b; 2020; TEODOSIU-BELEUȚĂ et al., 2020; CIOBOIU et al., 2023; ***. Fauna Europaea, 2023).

RESULTS AND DISCUTIONS

According to Fauna Europaea version 2.6.2. (August 29, 2023) and the European Red List of Freshwater Molluscs (CUTTELOD et al., 2011), there are 107 species of gastropods in the lower basin of the Danube (Table 1), which covers the Romanian territory as well (CIOBOIU, 2014a; b; 2019a; b; 2020; 2023).

A synthetic analysis shows significant differences in the distribution of species in inland waters (GROSSU, 1987; 1993; CIOBOIU, 2003; 2008; 2010; 2012; 2013; GLOER & GEORGIEV, 2014; SCHNIEBS et al., 2019).

14 species are found **in the torrents and mountain streams**, among which the following are characteristic *Paladilhia (Paladilhiopsis) carpathica, Bythinella dacica, Amphimelania holandri, Ancylus fluviatilis*.

In the submontane and the hilly sectors of the rivers where the slope is lower and the current slows down, the riverbed is more stable, the bottom is soft, muddy or sandy, with deeper areas in some places. The water is clear and getting warmer. The vegetation of the water is more and more abundant. 6 species were identified, the most common being *Lithoglyphus apertus*.

In the plain area, waters flow very slowly, being influenced by the steppe climate of the plains. During the summer the waters drop a lot until dry, while in winter they freeze. The characteristic gastropods are: *Pseudamnicola dobrogica, Valvata (Borysthenia) naticina*.

In the glacier lakes and alpine swamps, the gastropod *Stagnicola palustris* f. *flavida* was accidentally found. **In the hilly and plain lakes**, which are invaded by submerse and floating vegetation, the most common species are: *Theodoxus danubialis, Radix balthica, Valvata (Cincina) piscinalis, Anisus (A.) spirorbis*.

Other species are found in **stagnant waters in lowland, hill and mountain areas**: *Radix auricularia, Gyraulus acronicus, Stagnicola corvus, S. turricula*.

Table 1. Distribution of Gastropoda within the lower basin of the Danube.

