

DOMINANT SPECIES OF THE GASTROPOD FAUNA FROM THE LITTORAL REGION IN LAKE OHRID OF R. MACEDONIA

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Abstract: The class of Gastropoda is one of the Lake Ohrid' macrozoobenthic groups, which characterize highest level of endemism. Since the first published references until now, studying the Lake Ohrid's snail fauna represents huge scientific challenge for many malacologists from the world. The high percent of endemic as well as relic forms among the lake's gastropods could be explained by the processes of intralacustric speciation during the history and evolution of this aquatic ecosystem. These processes no doubt have been enabled by the complexity and stability of the Lake's basin.

This work represents the results of the dominant species, from both qualitative and quantitative sense of the gastropod fauna from 19 investigated littoral localities of Lake Ohrid. The results from the investigations on gastropod fauna has shown that following species: *Chilopyrgula sturanyi*, *Radix relicta* and *Valvata stenotrema* qualitatively predominates in the samples from the littoral region of the Macedonian part of Lake Ohrid. The quantitative analyses (according to their presence on m⁻²), has shown that the following species predominate: *Chilopyrgula sturanyi* (6879 No·m⁻²), *Theodoxus fluviatilis dalmaticus* (6412 No·m⁻²), *Pyrgohydrobia grochmalickii* (5504 No·m⁻²) and *Valvata stenotrema* (5009 No·m⁻²).

Key words: dominant species, gastropod fauna, littoral, Lake Ohrid, R. Macedonia.

Introduction

The benthic region of Lake Ohrid can be divided in three zones: littoral, sublittoral and profundal. The littoral habitat of lakes usually supports larger

and more diverse populations of gastropod fauna than to the sublittoral and profundal habitats. The littoral habitat is also highly variable due to seasonal influences, riparian variation, and direct climatic effects producing high-energy areas [1]. The interest of studying the class Gastropoda from the littoral region in Lake Ohrid has been very big ever since. According to Hadzisce (1974), only in the littoral of Lake Ohrid there are 29 or 54.72% of gastropoda species [2].

The main subject in our investigations was to find dominant gastropoda species on different habitats and in different localities of the littoral part from the Lake Ohrid.

The investigations were focused on the littoral region on the Macedonian part of Lake Ohrid from St. Naum to Radožda on 19 different localities.

Material and methods

The material was collected during the summer 2002. Samples were taken with van-Veen grab, with surface of 225 cm² (15 × 15 cm). The researches were made according to the standard limnological methods [3, 4, 5].

The samples of gastropod species were collected from 19 different localities along the coast of the Lake: from the north-west region (Radožda) to the south-east region of the Lake (St. Naum). From each locality, there were collected samples of the littoral zone (0.5 m, 1 m, 2 m, 3 m, 5 m, 10 m, 15 m, 20 meters depth). In the laboratory conditions, the gastropod fauna was watched by binocular and determined using keys for determination of freshwater invertebrates: Polinski (1929) [6]; Snegarova (1954) [7]; Hubendick, B., & Radoman, P., (1959) [8]; Hubendick (1960) [9]; Hadzisce (1974) [2]; Radoman (1983) [10]; Kerovec (1986) [11]; Krunić *et al.*, (1999) [12]. Gastropod fauna was determined to the level of species.

Results and discussion

The results from our investigations have shown that the gastropod fauna from the littoral region in Lake Ohrid is very diverse and rich. In this way, twenty-eight different species are found. The qualitative composition of gastropod fauna, found on the mentioned littoral regions is presented in the following list. The sign "+" means that the species are present.

