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HYDROMALACOLOGICAL RESEARCHES IN THE SIVERSKYI DONETS RIVER BASIN (SOUTH OF THE EASTERN EUROPEAN PLAIN): A REVIEW

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An analytical review of literature sources is presented, it contains information about the freshwater malacofauna of the basin of the Siverskyi Donets River, the right, largest tributary of the Don River, south of the East European Plain. A scheme of conditional subdivision of hydromalacological studies into three historical periods is proposed. The characteristics of the contribution of each of the researchers to the study of the hydromalacological fauna of the region is given. A list of all species of freshwater mollusks found in the region over a 190-year period of research (1832–2022) is provided. The identification of the names of mollusks recorded in the historical literature for the mollusks of the Siverskyi Donets River Basin is given. The ways and methods of the current research of the hydromalacological fauna of the region are characterized.

The entire history of the Siverskyi Donets River Basin freshwater mollusks study can be conventionally divided into three periods. During the first period (the 1830s–1920s), information about the presence of 42 species of gastropods and 14 species of bivalve mollusks in the Siverskyi Donets River Basin was published for the first time. One species new to science was described. In the second period (the 1920s–1950s), the regional malacofauna was replenished with five new species, and the total list had already reached 61 species. Between the 1950s and 1970s was the time of a big break in the history of the study of the regional malacofauna. The third period spans from the 1970s to the present time. This is the period of study of the composition and structure of the malacocenoses in the middle and upper part of the basin.

Keywords: Siverskyi Donets, mollusks, hydromalacological fauna, Krynicki, Lindholm, Rozen



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INTRODUCTION

The Siverskyi Donets River Basin (SDRB, hereinafter) is a vast region located in the south of the East European Plain (**Fig. 1**). Its area is about 100 thousand sq. km. The main river, Siverskyi Donets, has a length of more than 1000 km. It originates in the Central Russian Upland in Belgorod region, Russia. Source coordinates: 51°00'N, 36°59'E, located at an altitude of about



Fig. 1. The Siverskyi Donets River Basin (high-lighted in gray) is located in the south of the Eastern European Plain

200 meters a.s.l. It is the fourth largest river in Ukraine. It flows through the territory of its three eastern regions – Kharkiv, Donetsk and Luhansk. The length of the river within the borders of Ukraine is 723 km. The current speed is 0.15-1.41 meters/second. It is the largest right tributary of the Don River that flows into it in Rostov region, Russia. The average annual flow of water at the confluence is 200 cubic meters/second. There are more than 3,000 rivers in the SDRB, 425 of which are over 10 km long, and 11 rivers are over 100 km long. More than 1,000 rivers flow directly into the Siverskyi Donets (Antimonov, 1959; Bliznyak, Ovchinnikov & Bykov, 1945; Native land..., 1999; Vishnevsky, 2003).

The SDRB has a history of research of freshwater mollusks for about 190 years. Very few papers have been published during this period. However, they are of great historical importance. Many of them are unique scientific and monumental literary papers, but no one has carried out a deep critical analysis of this significant scientific heritage yet. In connection with the start of more intensive work on the revision of the hydromalacological fauna of the SDRB at a more up-to-date, molecular level it has become necessary to update the entire scientific malacological base, which was laid down by previous studies. This will make it possible to link historical data with the present and give wider access to further scientific research on the SDRB hydromalacological fauna.

The entire history of the SDRB freshwater mollusks study can be conventionally divided into three periods.

The first period – the 1830s–1920s, the time of theoretical substantiation of the composition of the SDRB hydromalacological fauna and the accumulation of primary experimental data. During this period, the main papers are those by professors of Kharkiv University, who at various times held the position of Head of the Zoological Museum Room. Publications on bivalve mollusks are also very interesting. Several species new

to the regional hydromalacological fauna were noted, attempts to organize the freshwater malacofauna of the former Kharkiv province were made. Representatives of Russian zoological science made their contribution to the study of the SDRB malacofauna. Most of these papers contain information about freshwater mollusks only in the upper reaches of the Siverskyi Donets and Oskil rivers within at present Kharkiv and Belgorod regions.

The second period is the 1920s–1950s, the period of more intensive work on the study of the SDRB malacofauna. Thanks to the organization of the Donets River Biological Station of the Society of Nature Testers at Kharkiv University, research on the composition of the SDRB fauna, including mollusks, was significantly expanded. Employees of other scientific institutions of the region and other biological stations also contributed to the study of the SDRB mollusks.

Between the 1950s and 1970s, no notable papers on the SDRB mollusks were published, this time is a big break in the history of the study of the SDRB malacofauna.

The third period spans from the 1970s to the present time. This is the period of study of the composition and structure of the malacocenoses in the middle part of the SDRB and additional information on the composition of the hydromalacological fauna in the upper part of the basin. During this period, materials concerning that part of the basin, which is located within Donetsk region were published. Representatives of educational institutions from non-SDRB region of Ukraine (Zhytomyr city) and from Russia (Belgorod city) as well as employees of museums of natural history from Kyiv and Lviv cities made their contribution to the study of the SDRB hydromalacological fauna.

1. THE 1ST PERIOD (the 1830s–1920s)

The scientific study of the SDRB mollusks was started by Professor of Kharkiv Imperial University Ivan Andreevich Krynicki's (1797–1838) articles (**Fig. 2**). In 1832, he made a detailed description of one of the most common (at that time) species of mollusks in the Kharkiv province – *Viviparus contectus* (Millet, 1813) – and proposed a scheme for describing mollusks that would be found in the future (Krynicki, 1832).

