

## Distribution of the snail *Amphimelania holandrii* Pfeiffer, 1828 (Melanopsidae; Gastropoda) in Serbia in the 2009-2012 period

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### Abstract

The paper presents the results of the study on the distribution of the freshwater snail *Amphimelania holandrii* (C.Pfeiffer, 1828) in Serbia. During the investigations, *A. holandrii* was recorded at 71 sampling sites located at 48 rivers. According to our data, the species is widely distributed within the investigated area. It was found to be the dominant snail species in the Drina River and some smaller rivers, while in the Danube the species was found to be rare and situated in a short stretch. As a widely distributed and frequent taxa in running waters situated in the hilly regions of Serbia, the species is suitable to be used in water monitoring for a particular group of stream types. Thus, it is important to further investigate the environmental factors that influence the distribution of *A. holandrii* to get more reliable information in order to include this species more effectively in a system of assessment of ecological status in the country.

**Keywords:** *Amphimelania holandrii*, distribution, Serbia, field research

### Introduction

In this paper we present data of the most recent distribution (in the period 2009-2012) of *Amphimelania holandrii* (C.Pfeiffer, 1828), syn. *Holandriana holandrii* (C.Pfeiffer, 1828) (Mollusca: Gastropoda: Neotaeniglossa: Melanopsidae) in Serbia, as a contribution to the knowledge of this taxa and its more effective use in ecological status assessment. Extensive knowledge on aquatic biota is essential for proper water management, in particular for the design of effective monitoring, selection of endangered taxa and habitats and to propose efficacious programs of measures.

The freshwater snail, *A. holandrii*, usually has a yellowish shell, a height of 15 mm and a 9 mm width, sometimes with 3-4 color bands. The apex is pointed and the shell has 4-6 convex whorls. The aperture is higher than broad, the inside is brownish with a brownish parietal margin, the columella merges continuously into the rounded basal margin. The operculum is relatively small and rounded (Figure 1).

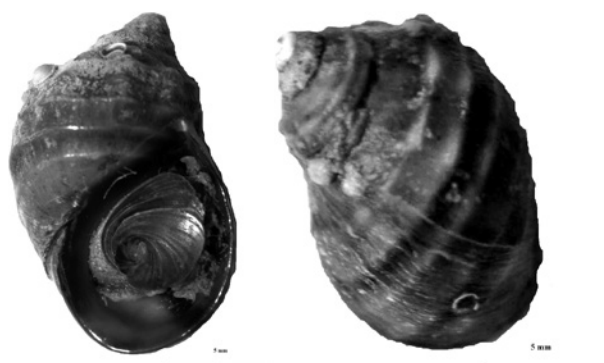


Figure 1: *Amphimelania holandrii* (C.Pfeiffer, 1828)

The snail is often found on hard substrates, such as rocks, stones and wood in rivers and lakes (Frank, 2000; Gloer, 2002). Although the major threats to the habitats come from pollution and siltation degrading habitat quality, this species is relatively resistant to pollution compared to other riverine species, and therefore suffers less from this threat than other taxa in the same habitat, based on IUCN criteria (Tomović et al, 2011). According to the AQEM database, this beta-mesosaprobic taxa is a good indicator of organic pollution (saprobic value 1.7; Moog, 2002). This snail is also a typical eopotamophil with relatively wide food preferences (grazer, shredder and gatherer).

Although not typically, *A. holandrii* can serve as an intermediate host for some parasitic trematodes (Kanev *et al.*, 1993). This species can also be used as a biomarker of oxidative stress in the environment (Vranković *et al.*, 2012).

The distribution range of *A. holandrii* covers South-Eastern Europe (Illyric province; Feher *et al.*, 2004), including the lower and the middle part of the Danube River Basin. In Hungary this species is protected, in Slovenia it is considered vulnerable (VU) while in South Austria it is extinct after habitat destruction. On the other hand, in the Balkans it is widespread, and because of this it has been assessed as Least Concern (LC) at the European level (Tomović *et al.*, 2011). The population trends for this species are unknown (Tomović *et al.*, 2011).