According to our list, we can notice, that qualitative composition of Gastropoda from the littoral part comprises 28 species that belong to both subclasses (Prosobranchia, Pulmonata). The richest is the qualitative composition of the subclass Prosobranchia with 18 taxa (from which 16 are endemic), and the poorest subclass Pulmonata, with 10 taxa (8 endemic). From attendant 28 spe-

cies, 24 or 85.71 % are endemic while the other 4 are cosmopolitan. According to Mackie (2001), pulmonates tend to be more tolerant than prosobranchs of enrichment because pulmonates can rise to the surface to obtain oxygen when the dissolved oxygen supply is depleted. The most of them originate by the process of intralacustric speciation many years ago, and still exist thanks to the complexity and stability of living conditions of the old lake ecosystem [13]. Radoman (1983) [10] found 37 littoral species in whole Lake Ohrid (in Macedonian and Albanian part) which belong to Hydrobioidea, a super family of Prosobranchia.

According to the values in the table, among the present taxa, *Pyrgohydrobia grochmalickii* characterizes highest density (5504 No·m⁻²) such as in Budzakoska&Trajanovski (2004) where there are registered 4751 No·m⁻². In quantitative sense, the most present are *Chilopyrgula sturanyi* and *Theodoxus fluvaiautilus dalmaticus*, with 6879 and 6412 No·m⁻².

Radix relicta characterizes highest frequency (it is only one species present in all 19 localities), and *Chilopyrgula sturanyi* was found in 18 localities (not present only in Ljubani { ta locality).

The following species: *Lychnidia had`ii* and *Gyuraulus paradoxus* are found only in locality Velidab (Table 1).

Table 1 – Табела 1

List of gastropoda species from the littoral region of Lake Ohrid (the Macedonian part)

Листа на gastropoda species од литоралниот регион на македонскиот дел од Охридското Езеро

SPECIES	LITTORAL REGION	Total ind·m ⁻²	ENDEMIC species
Subcl. PROSOBRANCHIA			
<i>Theodoxus fluvaiautilus dalmaticus</i>	+	<u>6412</u>	
<i>Viviparus viviparus</i>	+	308	
<i>Valvata stenotrema</i>	+	5009	+
<i>V. rhabdota</i>	+	178	+
<i>V. relicta</i>	+	89	+
<i>Xestopyrgula dybowskii</i>	+	178	+
<i>Chilopyrgula sturanyi</i>	+	<u>6879</u>	+
<i>Ohridopyrgula macedonica macedonica</i>	+	1813	+
<i>Macedopyrgula pavlovici</i>	+	88	+
<i>Macedopyrgula wagneri</i>	+	132	+
<i>Trachyochridia filocincta</i>	+	222	+
<i>Ginaia munda munda</i>	+	1994	+
<i>Pyrgohydrobia grochmalickii</i>	+	<u>5504</u>	+
<i>Polinskiola sturanyi</i>	+	3060	+

<i>Polinskiola polinskii</i>	+	44	+
<i>Lychmidia had`ii</i>	+	177	+
<i>Gocea ohridana</i>	+	133	+
<i>Neofossarulus stankovici</i>	+	178	+
Subcl. PULMONATA			
<i>Limnaea stagnalis</i>	+	44	
<i>Radix relicta</i>	+	3455	+
<i>Coretus corneus</i>	+	798	
<i>Gyraulus paradoxus</i>	+	89	+
<i>Carinogyraulus lychnidicus</i>	+	1065	+
<i>Carinogyraulus trapezoides</i>	+	532	+
<i>Gyraulus macedonicus</i>	+	1155	+
<i>Gyraulus albidus</i>	+	264	+
<i>Zaunia sanctizaumi</i>	+	88	+
<i>Ancylus lapicidus</i>	+	308	+

Table 2 – Табела 2

Quantitative composition of class Gastropoda from the littoral region in Lake Ohrid
Квантитативна композиција на класата Gastropoda од литоралниот
регион на Охридското Езеро