No.	Taxonomic composition	The upper Tisa	The Someş	The Crişuri	The Mureş	The Bega	The Timiş	The Caraş	The Nera	The Cerna	The Jiu	The Preajba	The Olt	The Vedea	The Argeş	The Ialomiţa	The Siret	The Prut	The Danube	Its flood plain, the Danube Delta	The ecosystem type characteristic for the species
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1.	*Theodoxus (Th..) danubialis*	+				+	+	+	+	+								+	+	+	rv, lk
2.	*Theodoxus (Th.) d. stragulatus*					+	+	+											+	+	rv, lk
3.	*Theodoxus (Th.) d. serratilinea*			+															+	+	rv, lk
4.	*Theodoxus (Th.) euxinus*																			+	lk
5.	*Theodoxus (Th.) fluviatilis*																	+	+	+	rv, lk
6.	*Theodoxus (Th.) pallasi*																		+	+	rv, lk
7.	*Theodoxus (Th.) prevostianus*			+															+	+	rv, lk
8.	*Theodoxus (Th.) transversalis*	+	+		+	+	+	+	+	+			+				+	+	+	+	ub
9.	*Viviparus acerosus*		+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	ub
10.	*Viviparus contectus*		+		+												+	+	+	+	rv, lk
11.	*Viviparus mamillatus*																		+	+	rv, lk
12.	*Viviparus viviparus*										+	+						+	+	+	rv, lk
13.	*Valvata (V.) cristata*	+				+	+	+	+	+			+				+	+	+	+	rv, lk
14.	*V. (Cincinna) studeri*					+	+	+	+	+									+		rv
15.	*V. (Cincinna) piscinalis*					+	+	+	+	+	+	+	+	+					+	+	ub
16.	*V. (Cincinna) p. antiqua*					+	+	+											+	+	rv, lk
17.	*Borysthenia naticina*	+																	+	+	rv, lk
18.	*Hydrobia acuta*																			+	br
19.	*Hydrobia ventrosa*																			+	br
20.	*Ventrosia stagnorum*																			+	br
21.	*Pseudamnicola (P.) bacescui*																			+	lk
22.	*Pseudamnicola (P.) dobrogica*																		+		rv
23.	*Pseudamnicola (P.) leontina*																			+	br
24.	*Pseudamnicola (P.) penchinati*																		+	+	rv, lk
25.	*Pseudamnicola (P.) razelmiana*																			+	br
26.	*Grossuana codreanui*																			+	rv
27.	*Heleobia dobrogica*																			+	br
28.	*Paladilhia (P.) carpathica*		+	+	+	+	+	+	+	+									+	+	ub
29.	*Paladilhia (P.) leruthi*				+	+	+	+													st
30.	*Paladilhia (P.) transsylvanica*		+	+	+	+	+	+													st
31.	*Bythinella calimanica*				+																rv
32.	*Bythinella a. melanostroma*					+	+	+	+	+											sp
33.	*Bythinella dacica*				+	+	+	+	+	+	+										sp
34.	*Bythinella grossui*	+																			rv
35.	*Bythinella molcsany*	+	+	+	+	+	+	+													sp
36.	*Bythinella viseuiana*	+	+																		rv
37.	*Bythinella radomanii*			+																	rv
38.	*Potamopyrgus antipodarum*							+	+	+									+		rv
39.	*Potamopyrgus jenkinsi*					+	+	+											+	+	rv, lk
40.	*Lithoglyphus apertus*	+												+		+			+	+	rv, lk
41.	*Lithoglyphus naticoides*				+	+	+	+	+	+			+						+	+	ub
42.	*Lithoglyphus pigmaeus*																		+		rv
43.	*Bithynia (B.) tentaculata*			+	+										+	+	+	+	+	+	ub
44.	*B. (Codiella) leachi*				+								+		+	+	+	+	+	+	rv, lk
45.	*B. (Codiella) troschelli*																		+	+	rv, lk
46.	*Turricaspia (Clessiniola) variabilis*																			+	br
47.	*T. (Laevicaspia) lincta*																			+	br
48.	*T. (Oxypyrgula) ismailensis*																			+	br
49.	*T. (Turricaspia) dimidiata*																		+	+	br
50.	*T. (Micromelania) ostroumovi*																			+	br
51.	*Micromelania (T.) spica*																			+	br
52.	*Caspia gmelinii*																			+	br
53.	*Esperiana esperi*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
54.	*E. (Microcolpia) daudebardii*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
55.	*E. (M.) daudebardii acicularis*		+	+	+	+	+	+	+	+	+	+								+	ub
56.	*Amphimelania holandri*					+	+	+	+	+											st, rv
57.	*Melanopsis parreyssi*			+																	lk