In Serbia according to the BAES database (Simić *et al.*, 2006) the first report dates from the late 19th century at the Danube River (Belgrade and Donji Milanovac). The Danube River remains its characteristic habitat throughout the 20th century (Simić *et al.*, 2006).

## Material and Methods

Macroinvertebrate samples were collected using a hand net (25x25 cm, 500 µm mesh size) at 105 sampling sites situated at 84 Serbian rivers in the period from 2009 to 2012. Sampling was performed twice per year, in the period summer/autumn within the Annual Water Quality Monitoring Program (Hydrometeorological Service of Serbia, Annual Water Quality Reports 2009 and 2010; Serbian Environmental Protection Agency, Annual Water Quality Reports 2011 and 2012) and investigations performed by the Institute for Biological Research "Siniša Stanković" in the 2010-2012 period. The multi-habitat sampling procedure (Hering *et al.*, 2004) and the AQEM protocol (AQEM, 2002) were applied. Samples were preserved using 70% ethanol solution and further processed in the laboratory. Identification was done by using appropriate keys (Gloer, 2002). Relative abundance of species was evaluated according to the scale given in Table 1. Average (annual) relative abundance and frequency of occurrence were calculated.

Table 1: Scale used for the relative abundance assessment

Relative abundance	Description	Number of individuals per sample
1	present	1
2	low abundance	2-5
3	moderate abundance	6-30
5	high abundance	31-60
7	very high abundance	61-100
9	mass present	>100

## Results and Discussion

During the investigations, *A. holandrii* was recorded in total at 71 sampling sites located at 48 rivers (Figure 2, Table 2). It was found to be a widely distributed species in running waters in the hilly regions of Serbia (south to the Danube). Based on our data, *A. holandrii* is a typical species for small to medium streams in Serbia situated at elevations below 500 m.

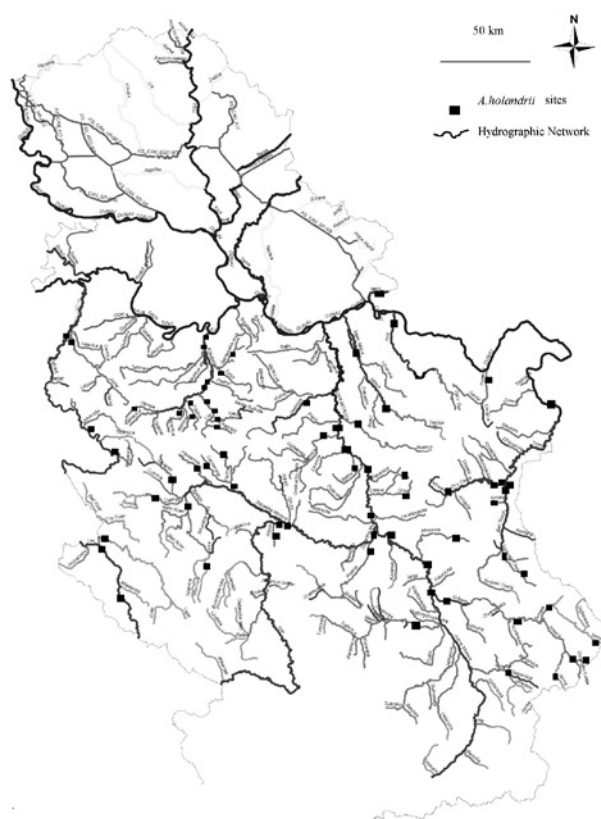


Figure 2: Distribution of *Amphimelania holandrii* (C.Pfeiffer, 1828) in Serbia in the 2009-2012 period.