In the annotated list of mollusks of Eastern Europe and Western Asia, I. Krynicki lists 69 freshwaters “species” (Krynicki, 1837) (**Fig. 3**). The malacological collection of the author, gathered both by him personally and through exchange with colleagues, was the basis of the list. In this list, for the first time, 23 species of gastropods and 11 species of bivalves which can be identified according to the World Register of Marine Species (WoRMS, hereinafter) (World Register..., 2021), were discovered for the SDRB. Some of the species were indicated by I. Krynicki for regions that are outside the boundaries of the SDRB, but later they were also found there. A number of “species”, such as “*Planorbis placentula* m.”, “*Lymnaea delicatula* Andr.”, “*Lymnaea pumila* m.”, “*Paludina elevata* m.”, including those described by I. Krynicki, cannot currently be identified, since the author did not provide their descriptions or drawings. The report by I. Krynicki about the habitation of *Dreissena polymorpha* (Pallas, 1771) in



Fig. 2. Professor of Kharkiv Imperial University I. A. Krynicki

the former Kharkiv province, apparently, did not refer to the SDRB rivers, since it was not confirmed by any of the researchers who studied the hydromalacological fauna in the described region for 150 years. Probably, referring to this species, I. Krynicky had in mind the rivers of the Dnipro basin, part of the region of which was included in the former Kharkiv province.

CONCHYLIA			
TAM TERRESTRIA, QUAM FLUVIATILIA ET E MARIBUS ADJACENTIBUS IMPERII ROSSICI INDIGENA, QUÆ PRO MUTUA OFFERUNTUR HISTORIÆ NATURALIS CULTORIBUS COMMUTATIONE			
A. J. KRYNICKI			
PROFESSORE CÆSARÆ UNIVERSITATIS CHARKOVIENSIS.			
ANIMALIA MOLLUSCA			
1. GASTEROPODA.			
A.) TERRESTRIA.			
	GEN. 1 VITRINA. DRAP.	Loc. nat.	R. C.
1	{ Pellucida. Fer.	(a)	20
	{ Beryllina. Pf.		
	2. SUCCINEA. DRAP.		
2	Amphibia Drp.		
	{ <i>α. Putris.</i> Sturm.	Ch.	20
	{ <i>β. Amphibia</i> Brard.	id.	20
	{ <i>γ. Lutescens.</i> m.	Polt.	25
	{ <i>δ. Succinoides.</i> m.	Taur.	30
	{ <i>ε. Taurica.</i> m.		
(a) Locum natale talium non est indicatum, quæ magnum Rossicæ spatium occupant.			
Obs. Desiderantibus varias habere species, sed propria carentibus ad commutandum collectione, offeruntur illæ pro indicato valore, quo notatas asterisco ipse auctor lubenter accipiet.			

Fig. 3. Title of the I. A. Krynicky's publication, 1837

Yu. Siemaschko reviewed the mollusk fauna of the European and West Siberian part of the Russian Empire (Siemaschko, 1847). The paper was based on the materials of the already mentioned article by I. Krynicki and several other outstanding publications on mollusks that existed at that time. In total, the author lists 60 “species” of freshwater mollusks in this paper, but for the SDRB it (according to the WoRMS) lists only 18 species of gastropods and eight species of bivalves. A number of species are given by Yu. Siemaschko for regions outside the SDRB, but they either had already been found by I. Krynickyi in previous studies, or would be subsequently found in the SDRB by subsequent researchers.

In the publications of P. Stepanov (1870) and I. Ryabinin (1886, 1889) the fauna of bivalve mollusks of the SDRB is considered, including those from the still existing Banne Lake in the town of Svyatohirsk, Donetsk region. They cite four valid species and 21 forms of bivalve mollusks, of which, according to the WoRMS, all six species of unionids inherent in the SDRB can be identified, and the species *Pseudanodonta complanata* (Rossmässler, 1835) is cited for the first time for the basin.

G. Radkevich left a small, but very informative note about water mollusks of the former Kharkiv and Poltava provinces, in which he noted 31 “species” of freshwater gastropods and 14+ forms of bivalve mollusks (Radkevich, 1879). However, it is quite difficult to establish which species were collected in which basin – in the rivers of the SDRB or in the rivers of the Dnipro basin. In the list according to the WoRMS, 29 species of gastropods and 10 species of bivalve (without the genus *Pisidium*) mollusks are specified. Thanks to this paper, the list of the SDRB hydromalacological fauna was replenished with nine new species. However, those species as a *Omphiscola glabra* (O. F. Müller, 1774) and *Lithoglyphus fuscus* (C. Pfeiffer, 1828), cited by H. Radkevich, are probably erroneously indicated, since they are not confirmed in the SDRB by any of the researchers.

The paper of the senior zoologist of the Zoological Museum in St. Petersburg V. A. Lindholm was the most outstanding in faunistic terms during this period (Lindholm, 1901) (**Fig. 4**). The author very carefully outlined information about the composition of the mollusk fauna of the Oskil River near Novyi Oskil town and Golubyne village within the former Kursk province (now Belgorod region, Russia). In it, the author cites 44 species and varieties of freshwater mollusks, of which 27 species of gastropods and 10 species of bivalve mollusks can be identified according to the WoRMS. The author cited five new species for the SDRB for the first time. He also described a new form of River Nerite – *Neritina fluviatilis* (L.) var. *sarmatica* nov. (as well as its variety – forma *atra*), which according to the WoRMS is considered a valid species – *Theodoxus sarmaticus* (Lindholm, 1901). One species, *Gyraulus stromi* (Westerlund, 1881), noted by V. Lindholm, was probably erroneously indicated.

The papers of Otto von Rozen provide information on the “slugs” of Kharkiv and its immediate surroundings – a total of 24 species and varieties of freshwater mollusks, of which at present (according to the WoRMS) 17 species of gastropods and five species of bivalve mollusks can be identified (Rozen, 1901; Rozen, 1903).

The detailed paper of P. Beletsky is the result of his long-term observations of many water bodies in Kharkiv province from 1911 to 1917. In it, the author lists 56 species and varieties, of which 40 species of gastropods can be identified according to the WoRMS (Beletsky, 1918). For the first time, the author lists six new species for the SDRB.

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Andere die Gesellschaft angehende **Mittheilungen**, Reklamationen, Beitrittserklärungen u. s. w. gehen an den Präsidenten: Herrn **D. F. Heynemann** in Frankfurt a. M. — Sachsenhausen.