58.	*Cerithium vulgatum*																		+	br
59.	*Retusa ovoides*																		+	br
60.	*R. (Coleophysis) truncatulla*																		+	br
61.	*R. (C.) striatula*																		+	br
62.	*R. (C.) piriformis*																		+	br
63.	*Cylichnina strigella*																		+	br
64.	*Ovatella (Myosotella) myosotis*																		+	br
65.	*Physa fontinalis*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
66.	*Physella (Costatella) acuta*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
67.	*Aplexa hypnorum*				+				+	+	+	+					+	+		+	rv, lk
68.	*Lymnaea stagnalis*	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	ub
69.	*Stagnicola corvus*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
70.	*Stagnicola fuscus*																			+	lk
71.	*Stagnicola palustris*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
72.	*Stagnicola palustris* f. *flavida*																		+	+	rv, lk
73.	*Stagnicola p. transsylvanica*		+	+	+															+	lk
74.	*Stagnicola turricula*	+	+	+	+														+		rv
75.	*Radix ampla*					+	+	+	+					+	+				+		rv, lk
76.	*Radix auricularia*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
77.	*Radix balthica*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
78.	*Radix labiata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
79.	*Galba truncatula*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
80.	*Myxas glutinosa*																		+	+	rv, lk
81.	*Ancylus fluviatilis*					+	+	+	+	+	+		+						+		rv
82.	*Ancylus fluviatilis* f. *cornu*												+						+		st
83.	*Acroloxus lacustris*	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	ub
84.	*Ferrissia (Pettancylus) wautieri*			+		+	+	+	+	+									+	+	rv, lk
85.	*Planorbis (P.) carinatus*	+		+					+	+				+					+	+	rv, lk
86.	*Planorbis (P.) planorbis*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
87.	*Biomphalaria tenagophila*			+																	sp
88.	*Anisus (A.) calculiformis*					+	+			+									+		lk
89.	*Anisus (A.) leucostoma*									+	+										sp
90.	*Anisus (A.) septemgyratus*	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	ub
91.	*Anisus (A.) spirorbis*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
92.	*Anisus (Disculifer) vortex*	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	ub
93.	*Anisus (D.) vorticulus*			+															+	+	rv, lk
94.	*Bathyomphalus contortus*				+	+	+	+	+	+				+	+	+			+	+	rv, lk
95.	*Gyraulus (Armiger) crista*	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	ub
96.	*Gyraulus (G.) acronicus*					+	+	+	+	+							+	+	+		rv
97.	*Gyraulus (G.) albus*	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	ub
98.	*Gyraulus (G.) albidus*																			+	lk
99.	*Gyraulus (Torquis) laevis*					+	+	+	+	+			+				+			+	rv, lk
100.	*Gyraulus (Lamorbis) rossmaessleri*																			+	lk
101.	*Hippeutis complanatus*	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	ub
102.	*Segmentina nitida*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ub
103.	*Planorbarius corneus*	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	ub
104.	*Planorbella duryi*																			+	lk
105.	*Oxyloma (O.) dunkeri*		+												+	+				+	lk
106.	*Oxyloma (O.) elegans*	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	ub
107.	*Oxyloma (O.) pinteri*																		+	+	lk

Legend: br – brackish; lk – lake; rv – river; sp – spring; st – stream; ub – ubiquarian

The salty and brackish lacustrine ecosystems are populated with species adapted to these environments, as sarmatic relicts: *Hydrobia ventrosa*, *Clessiniola variabilis*, *Potamopyrgus jenkinsi*, *Cerithium vulgatum*. *Theodoxus euxinus, Valvata (B.) naticina, Hydrobia ventrosa, Pseudamnicola razelmiana, P. dobrogica, Clessiniola variabilis, Rissoa (Rissostomia) membranacea, Cerithium vulgatum, Retusa (C.) truncatulla*. These species have been found in both freshwaters and brackish ecosystems.

In the Romanian sector of the Danube, through the relation of the river with its floodplain zone and the influence of many tributaries, the diversity of gastropod populations is much higher, with 83 species being identified (MARINESCU P., 1992; CIOBOIU, 2006; OERTEL & NOSEK, 2006; ZIERITZ & WARINGER, 2006; GLOER & MEIER-BROOK, 2008; FALNIOWSKI et al., 2009; LIASHENKO et al., 2010; LIASHENKO & ZORINA-SAKHAROVA, 2012). The river is populated by both characteristic species of the eutrophic lacustrine ecosystems: *Theodoxus (Th.) danubialis stragulatus*, *Theodoxus (Th.) pallasi*, *Viviparus acerosus*, *Valvata (C.) piscinalis*, *Lymnaea stagnalis*, *Stagnicola corvus*, *Radix auricularia*, *Planorbis planorbis*, *Gyraulus (G.) acronicus*, and those that prefer the conditions of rheophilic ecosystems: *Lithoglyphus naticoides, L. pygmaeus, Esperiana (M.) daudebardii acicularis, Radix ampla*, *Segmentina nitida* (Fig. 2).

Figure 2. The floodplain of the Danube in the oltenian sector (original).

On the other hand, several species prefer sandy facies *Theodoxus (Th.) prevostianus*, *Turricaspia (Oxypyrgula) ismailensis*, *Radix balthica*, others on clayey facies *Lithoglyphus apertus*, *Galba truncatula*, and the stony areas are populated by the species *Bythinella austriaca*, *Amphimelania holandri*. Therefore, from what is reported, it results that the variable environmental factors of the Danube (water flow rate, substrate nature, trophic state) determine this distribution of gastropod populations (BUŞNIŢĂ & BREZEANU, 1970; NEGREA & MARINESCU P., 1992; NEGREA, 1994; TITTIZER et al., 1997; CIOBOIU & BREZEANU, 2000; OERTEL, 2000; CIOBOIU, 2008; IVANYI et al., 2012).