Region	Localities	Total No·m ⁻²	Number of species	Total No·m ⁻²	Middle value No·m ⁻²
Northwestern littoral region	Rado`da	754	5	6391	1598
	Livadi {te	1414	6		
	Kali {ta	1654	5		
	Struga	2596	5		
Northeast littoral region	St. Erazmo	531	4	5405	1081
	Daljan	841	5		
	Gra {nica	709	5		
	Kaneo	1728	6		
	Pristani {te	1596	5		
East littoral region	Metropol	2827	10	17230	3446
	Ele {ec	2653	8		
	Pe {tani	3417	9		
	Gradi {te	1018	6		
	Velidab	7315	12		
Southeast littoral region	Veljape {	486	6	14197	2839
	Trpejca	798	8		
	Zaum	1772	8		
	Ljubani {ta	6081	7		
	St. Naum	5060	12		
Total No·m ⁻²				43223	2241

Table 2 shows the different qualitative and quantitative composition on gastropod fauna from the littoral regions on Lake Ohrid.

Actually, the maximum number of species (12) of the gastropoda fauna are recorded on the localities Velidab and St. Naum. In the locality St. Erazmo, the qualitative composition was poorer compared with other localities.

The southeast littoral region characterizes highest biodiversity (19 species). The east littoral region, with 15 registered taxa takes second place about diversity, and northwestern littoral region, with 12 taxa, takes the last place, that is seen from Table 2.

East littoral region with middle value of $3446 \text{ No}\cdot\text{m}^{-2}$, northwestern with $1598 \text{ No}\cdot\text{m}^{-2}$, and lowest total middle density have southeastern littoral region with $2839 \text{ No}\cdot\text{m}^{-2}$.

These different qualitative composition, and density of Gastropoda (Table 2) can be explained with the different combination of complex water conditions that happens in investigated localities, especially on habitat where they live, where different gastropod species have special affinity, like taxa *Pyrgohydrobia grochmalickii* on sandy bottom to 5 meters depth. Rado`da locality, represents north-western watershed area where rocky dominates bottom facies. In locality Kališta has muddy community with well developed macrophytic vegetation. St. Naum is watershed point in southeastern littoral area which is found on beach near monastery St. Naum, where dominates sandy bottom. Habitat is important for quantitative and qualitative density of the fauna of Gastropoda.

There are typical taxa for various habitat that can be found rarely, or those who can be found in Lake ecosystem. So, taxa *Gyraulus paradoxus*, *Pyrgohydrobia grochmalickii* and *Gocea ochridana* are registered in the littoral region on research localities in Lake. First in Velidab locality; second in Daljan, Zaum, Ljubaništa; and the third just in locality Zaum.

Regarding the qualitative composition (Table 2), it is obvious that Velidab with $7315 \text{ No}\cdot\text{m}^{-2}$, represent the most populated locality. The locality Ljubaništa is on the second place with $6081 \text{ No}\cdot\text{m}^{-2}$, and the poorest density is registered in the locality Veljape {, $486 \text{ No}\cdot\text{m}^{-2}$.

Unfortunately, there are not published data about the dominant species of Gastropoda on the littoral region of Lake Ohrid. So, it is not possible to make a comparison from this aspect.

The following species: *Chilopyrgula sturanyi*, *Radix relictata* and *Valvata stenotrema* qualitatively predominates in the samples from the littoral region of the Macedonian part of Lake Ohrid. The quantitative analyses (according to their presence on m^{-2}), has shown that the following species predominate: *Chilopyrgula sturanyi* ($6879 \text{ No}\cdot\text{m}^{-2}$), *Theodoxus fluviatilis dalmaticus* (6412

No·m⁻²), *Pyrgohydrobia grochmalickii* (5504 No·m⁻²) and *Valvata stenotrema* (5009 No·m⁻²).

Conclusions

According to our results, the qualitative composition of the class Gastropoda from the littoral region on Lake Ohrid in R. Macedonia comprises 28 species. From 28 registered species, 24 belong to endemic and 4 to the group of cosmopolitan gastropoda fauna. This fact indicates that from qualitative aspect, the gastropodes' fauna on the littoral part of Lake Ohrid is richer with endemic species. Velidab with 7315 No·m⁻², represent the most populated locality.