Mittheilungen aus dem Gebiete der Malakozoologie.

Beiträge zur Kenntniss der Weichthierfauna Süd-Russlands.

Von

Wilh. A. Lindholm, Wiesbaden.

I. Verzeichniss der Mollusken von Nowyi Oskol (Gouvernement Kursk.)

Im Nachfolgenden gebe ich das Verzeichniss der von mir in der Umgebung von Nowyi Oskol in den Jahren 1897 und 1898 beobachteten und gesammelten Land- und Süßwassermollusken. — Nowyi Oskol ist der südöstliche Kreis („Ujesd“) des Gouvernements Kursk und grenzt nach

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Fig. 4. Title of W. A. Lindholm's publication, 1901

Most of the species found during this period of research are listed under old names that are not currently used, and their species identification is rather difficult. **Table 1** contains the current names of mollusks, which correspond to their author's spelling.

Data on the species composition of the SDRB freshwater mollusks found by various researchers, who worked there from the 1830s to the 1920s, are presented in **Table 2**.

Table 1. The current names of some species of mollusks that correspond to their author's spelling (1830–1920s)

No	Names of mollusk's according to WoRMS	Names of mollusk's according to author's spelling	Authors
1	<i>Ampullaceana ampla</i> (W. Hartmann, 1821)	<i>Limnaea ovata</i> , var. <i>patula</i> , Dacosta (= <i>L. ampullacea</i> Kuster)	Beletsky, 1918
2	<i>Ampullaceana balthica</i> (Linnaeus, 1758)	<i>Lymnaea ovata</i> Lm.	Krynicky, 1837
		<i>Lymnaeus ovatus</i> Drap.	Siemaschko, 1847
		<i>Limnaea limosa</i> L.	Radkevich, 1878
		<i>Gulnaria ovata</i> (Drap.)	Lindholm, 1901
		<i>Limnaea ovata</i> , Drap., typ	Beletsry, 1918
3	<i>Ampullaceana lagotis</i> (Schrank, 1803)	<i>Lymnaea rustica</i> Andr. (= <i>L. meridionalis</i> Andr.)	Krynicky, 1837
4	<i>Anisus leucostoma</i> (Millet, 1813)	<i>Planorbis rotundatus</i> Poir.	Radkevich, 1878
5	<i>Anodonta anatina</i> (Linnaeus, 1758)	<i>Anodonta intermedia</i> Lm.	Krynicky, 1837
		<i>Anodonta piscinalis</i> Nilss.	Radkevich, 1878 Ryabinin, 1886; 1889 Lindholm, 1901
		<i>Anodonta ponderosa</i> Pfeiff.	Radkevich, 1878 Ryabinin, 1886; 1889
		<i>Anodonta rostrata</i> Kok.	Ryabinin, 1886; 1889
6	<i>Anodonta cygnea</i> (Linnaeus, 1758)	<i>Anodonta cellensis</i> Pf. <i>Anodonta ventricosa</i> Pf.	Krynicky, 1837
		<i>Anodonta cellensis</i> Schröt. (= <i>A. sulcata</i> Nills.)	Siemaschko, 1847
		<i>Anodonta cellensis</i> Schröt.	Stepanov, 1870 Radkevich, 1878
		<i>Anodonta cellensis</i> Schröt. var. <i>ventricosa</i> Pf.	Ryabinin, 1886; 1889
		<i>Anodonta sulcata</i> (Lam.), Nilss. (<i>A. cellensis</i> Auct.)	Lindholm, 1901
		<i>Anodonta fragilissima</i> Cl. <i>Anodonta gallica</i> Bgt.	Rozen, 1901; Rozen, 1903
7	<i>Bithynia tentaculata</i> (Linnaeus, 1758)	<i>Paludina impura</i> Lm. (= <i>P. elongata</i> Parr.)	Krynicky, 1837
8	<i>Bithynia transsilvanica</i> (Bielz, 1853)	<i>Bythinia leachi</i> (Shepp.) var. <i>troscheli</i> Paasch.	Lindholm, 1901
		<i>Bythinia leachi</i> , Shepp. var. <i>inflata</i> , Hansen <i>Bythinia leachi</i> , Shepp. morpha (forma) <i>major</i> nov.(?)	Beletsky, 1918
		<i>Bithynia leachi</i> Shepp. var. <i>troscheli</i> Paasch.	Rozen, 1901; Rozen, 1903
9	<i>Euglesa casertana</i> (Poli, 1791)	<i>Pisidium fontinale</i> Pf.	Krynicky, 1837
		<i>Cyclas fontinalis</i> Drap.	Siemaschko, 1847
		<i>Pisidium (Fossarina) fontinale</i> C. Pfr.	Lindholm, 1901
10	<i>Gyraulus albus</i> (O.F. Müller, 1774)	<i>Planorbis hispidus</i> Drp.	Krynicky, 1837