Table 2: *Amphimelania holandrii* (C.Pfeiffer, 1828) in Serbia in the 2009-2012 period

No.	Sampling locality	River	Date of sampling	Relative abundance
1.	Brančić	Kačar	22 Apr 2009	2
2.	Brančić	Kačar	25 Aug 2010	7
3.	Gukoš	Dragobilj	25 Aug 2010	5
4.	Bogovađa	Ljig	24 Apr 2009	3
5.	Bogovađa	Ljig	22 June 2010	5
6.	Bogovađa	Ljig	10 June 2011	3
7.	Bogovađa	Ljig	07 June 2012	3
8.	Donji Lajkovac	Ljig	25 Aug 2010	7
9.	Markova Crkva	Toplica (Kolubarska)	22 Apr 2009	1
10.	Markova Crkva	Toplica (Kol.)	24 June 2010	7
11.	Markova Crkva	Toplica (Kol.)	28 Aug 2010	7
12.	Virovac	Toplica (Kol.)	24 June 2010	7
13.	Virovac	Toplica (Kol.)	28 Aug 2010	5
14.	Tabanović	Lepenica (Kol.)	24 Apr 2009	1

No.	Sampling locality	River	Date of sampling	Relative abundance	No.	Sampling locality	River	Date of sampling	Relative abundance
15.	Tabanović	Lepenica (Kol.)	28 Aug 2010	5	69.	Maskare	Zapadna Morava	20 Oct 2010	2
16.	Beljina	Beljanica (Barajevska Reka)	30 Aug 2010	1	70.	Grište	Belorečka Reka (Griška)	22 May 2009	3
17.	Veliki Crljeni	Turija	30 Aug 2010	3	71.	Sokobanja	Moravica (Sokobanja)	20 May 2009	3
18.	Veliki Crljeni	Turija	07 June 2012	3	72.	Čestobrodica	Grza	20 May 2009	2
19.	Majinović	Obnica	24 June 2010	1	73.	Strmosten	Resava	23 May 2009	1
20.	Majinović	Obnica	23 Aug 2010	5	74.	Svilajnac	Resava	29 Apr 2009	7
21.	Mislođin	Kolubara	26 May 2009	2	75.	Svilajnac	Resava	19 July 2010	7
22.	Draževac	Kolubara	26 May 2009	2	76.	Svilajnac	Resava	20 Sep 2010	9
23.	Draževac	Kolubara	30 Aug 2010	3	77.	Svilajnac	Resava	03 June 2011	9
24.	Beli Brod	Kolubara	21 Apr 2009	1	78.	Svilajnac	Resava	15 June 2012	5
25.	Beli Brod	Kolubara	10 June 2011	7	79.	Zabrega	Crnica	20 May 2009	3
26.	Beli Brod	Kolubara	07 June 2012	5	80.	Kusići	Pek	26 Sep 2012	2
27.	Čelije	Kolubara	19 Sep 2012	2	81.	Gornjak	Mlava	14 July 2010	5
28.	Lešnica	Jadar	17 Aug 2010	7	82.	Bratinac	Mlava	26 Sep 2012	3
29.	Lešnica	Jadar	28 June 2011	7	83.	Baranica	Trgoviški Timok	21 May 2009	3
30.	Lešnica	Jadar	17 Oct 2011	9	84.	Baranica	Trgoviški Timok	06 Aug 2010	7
31.	Lešnica	Jadar	25 July 2012	3	85.	Baranica	Trgoviški Timok	07 July 2011	3
32.	Bajina Bašta	Drina	18 Aug 2010	5	86.	Knjaževac	Trgoviški Timok	28 Sep 2012	5
33.	Bajina Bašta	Drina	02 Nov 2010	3	87.	Bogovina	Crni Timok	21 May 2009	3
34.	Bajina Bašta	Drina	29 June 2011	5	88.	Bogovina	Crni Timok	13 July 2010	3
35.	Ljubovija	Drina	18 Aug 2010	7	89.	Bogovina	Crni Timok	06 July 2011	9
36.	Ljubovija	Drina	29 June 2011	3	90.	Gamzigrad	Crni Timok	21 May 2009	1