Radix relictata characterizes highest frequency (it is only one species present in all 19 localities), and *Chilopyrgula sturanyi* was found in 18 localities (not present only in Ljubani { ta locality).

The following species: *Lychnidia had`ii* and *Gyraululus paradoxus* are found only in locality Velidab.

We can conclude that east littoral region is the most populated with middle value of 3446 No·m⁻².

The results from the investigations on gastropod fauna has shown that following species: *Chilopyrgula sturanyi*, *Radix relictata* and *Valvata stenotrema* qualitatively predominates in the samples from the littoral region of the Macedonian part of Lake Ohrid. The quantitative analyses (according to their presence on m⁻²), has shown that the following species predominate: *Chilopyrgula sturanyi* (6879 No·m⁻²), *Theodoxus fluviatilis dalmaticus* (6412 No·m⁻²), *Pyrgohydrobia grochmalickii* (5504 No·m⁻²) and *Valvata stenotrema* (5009 No·m⁻²).

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Резиме

ДОМИНАНТНИ ВИДОВИ ОД ГАСТРОПОДНАТА ФАУНА НА ЛИТОРАЛНИОТ РЕГИОН НА ОХРИДСКОТО ЕЗЕРО ВО Р. МАКЕДОНИЈА

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Класата Gastropoda е една од фаунистичките групи на охридските инвертебрати, кои демонстрираат висок степен на ендемизам. Проучувањето на охридските полжави претставува посебен интерес заради реликтни и ендемични форми кои се создадени по пат на интралакустрична специјација, која сè уште трае, благодарение на комплексните, меѓутоа стабилни животни услови во езерскиот екосистем.

Во овој труд се дадени доминантните таксони од гастроподната фауна од 19-те истражувани литорални локалитети од Охридското Езеро, во квалитативен и квантитативен поглед. Резултатите од нашите истражувања покажаа дека таксоните: *Chilopyrgula sturanyi*, *Radix relicta* и *Valvata stenotrema*,

квалитативно доминираат во пробите од литоралниот регион на Охридското Езеро во Р. Македонија. Квантитативните анализи на пробите покажаа дека доминираат следните таксони: *Chilopyrgula sturanyi* (6879 ind·m⁻²), *Theodoxus fluviatilis dalmaticus* (6412 ind·m⁻²), *Pyrgohydrobia grochmalickii* (5504 ind·m⁻²) и *Valvata stenotrema* (5009 ind·m⁻²).

Клучни зборови: доминантни видови, гастроподна фауна, литорал, Охридско Езеро.

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<i>Valvata stenotrema</i>	+	5009	+
<i>V. rhabdota</i>	+	178	+
<i>V. relictata</i>	+	89	+
<i>Xestopyrgula dybowskii</i>	+	178	+
<i>Chilopyrgula sturanyi</i>	+	<u>6879</u>	+
<i>Ohridopyrgula macedonica macedonica</i>	+	1813	+
<i>Macedopyrgula pavlovici</i>	+	88	+
<i>Macedopyrgula wagneri</i>	+	132	+
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<i>Ginaia munda munda</i>	+	1994	+
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Table 2. Quantitative composition of class Gastropoda from the littoral region in Lake Ohrid

Табела 2. Квантитативна композиција на класата Gastropoda од литоралниот регион на Охридско езеро.

Region	Localities	Total No·m ⁻²	Number of species	Total No·m ⁻²	Middle value No·m ⁻²
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	Daljan	841	5		
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	Kaneo	1728	6		
East littoral region	Pristani {te	1596	5	17230	3446
	Metropol	2827	10		
	Ele {ec	2653	8		
	Pe {tani	3417	9		
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Southeast littoral region	Velidab	7315	12	14197	2839
	Veljape {	486	6		
	Trpejca	798	8		
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St. Naum	5060	12			
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Клучни зборови: доминантни видови, гастроподна фауна, литорал, Охридско Езеро.

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