End of the Table 1

11	<i>Gyraulus crista</i> (Linnaeus, 1758)	<i>Planorbis nautilus</i> L.	Radkevich, 1878
12	<i>Gyraulus laevis</i> (Alder, 1838)	<i>Planorbis (Gyraulus) glaber</i> Jeffr.	Lindholm, 1901
		<i>Planorbis glaber</i> , Jeffreys	Beletsky, 1918
13	<i>Hippeutis complanatus</i> (Linnaeus, 1758)	<i>Planorbis fontanus</i> Lightf.	Radkevich, 1878
		<i>Planorbis (Hippeutis) fontanus</i> Lighf.	Lindholm, 1901
		<i>Planorbis fontanus</i> , Lightfoot	Beletsky, 1918
14	<i>Lymnaea fragilis</i> (Linnaeus, 1758)	<i>Limnaea stagnalis</i> , var. <i>charpentieri</i> Cless. (= var. <i>fragilis</i> L.)	Beletsky, 1918
15	<i>Pisidium amnicum</i> (O. F. Müller, 1774)	<i>Pisidium obliquum</i> Lm.	Krynicky, 1837
		<i>Cyclas obliqua</i> Lmk. (= <i>C. palustris</i> Drap., <i>Pisidium obliquum</i> Pfeiff.)	Siemaschko, 1847
16	<i>Planorbarius corneus</i> (Linnaeus, 1758)	<i>Planorbis (Coretus) elophilus</i> Bgt. var. <i>ammonoceras</i> Westerl.	Lindholm, 1901
17	<i>Planorbis planorbis</i> (Linnaeus, 1758)	<i>Planorbis marginatus</i> Drp.	Krynicky, 1837 Radkevich, 1878
		<i>Planorbis (Tropidiscus) umbilicatus</i> Müll. typ <i>Planorbis (Tropidiscus) umbilicatus</i> Müll. forma <i>submarginata</i> Jan.	Lindholm, 1901
		<i>Planorbis marginatus</i> Drp. var. <i>submarginatus</i> Jan.	Rozen, 1901; Rozen, 1903
18	<i>Radix auricularia</i> (Linnaeus, 1758)	<i>Lymnaea vulgaris</i> Pf.	Krynicky, 1837
19	<i>Segmentina nitida</i> (O. F. Müller, 1774)	<i>Planorbis clessini</i> , Westerlund	Beletsky, 1918
20	<i>Stagnicola callomphala</i> (Servain, 1882)	<i>Limnaea palustris</i> , Müll. var. <i>transsylvanica</i> , Kim.	Beletsky, 1918
21	<i>Unio crassus</i> Philipsson, 1788	<i>Unio steveniana</i> m. (= <i>U. batava</i> ? Nilss.)	Krynicky, 1837
		<i>Unio ater</i> Nilss.	
		<i>Unio ater</i> Nilss. var. <i>consentaneus</i> Zieg.	Ryabinin, 1886; 1889
		<i>Unio batavus</i> Lam.	
		<i>Unio batavus</i> Lam. var. <i>carinthiacus</i> Zieg.	Ryabinin, 1886; 1889
		<i>Unio consentaneus</i> Ziegl.	Radkevich, 1878
		<i>Unio ater</i> Nilss.	Lindholm, 1901
		<i>Unio ater</i> Nils. var. <i>intermedia</i> Rossm.	Rozen, 1901; Rozen, 1903
22	<i>Unio pictorum</i> (Linnaeus, 1758)	<i>Unio limosus</i> Nils. var. <i>maltzani</i> Kstr.	Rozen, 1901; Rozen, 1903
23	<i>Viviparus contectus</i> (Millet, 1813)	<i>Paludina vivipara</i> Lm. (= <i>P. anatina</i> Parr.)	Krynicky, 1832
		<i>Paludina vivipara</i> L.	Siemaschko, 1847
		<i>Paludina (Vivipara) vera</i> Frauenf.	Rozen, 1901; Rozen, 1903
24	<i>Viviparus viviparus</i> (Linnaeus, 1758)	<i>Paludina achatina</i> Lm. (= <i>P. fluviatilis</i> m.)	Krynicky, 1837
		<i>Paludina fasciata</i> Müll.	Radkevich, 1878
		<i>Paludina duboisiana</i> Mss. var. <i>concosa</i> Westl.	Lindholm, 1901
		<i>Paludina duboisiana</i> , Mss. var. <i>okaënsis</i> , Clessin	Beletsky, 1918

Table 2. Taxonomic composition of the hydromalacological fauna of the Siverskyi Donets River Basin according to the results of scientific research since the 1830s to present time (I–III periods) by literary sources

	# in orders	# in families	1st period (1830–1920s)				2d period (1920–1950s)			3rd period (1950–2020s)				
			4	5	6	7	8	9	10	11	12	13	14	
			Authors											
			Family / Species of mollusks ^A											
	1	2	3	Krynickyi, 1832; Krynicki, 1837 ^B ; Siemaszko, 1847	Stepanov, 1870; Ryabinin, 1886, 1889; Radkevich, 1878	Lindholm, 1901; Rozen, 1901; Rozen, 1903	Beletsky, 1918	Zhadin, 1929; Fadev, 1929	Booth, 1940; Solodovnikov, 1940	Popova, 1950	Zatravkin, 1980; Timoshenko, Yaroshenko, 1991; Timoshenko, 1992	Mandrygina, Segin, 2005	IF ZSU ^C 2000-2012	SMNH(L) ^D 2009-2018
Family Planorbidae Rafinesque, 1815														
1	1	1	X ¹	X	X	X	X	X	X	X	X	X	X	X
–	–	–	–	–	–	–	–	–	–	–	X?	–	X?	–
–	–	–	–	–	–	–	–	–	–	–	–	X?	–	–
2	2	2	–	–	–	–	–	–	–	–	X	–	–	–
3	3	3	X	X	X	X	X	X	X	X	X	X	X	X
4	4	4	X	X	X	X	X	X	X	X	X	–	X	X
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
5	5	5	x	X	X	X	X	X	X	–	–	–	X	X
6	6	6	X	X	X	X	X	X	X	X	X	–	X	X
7	7	7	–	–	X	X	X	X	X	X	X ^{3,4}	–	X	X
8	8	8	X	X	X	X	X	X	X	X	X	X	X	X
9	9	9	–	X	X	X	X	X	X	–	X ^{3,4}	X	X	X
10	10	10	–	–	–	–	–	X	X	–	X ^{3,4}	X	–	–