37.	Ljubovija	Drina	18 Oct 2011	7	91.	Gamzigrad	Crni Timok	06 Aug 2010	5
38.	Jelav	Drina	17 Aug 2010	5	92.	Gamzigrad	Crni Timok	05 July 2011	5
39.	Jelav	Drina	17 Oct 2011	5	93.	Zaječar 1	Crni Timok	29 Sep 2012	2
40.	Priboj 1	Uvac	07 Oct 2011	7	94.	Zaječar 2	Beli Timok	21 May 2009	1
41.	Priboj 2	Lim	07 Oct 2011	5	95.	Zaječar 2	Beli Timok	06 Aug 2010	7
42.	Prijepolje	Lim	06 Oct 2011	9	96.	Zaječar 2	Beli Timok	07 July 2011	7
43.	Prijepolje	Lim	26 July 2012	3	97.	Zaječar 3	Beli Timok	29 Sep 2012	3
44.	Semedraž	Dičina	07 July 2010	3	98.	Krivi Do	Visočica	02 Aug 2010	2
45.	Semedraž	Dičina	17 June 2011	3	99.	Temska	Temštica	02 Aug 2010	3
46.	Rogot	Lepenica (V.Morava)	30 Apr 2009	1	100.	Mrtvine	Gaberska Reka	02 Aug 2010	7
47.	Rogot	Lepenica (V.Morava)	20 July 2010	3	101.	Mrtvine	Gaberska Reka	21 Sep 2011	5
48.	Orašje	Jasenica	19 July 2010	3	102.	Mrtvine	Gaberska Reka	26 June 2012	2
49.	Orašje	Jasenica	20 Sep 2010	3	103.	Trnsko Odorovce	Jerma	06 Aug 2010	2
50.	Orašje	Jasenica	03 June 2011	3	104.	Manastirište	Vlasina	04 Aug 2010	9
51.	Jagodina	Belica	02 June 2011	3	105.	Dimitrovgrad	Nišava	02 Aug 2010	7
52.	Rošci	Kamenica	11 May 2009	3	106.	Dimitrovgrad	Nišava	21 Sep 2011	5
53.	Rošci	Kamenica	07 July 2010	7	107.	Dimitrovgrad	Nišava	26 June 2012	3
54.	Rošci	Kamenica	13 July 2011	9	108.	Bela Palanka	Nišava	02 Aug 2010	7
55.	Gornja Gorevnica	Čemernica	11 May 2009	5	109.	Bela Palanka	Nišava	19 Sep 2011	7
56.	Gornja Gorevnica	Čemernica	07 July 2010	3	110.	Niš	Nišava	20 May 2009	3
57.	Preļjina	Čemernica	13 June 2011	2	111.	Prokuplje	Toplica (J.Morava)	07 Sep 2011	2
58.	Požega	Skrpež	08 Sep 2010	2	112.	Bivolje	Rasina	10 Aug 2010	1
59.	Požega	Skrpež	19 June 2012	3	113.	Korvingrad	Južna Morava	29 May 2012	2
60.	Šengolj	Đetinja	13 Sep 2011	2	114.	Mojsinje	Južna Morava	11 Aug 2010	5
61.	Bedina Varoš	Moravica (Golijaska)	12 July 2011	3	115.	Aleksinac	Južna Morava	11 Aug 2010	5
62.	Ariļje	Veliki Rzav	12 May 2009	3	116.	Aleksinac	Južna Morava	25 June 2011	3
63.	Ariļje	Veliki Rzav	12 July 2011	9	117.	Varvarin	Velika Morava	14 July 2010	2
64.	Ribnica	Ribnica	18 May 2009	2	118.	Varvarin	Velika Morava	17 Aug 2010	2
65.	Ribnica	Ribnica	09 July 2010	3	119.	Varvarin	Velika Morava	19 Oct 2010	5
66.	Kraljevo	Ibar	18 June 2011	3	120.	Varvarin	Velika Morava	16 Nov 2010	9
67.	Kraljevo	Zapadna Morava	13 Sep 2011	2	121.	Varvarin	Velika Morava	14 Apr 2010	3
68.	Kraljevo	Zapadna Morava	18 June 2012	1					