The Danube Delta, with an area of about 434,000 ha, is the final segment of the Danube; 70% of its surface is occupied by a great diversity of aquatic ecosystems: canals, lakes, swamps. To date, 45 species have been identified, of which the most common are: *Theodoxus (Th.) danubialis*, *Th. fluviatilis*, *Viviparus acerosus*, *Pseudamnicola (P.) dobrogica*, *P. leontina*, *P. razelmiana*, *Potamopyrgus antipodarum*, *Turricaspia (Laevicaspia) lincta*, *T. dimidiata*, *Physella (Costatella) acuta*, *Anisus (A.) spirorbis*, *Gyraulus (Torquis) laevis*, *Planorbarius corneus* (GROSSU 1993; CIOBOIU, 2010).

According to the ecological character of the rivers, the species *Lithoglyphus apertus*, *Radix ampla*, *R. balthica*, *Stagnicola palustris* are more characteristic to mountain and hilly rivers; *Amphimelania holandri*, *Ancylus fluviatilis* populate especially the mountain streams and torrents; *Theodoxus fluviatilis*, *Viviparus viviparus*, *Lithoglyphus naticoides*, *Esperiana esperi*, *E. (Microcolpia) daudebardii acicularis* are present in the rivers from plain regions.

A reduced number of species identified within the entire country, namely in all the rivers located in mountainous, hilly and plain areas, belong to the category of ubiquist species: *Theodoxus (Th.) transversalis*, *Viviparus acerosus*, *Esperiana esperi*, *Physa fontinalis*, *Physella (Costatella) acuta*, *Lymnaea stagnalis*, *Stagnicola palustris*, *S. corvus*, *S. turricula*, *Radix auricularia*, *R. balthica*, *R. lagotis*, *Galba truncatula*, *Acroloxus lacustris*, *Planorbis (P.) planorbis*, *Anisus (A.) spirorbis*, *A. leucostoma*, *A. (Disculifer) vortex*, *Gyraulus (G.) albus*, *G. (Armiger) crista*, *Hippeutis complanatus*, *Segmentina nitida*, *Planorbarius corneus*. The species *Viviparus contectus*, *Valvata (Cincinna) piscinalis*, *V. (Tropidina) macrostoma*, *Bithynia (B.) tentaculata*, *Amphimelania holandri*, *Gyraulus (G.) acronicus* present a more limited distribution (NEGREA, 1994; CIOBOIU, 2002; 2003; 2008; 2010; 2013; CIOBOIU & CISMAȘIU, 2018a).

Under the conditions of global climate change, the structure of gastropod populations will undergo significant changes: some species may become extinct, others may multiply beyond current limits. Thus, cryophilic and oxyphilic species, such as *Bythinella austriaca*, *B. cylindrica*, *Stagnicola palustris* f. *flavida*, lovers of clean waters, will limit their area or disappear. The ubiquitous species *Lymnaea stagnalis*, *Radix ampla*, *Planorbis planorbis*, *Planorbarius corneus*, which live in strongly eutrophic and polysaprobe waters, at high temperatures, will be frequent species in the conditions of changing hydrological characteristics and the water quality. As for the extension of brackish waters, the species *Theodoxus euxinus*, *Pseudamnicola razelmiana*, *Turricaspia (Laevicaspia) lincta*, *T. dimidiata* will widen their area and will be more frequent (CIOBOIU, 2010).

The ecological classification of gastropods in Romanian river basins shows that the most common are fluvio-lacustrine species - 41 and ubiquitous - 27, followed by rheophilic species - 17, brackish - 15 and cryophilic - 12 from springs and streams (Fig. 3).