Continued Table 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14
11	11	<i>Bathomphalus contortus</i> (Linnaeus, 1758)	X	X	X	X	X	X	X	X	-	X	X
12	12	<i>Gyraulus albus</i> (O. F. Müller, 1774)	X	X	X	X	X	X	-	X	-	X	-
13	13	<i>Gyraulus laevis</i> (Alder, 1838)	-	X	X	X	-	-	-	X	-	X	-
-	-	<i>Gyraulus stromi</i> (Westerlund, 1881)**	-	-	X?	-	-	-	-	-	-	-	-
14	14	<i>Gyraulus rosmaessleri</i> (Auerwald, 1852)	-	-	-	-	-	-	-	X	-	X	X
15	15	<i>Gyraulus acronicus</i> (J. B. Férussac, 1807)	-	-	-	-	-	-	-	-	-	X	X
16	16	<i>Gyraulus riparius</i> (Westerlund, 1865)	-	-	-	-	-	-	-	-	-	X	-
17	17	<i>Gyraulus crista</i> (Linnaeus, 1758)	-	X	X	X	X	X	-	-	-	X	X
Family Physidae Fitzinger, 1833													
18	1	<i>Physa fontinalis</i> (Linnaeus, 1758)	X	X	X	X	X	X	X	X	X	X	X
19	2	<i>Physella acuta</i> (Draparnaud, 1805)	-	X	-	X	X	-	-	X	-	X	X
20	3	<i>Aplexa hypnorum</i> (Linnaeus, 1758)	x	X	X	X	-	-	-	X ^{4,5}	-	-	X
Family Lymnaeidae Rafinesque, 1815													
21	1	<i>Lymnaea stagnalis</i> (Linnaeus, 1758)	X	X	X	X	X	X	X	X	X	X	X
22	2	<i>Lymnaea fragilis</i> (Linnaeus, 1758)	-	-	-	X	-	-	-	X	X	-	-
23	3	<i>Stagnicola palustris</i> (O. F. Müller, 1774)	X	X	X	X	X	-	X	X	X	-	X
24	4	<i>Stagnicola fuscus</i> (C. Pfeiffer, 1821)	X	-	X	X	-	-	-	X ⁶	-	-	-
25	5	<i>Stagnicola corvus</i> (Gmelin, 1791)	-	-	-	X	-	-	-	X ^{4,7}	-	X	X
26	6	<i>Stagnicola turricula</i> (Held, 1836)	-	-	-	X	X	-	-	X	X	-	-
27	7	<i>Stagnicola callomphala</i> (Servain, 1882)	-	-	-	X	-	-	-	X	X	-	-
-	-	<i>Ladislavella terebra</i> (Westerlund, 1885)**	-	-	-	-	-	-	-	X?	-	-	-
-	-	<i>Omphiscola glabra</i> (O. F. Müller, 1774)**	-	X?	-	-	-	-	-	-	-	-	-
28	8	<i>Galba truncatula</i> (O. F. Müller, 1774)	x	X	X	X	X	X	X	X	X	-	X
29	9	<i>Radix auricularia</i> (Linnaeus, 1758)	X	X	X	X	X	X	X	X	X	X	X
30	10	<i>Ampullaceana bathica</i> (Linnaeus, 1758)	X	X	X	X	X	X	X	X	X	X	X
31	11	<i>Ampullaceana ampla</i> (W. Hartmann, 1821)	-	-	-	X	-	-	-	X	X	X	-
32	12	<i>Ampullaceana lagotis</i> (Schrank, 1803)	X	-	-	X	X	-	-	X	-	-	-
33	13	<i>Ampullaceana fontinalis</i> (S. Studer, 1820)	-	-	-	X	-	-	-	X	X	X	-

Continued Table 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14
34	14	<i>Peregriana peregra</i> (O. F. Müller, 1774)	X	X	-	X	X	-	-	X	-	-	-
Family Acroloxidae Thiele, 1931													
35	1	<i>Acroloxus lacustris</i> (Linnaeus, 1758)	X	X	X	X	X	X	-	X	-	-	-
Family Valvatidae Gray, 1840													
36	1	<i>Valvata piscinalis</i> (O. F. Müller, 1774)	X	X	X	X	X	X	X	X	X	-	X
-	-	<i>Valvata depressa</i> C. Pfeiffer, 1821*	X?	-	-	X?	X?	-	-	X?	X?	-	-
37	2	<i>Valvata cristata</i> O. F. Müller, 1774	X	X	-	X	-	-	-	X	-	-	-
38	3	<i>Valvata macrostoma</i> Mörch, 1864	-	-	X	-	-	-	-	-	-	-	-
39	4	<i>Valvata antiqua</i> Morris, 1838	-	-	X	-	X	-	-	X	-	-	-
40	5	<i>Valvata ambigua</i> Westerlund, 1873	-	-	-	-	-	-	-	X	-	-	-
Family Viviparidae Gray, 1847													
41	1	<i>Viviparus confectus</i> (Millet, 1813)	X	X	X	X	-	X	X	X	X	-	X
42	2	<i>Viviparus viviparus</i> (Linnaeus, 1758)	X	X	X	X	X	X	X	X	X	-	X
Family Bithyniidae Gray, 1857													
43	1	<i>Bithynia tentaculata</i> (Linnaeus, 1758)	X	X	X	X	X	X	X	X	X	-	X
44	2	<i>Bithynia leachii</i> (Sheppard, 1823)	-	X	-	X	X	X	X	X	X	-	X
45	3	<i>Bithynia transsilvanica</i> (Bielz, 1853)	-	-	X	X	X	-	-	X	-	-	-
Family Lithoglyphidae Tryon, 1866													
46	1	<i>Lithoglyphus naticoides</i> (C. Pfeiffer, 1828)	X	X	X	X	X	-	-	X	X	-	-
-	-	<i>Lithoglyphus fuscus</i> (C. Pfeiffer, 1828)**	-	X?	-	-	-	-	-	-	-	-	-
Family Neritidae Rafinesque, 1815													
47	1	<i>Theodoxus fluviatilis</i> (Linnaeus, 1758)	X	X	X	X	X	X	-	X	X	-	X
48	2	<i>Theodoxus sarmaticus</i> (Lindholm, 1901)	-	-	X ²	X	-	-	-	-	-	-	-
Family Dreissenidae Gray, 1840													
49	1	<i>Dreissena polymorpha</i> (Pallas, 1771)	X***	-	-	-	-	-	-	X	X	X	X
50	2	<i>Dreissena bugensis</i> Andrusov, 1897	-	-	-	-	-	-	-	-	X	X	X
Family Unioniidae Rafinesque, 1820													
51	1	<i>Anodonta cygnea</i> (Linnaeus, 1758)	X	X	X	-	X	X	-	X	X	X	-