No.	Sampling locality	River	Date of sampling	Relative abundance
122.	Varvarin	Velika Morava	20 Sep 2010	2
123.	Čuprija	Velika Morava	17 Aug 2010	1
124.	Čuprija	Velika Morava	16 Nov 2010	3
125.	Markovac	Velika Morava	17 Aug 2010	1
126.	Markovac	Velika Morava	19 Oct 2010	1
127.	Markovac	Velika Morava	16 Nov 2010	1
128.	Markovac	Velika Morava	13 Apr 2010	1
129.	Bagrdan	Velika Morava	13 Apr 2010	1
130.	Bagrdan	Velika Morava	14 July 2010	3
131.	Bagrdan	Velika Morava	17 Aug 2010	2
132.	Bagrdan	Velika Morava	14 June 2012	3
133.	Bagrdan	Velika Morava	29 Sep 2012	3
134.	Kusić	Nera	11 July 2012	3
135.	Kusić	Nera	18 Sep 2012	3
136.	Mosna	Porečka Reka	08 July 2011	1
137.	Radujevac	Dunav	26 Sep 2011	3

In the lowland part of the country (Vojvodina), *A. holandrii* was only found in the Nera River (site Kusić) in Southeastern Banat. In the Danube River it is only recorded at one locality - Radujevac, the Iron Gate stretch.

With regard to species relative abundance, *A. holandrii* was found to be the dominant snail species in small to medium size rivers with domination of hard bottom substrate (gravel and stones of different size), most of them belonging to Type 3 according to Serbian national typology (small to medium streams, altitude to 500 m, with domination of large fractions of substrate) (Official Gazette, 74/2011) – localities/rivers: Brančić/Kačer, Donji Lajkovac/Ljig, Markova Crkva/Toplica (Kolubarska), Virovac/Toplica (Kolubarska), Beli Brod/Kolubara, Lešnica/Jadar, Prijepolje/Lim, Ljubovija/Drina, Rošci/Kamenica, Arilje/Veliki Rzav, Svilajnac/Resava, Baranica/Trgoviški Timok, Bogovina/Crni Timok, Zaječar 2/Beli Timok, Manastirište/Vlasina and Bela Palanka/Nišava.