Another factor that determines the spread of gastropods in the hydrographic network is the degree of water pollution. In relation to the state of water quality, three types of biocenotic structures are found in rivers: complex, simplified and degraded (BREZEANU & GRUIȚĂ, 2002; CIOBOIU C., 2003). In the river sectors where biocenotic structures are totally degraded due to pollution, gastropods have completely disappeared. This is the case of the Dâmbovița river downstream of the wastewater discharge of Bucharest and of the Argeș river downstream of the confluence with Dâmbovița, of some sectors of the rivers Prahova, Ialomița, Jiu, Olt, Trotuș (PRICOPE et al., 2003; CISMAȘIU et al. , 2016; CIOBOIU & CISMAȘIU, 2018b; GAVRILESCU et al., 2018; 2020).

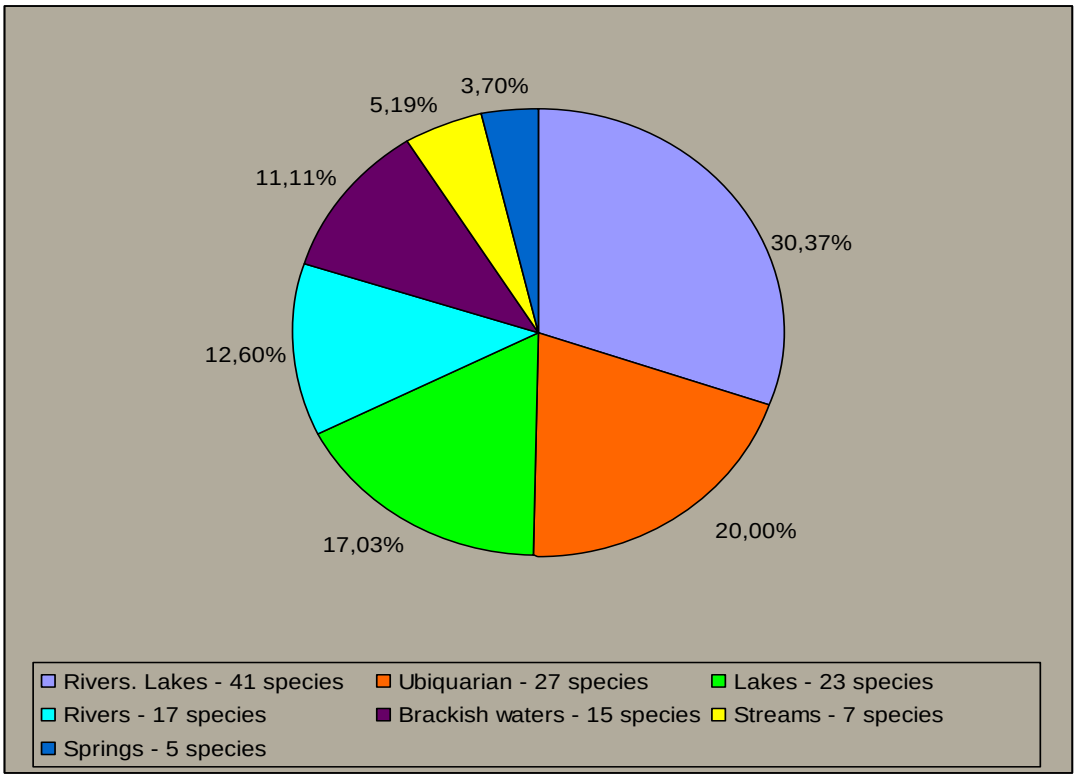

Figure 3. Distribution of gastropods by ecosystem type.

CONCLUSIONS

The performed synthesis can be a parameter for assessing the evolution, in perspective, of the spread of gastropod populations in the Danube basin (***. ICPDR; Fauna Europaea 2023). A range of ecological factors, including the zonality of the hydrographic network of the Romania, the diversity of ecosystems in the lower Danube basin, suggest a specific structure and distribution of gastropod populations, respectively of the 107 species, of which the most common are river-lake species - 41 and ubiquitous - 27, followed by rheophilic species - 17, brackish - 15 and cryophilic - 12 from springs and streams. Under the conditions of global climate change, the structure of gastropod populations will undergo significant changes: some species may become extinct, others may multiply beyond current limits. Water pollution is another factor that influences the structural characteristics of biocenoses in relation to the state of water quality and causes negative influences on the spread of gastropods in the hydrographic network.

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