End of the Table 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14
52	<i>Anodonta anatina</i> (Linnaeus, 1758)		X	X	X	-	X	-	-	X	X	X	X
53	<i>Pseudanodonta complanata</i> (Rossmässler, 1835)		-	X	X	-	-	-	-	X	X	X	X
54	<i>Unio crassus</i> Philipsson, 1788		X	X	X	-	X	-	-	X	X	X	X
55	<i>Unio pictorum</i> (Linnaeus, 1758)		X	X	X	-	X	X	-	X	X	X	X
56	<i>Unio tumidus</i> Philipsson, 1788		X	X	X	-	X	X	-	X	X	X	X
XII	Family Sphaeriidae Deshayes, 1855 (1820)												
57	<i>Sphaerium rivicola</i> (Lamarck, 1818)		X	X	X	-	X	X	-	X	X	-	-
58	<i>Sphaerium corneum</i> (Linnaeus, 1758)		X	X	-	-	X	X	-	X	X	-	-
59	<i>Sphaerium solidum</i> (Normand, 1844)		-	X	X	-	-	-	-	X	-	-	-
60	<i>Musculium lacustre</i> (O. F. Müller, 1774)		X	X	X	-	X	X	-	X	-	-	X
61	<i>Pisidium amnicum</i> (O. F. Müller, 1774)		X	-	X	-	X	-	-	X	-	-	-
62	<i>Pisidium obtusale</i> (Lamarck, 1818)		X	-	-	-	X	-	-	X	-	-	-
63	<i>Pisidium supinum</i> A. Schmidt, 1851		-	-	X	-	X	-	-	X	-	-	-
64	<i>Pisidium nitidum</i> Jenyns, 1832		-	-	-	-	X	-	-	X	-	-	-
65	<i>Pisidium nitidum tenuilineatum</i> (Stelfox, 1918)		-	-	-	-	X	-	-	X	-	-	-
66	<i>Euglesa casertana</i> (Poli, 1791)		X	-	X	-	-	-	-	-	X	-	-
67	<i>Euglesa henslowana</i> (Sheppard, 1825)		-	-	-	-	X	-	-	X	-	-	-
68	<i>Euglesa subtruncata</i> (Malm, 1855)		-	-	-	-	X	-	-	X	-	-	X
69	<i>Euglesa ponderosa</i> (Stelfox, 1918)		-	-	-	-	-	-	-	X	-	-	-

Comment: A – according to the current taxonomy (WoRMS); B – the link is given in the list of sources; C – publications of representatives of Ivan Franko Zhytomyr State University (in some cases together with employees of other scientific and educational institutions): O. Garbar, 2000; D. Garbar, O. Garbar, 2003 (families Planorbidae, Lymnaeidae); Uvaeva, 2005a; Uvaeva, 2005b; 2006; 2007; Uvaeva, Pavlyuchenko, Gural, 2007; Uvaeva, Gural, 2008 (family Planorbidae); Leichenko, 2009; Garlinska, 2012 (subfamily Physinae); Janovich, Pampura, 2010 (family Dreissenidae); Melnichenko, 1999; Janovich, Pampura, 2011; (family Unionidae); D – publications of employees of the State Museum of Natural History Lviv (in some cases together with employees of other scientific and educational institutions): Gural-Sverlova, Gural, 2009; 2012; Gural-Sverlova, V. Martynov, A. Martynov, 2012; Gural, Gural-Sverlova, 2018; X – species found outside the BRSD; x – species found outside the BRSD; X? – problem species; * – the status of the species is not definitively clarified (taxon inquirendum); ** – possible error in definition; *** – erroneous message about finding the species in the SDRB; 1 (green background) – the species first mentioned in the SDRB; 2 (blue background) – a species described as new to science; 3 – species given on the basis of the publication: Fadeev, 1929; 4 – species given on the basis of the publication: Zhadin, 1929; 5 – species given on the basis of the publication: Radkevich, 1878; 6 – species given on the basis of the publication: Rozen, 1901; Rozen, 1903; 7 – species given on the basis of the publication: Beletsky, 1918

2. THE 2ND PERIOD (the 1920s–1950s)

In the 1920s–1950s, a number of publications appeared containing information on mollusks in the upper reaches of the Siverskyi Donets River, mostly within at present Kharkiv region.

An employee (at that time) of the Okska Biological Station (Murom town, now Riazan region, Russia) V. Zhadin reviewed the collection gathered under the leadership of M. Fadeev. It consisted of regular periodical samplings in the Siverskyi Donets River and its tributaries – the Udy, Lopan and Oskil rivers – in 1917–1925 within Kharkiv region (Zhadin, 1929). Data about 55 species and varieties of freshwater mollusks are published in the paper. According to the WoRMS, 30 species of gastropods and 15 species of bivalves are valid. Thanks to these studies, the hydromalacological fauna of the SDRB has been enriched by another five species.

Employees of the Donets River Biological Station of the Society of Nature Testers at Kharkiv University carried out extensive studies of the fauna at the Siverskyi Donets River from Vovchansk town to Lysychansk town, as well as floodplain oxbow lakes. M. Fadeev compiled a list of all animal species of the Siverskyi Donets River (Fadeev, 1929), including mollusks, based on the collection identified by V. Zhadin. In it, the author cites 31 species that represent the Gastropoda class and 11 species of Bivalvia (according to the WoRMS). M. Fadeev also published material, in which the unlikelihood of the habitat of *Dreissena polymorpha* (Pallas, 1771) in the SDRB (Fadeev, 1923) was stated, as reported in the review by I. Krynicki (1837).