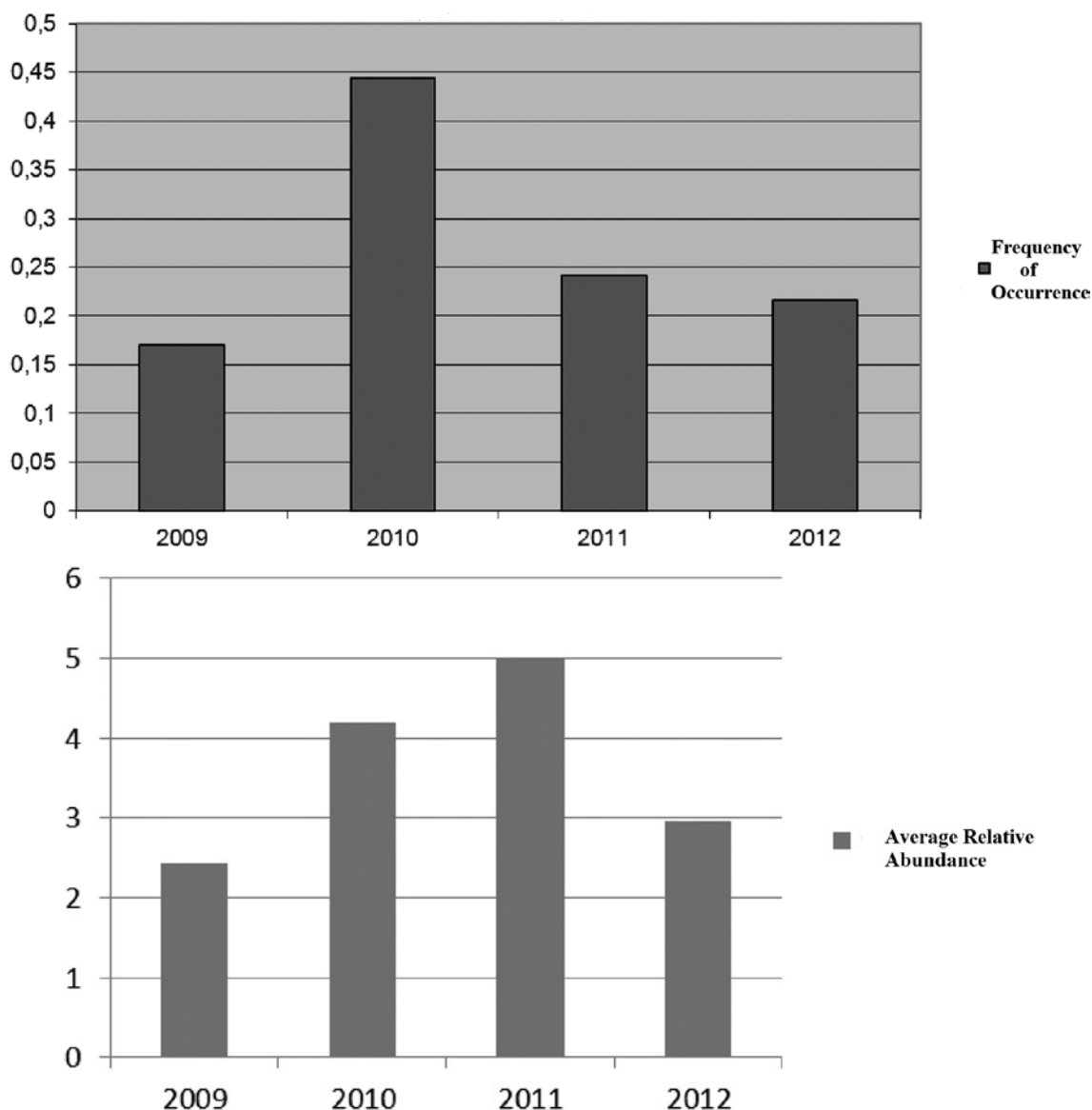


Figure 3: Average annual frequencies and relative abundances of *A. holandrii* in Serbia

The highest overall frequency and relative abundance of the species was noted in 2010 and 2011, while the lowest was registered in 2009 (as shown in Figure 3).

The limited distribution in the Serbian stretch of the Danube River, that was confirmed by previous investigations as well (recorded in the Iron Gate sector only - Graf *et al.*, 2008, Tubić *et al.*, 2013) which could be due to the absence of available substrate, but could also be due to pollution, deterioration of shallow water habitats, where this species predominantly occurs and increased biotic pressures (biological invasions) in this prominent invasive corridor. Thus smaller rivers could act as a refugium, as is the case with some other groups, for example, native gammarids (Grabowski *et al.*, 2009).

As the species is characterized as a good indicator of organic pollution (Moog, 2002) and based on the distribution pattern (species found to be characteristic for hilly streams belonging to Type 3 based on Serbian national typology - Official Gazette, 74/2011) *A. holandrii* is suitable to be used as an indicator organism in water monitoring for a particular group of stream types.

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