In the 1930s, V. Booth and S. Solodovnikov carried out a thorough study of the benthos and fauna of overgrown biocenoses of aquatic vegetation of various types in some floodplain oxbow lakes located in the vicinity of the Donets River Biological Station (now Zmiiv district of the Kharkiv region). Twenty-one species of gastropods and six+ species of bivalves have been recorded (Booth, 1940; Solodovnikov, 1940).

An employee of the Ukrainian Research Institute of Experimental Veterinary Medicine (Kharkiv) S. Popova conducted research on the fauna of mollusks of Izyum district in Kharkiv region in connection with their role in the development cycle of a number of species of parasitic worms. She noted 19 species and varieties of gastropods, of which 18 species of gastropods can be identified according to the WoRMS (Popova, 1950).

3. THE 3RD PERIOD (FROM THE 1970s TO THE PRESENT)

Information about mollusks in the Donetsk region, Ukraine, appeared only in the 1980s. In the summer of 1972, an employee of the Moscow Regional Pedagogical Institute M. Zatravkin conducted research on the species composition of mollusks in the area of the Siverskyi Donets River in the Donetsk region (from the borders of Kharkiv region to Luhansk region) and the lower reaches of the Kazennyi Torets River – from Sloviansk town to the river mouth (Zatravkin, 1980). The author listed 45 “species” of gastropods and 26 “species” of bivalves, both found by him personally (60) and based on literary sources. This paper contains a lot of errors – in the spelling of species names and authors’ names, in references to primary sources, in the definition of species. M. Zatravkin categorically rejected the existence of *Gyraulus crista* in the SDRB, although V. Zhadin (Zhadin, 1929) provided a drawing that clearly shows that it was *G. crista*. M. Zatravkin also believed that the species “*Physella integra* (Heldeman)” introduced from aquariums was indicated under the name *Physa acuta* in previous years in the SDRB, but later it was found out that it was *Ph. acuta*. In total, 38 species

of gastropods and 16 species of bivalves can be identified in this paper according to the WoRMS. *Gyraulus rossmaessleri* (Auerswald, 1852) was recorded for the first time as part of the SDRB freshwater malacofauna.

According to the results of studies conducted in 1985–1988, employees of the Donetsk State University (now Vasyl Stus Donetsk National University) published lists of mollusks of Donetsk region and the Krasnooskilske Reservoir (Timoshenko & Yaroshenko, 1991; Timoshenko, 1992). These papers, probably influenced by a previous publication by M. Zatravkin, also contain errors, such as incorrect spelling of species and authors' names, double indication of the same species, and incorrect interpretation of species composition. In the publications, the authors list 87 “species” of mollusks, among which 43 species of gastropods and 19 species of bivalve mollusks can currently be identified (provided that they are correctly identified, because no anatomical or molecular studies were carried out at that time). The authors introduced four new species into the SDRB hydromalacological fauna, which are valid according to the WoRMS. *Planorbella duryi* (Wetherby, 1879) is noted as an adventitious species introduced from aquariums. The habitat of *Dreissena polymorpha* in the SDRB has been restored. On the other hand, the mention of *Ladislavella terebra* (Westerlund, 1885), is probably erroneous, since there are no data from other sources confirming the presence of the species here (Jackiewicz, 1998; Stadnichenko, 2004; Vinarski & Glöer, 2008). The “species” “*Lymnaea psilia* Bourguignat” is currently rejected, as it has been proved that when describing the species by the author (Bourguignat, 1862) a mistake was made, young specimens of *Radix auricularia* were designated as representatives of the “new” species (Vinarski, Gloer, 2009). *Ampullaceana intermedia* sensu N. Kruglov & Ya. Starobogatov (1993), provided for the SDRB by M. Yaroshenko and Ye. Tymoshenko, is probably not conspecific with *A. intermedia* sensu Lamarck, 1822, since recent molecular genetic studies confirmed the presence of this species only for Spain and France (Aksenova *et al.*, 2018). The species *Lymnaea tumida* sensu N. Kruglov & Ya. Starobogatov (1993), indicated by these and some other authors, is most likely not identical to the real *L. tumida* sensu Held, 1836, since the latter taxon is usually considered an intraspecific morph of *Radix auricularia* living in large alpine lakes (Aksenova *et al.*, 2018).

Over the next years, no systematic targeted study of the SDRB mollusks was carried out due to the lack of relevant specialists and scientific programs of specialized departments at local universities. Therefore, at that time, the malacological studies in the SDRB proceeded as follows.

Firstly, fragmentary information about the mollusks of the Siverskyi Donets was obtained during research in the SDRB (as part of the general territory of Ukraine) during the dissertation work on certain systematic groups of mollusks by graduate students of Ivan Franko Zhytomyr State University. According to the results of the study 1997–1999 in the basins of the rivers of Ukraine (including the Siverskyi Donets River), within the borders of Kharkiv region, eight “species” of limneids were noted, six of which are currently valid (Garbar O., 2000). In a short paper, material on the finding of five species of limneids and three species of planorbids in Kharkiv region is presented (Garbar D., Garbar O., 2003). O. Uvaieva studied the composition of the fauna of small snails of the Planorbinae subfamily both throughout Ukraine in general and in the SDRB in particular. In the papers of this researcher with co-authors (Uvaeva, 2005a; Uvaeva, 2005b; Uvaeva, 2007; Uvaeva & Gural, 2008; Uvaeva, Pavlyuchenko & Gural, 2007), 18 “species” of small Planorbidae are presented for the SDRB, 14 of which, according to the

WoRMS, are considered valid. Moreover, she presented two new species – *Gyraulus riparius* (Westerlund, 1865) and *G. acronicus* (J. B. Férussac, 1807) for the SDRB for the first time. In 2007–2010 a study of the fauna of the Physinae subfamily of the waterways of Ukraine in general and the SDRB in particular was carried out. Preliminary studies provide information on six “species” of physids (Leichenko, 2010), but in the final presentation, three species were already included in the fauna of the Physinae subfamily in Ukraine (and the SDRB in particular) (Garlinska, 2014). Studies of the Unionidae confirmed the presence of all six species of unionids native to the region under study in the SDRB (Siverskyi Donets River, Luhansk region; the Udy River and Liman Lake, Kharkiv region) (Melnichenko, 1999; Yanovych & Pampura, 2011). In 2008–2009 new habitats of two species – *Dreissena polymorpha* (Pallas, 1771) and *D. bugensis* (Andrusov, 1897) – were found in the SDRB in Luhansk and Kharkiv regions (Yanovich & Pampura, 2010).

Secondly, the study of the SDRB hydromalacological fauna at that time was carried out through the cooperation of individual collectors with the natural science museums in the cities of Lviv and Kyiv – these were incidental collections of mollusks during the main studies of other groups of animals. Information about six species of unionids (recorded under 10 “species” names) and one species of spheriids collected in the SDRB by various collectors at different times is included in the catalog of bivalves published by the Zoological Museum of the National Museum of Natural History of the National Academy of Science of Ukraine (Pogrebnyak, Sedysheva & Kornushin, 2008). Numerous papers by researchers of the State Museum of Natural History Lviv (Gural & Gural-Sverlova, 2018; Gural-Sverlova & Gural, 2009; Gural-Sverlova & Gural, 2012; Gural-Sverlova, Martinov V. & Martinov O., 2012) contain information about the shells of 27 gastropod and nine bivalves species (according to the WoRMS), which were collected in Donetsk, Kharkiv and Luhansk regions at different times (2001–2015) by various collectors (V. Martynov, I. Balashov, A. Shklyaruk and others) and are stored in the museum collections (malacological fund).

The publication of representatives of Belgorod University (Mandrygina, Snegin, 2005) provides information on freshwater mollusks in the rivers on the southern slopes of the Central Russian Upland. However, based on this paper it is impossible to establish exactly (with some exceptions) which species of mollusks originated from the Dnipro River Basin (Psel and Vorskla), and which from the Siverskyi Donets River and its tributaries (Oskil and Aidar). The authors noted 69 “species” of mollusks in the understanding of Ya. Starobogatov *et al.* (2004). In our opinion and according to the WoRMS, 39 species of freshwater mollusks are given by the named authors for the rivers of the south of the Central Russian Upland in Belgorod region, Russia. *Dreissena bugensis* Andrusov 1897 is mentioned in the SDRB for the first time. It is quite clear that it has lived here since approximately 1985, but there was no information about its existence.

CONCLUSION

During the period of study from the 1830s to the 1920s, information about the presence of 42 species of gastropods and 14 species of bivalve mollusks in the SDRB was published for the first time. One species new to science was described. Three species, *O. glabra*, *L. fuscus* and *G. stromi*, were probably erroneously indicated, since they are not confirmed in the SDRB by any of the researchers. There was also an erroneous indication of the habitation of *D. polymorpha* in the SDRB at that time.

In the second period of malacological studies (the 1920s–1950s), 42 species of mollusks were confirmed to inhabit the SDRB. Eleven species of gastropods and three species of bivalves were not found. At the same time, the regional mollusks fauna was replenished with five new species, and the total list reached 61 species.

In the third period of research, all species of mollusks found there before the 1950s were recorded. Eight new species have been added to the list of the SDRB hydromalacological fauna. The habitat of *Dreissena polymorpha* in the SDRB has been restored. At the same time, the mentions of four species in the SDRB malacofauna turned out to be erroneous.

In general, over the 190-year period (1832–2022) of hydromalacological studies in the SDRB, 69 species of freshwater mollusks, the species statuses of which correspond to the WoRMS were reliably recorded. The statuses of four species (*Valvata depressa*, *Planorbium banaticus*, *P. adulosius* and *Segmentina montgazonia*) are currently not finalized.

COMPLIANCE WITH ETHICAL STANDARDS

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Human Rights: This article does not contain any studies with human subjects performed by any of the authors.

Animal studies: All institutional, national and institutional guidelines for the care and use of laboratory animals were followed.

AUTHOR CONTRIBUTIONS

Authors have read and agreed to the published version of the manuscript.

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ГІДРОМАЛАКОЛОГІЧНІ ДОСЛІДЖЕННЯ В БАСЕЙНІ РІЧКИ СІВЕРСЬКИЙ ДОНЕЦЬ (ПІВДЕНЬ СХІДНО-ЄВРОПЕЙСЬКОЇ РІВНИНИ): ОГЛЯД ЛІТЕРАТУРНИХ ДЖЕРЕЛ

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Наведено аналітичний огляд літературних джерел, які містять відомості про прісноводну малакофауну басейну річки Сіверський Донець, правої, найбільшої притоки Дону, південь Східноєвропейської рівнини. Запропоновано схему умовного поділу гідромалакологічних досліджень на три історичних періоди. Це характеристика внеску кожного з дослідників у вивчення гідромалакологічної фауни регіону. Наведений перелік усіх видів прісноводних молюсків, знайдених у регіоні за 190-річний період досліджень (1832–2022). Подано ідентифікацію назв молюсків, зафіксованих в історичній літературі у басейні річки Сіверський Донець. Схарактеризовано способи та методи сучасних досліджень гідромалакологічної фауни регіону.

Всю історію досліджень прісноводних молюсків басейну річки Сіверський Донець умовно можна поділити на три періоди. У перший період (1830–1920-ті рр.) уперше було опубліковано відомості про наявність 42 видів червононогих молюсків і 14 видів двостулкових молюсків у басейні річки Сіверський Донець. Було описано один новий для науки вид. У другий період (1920–1950-ті рр.) регіональна малакофауна поповнилася п'ятьма новими видами, а загальний список уже досяг 61 виду. Між 1950-ми і 1970-ми роками – час великої перерви в історії вивчення регіональної малакофауни. Третій період – з 1970-х років по теперішній час. Це період вивчення складу і структури малакоценозів у середній і верхній частинах басейну.

Ключові слова: Сіверський Донець, молюски, гідромалакологічна фауна, Криницький, Ліндгольм, Розен

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