

## The aquatic mollusc fauna of river Tisza and its tributaries.

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### **Abstract**

The author has been investigating the mollusc fauna of the river Tisza and its tributaries as a member of the Tisza Research Workgroup since 1958. His personal findings, as well as data collected from the literature on the malacofauna of these rivers have been utilized for the determination of the faunal composition of the individual streams. The area-analytical zoogeographical classification of the species afterwards enabled the delineation of those floodplain areas or rivers, which had not been subjected to analysis so far and require further investigations regarding the mollusc fauna.

Keywords: river reaches, dead arms, floodplains, tributaries, faunal elements and refugial areas

### **Material and methods**

The major aim of this paper was to collect all available information on the malacofauna of the Lower, Middle and Upper Tisza and its tributaries plus the backwater areas as well as the dead arms, along with those of the rivers Maros and Körös and the accompanying channels. The rivers, tributaries as well as the channels are depicted on Fig.1 and numbered in Table 1. The dead arms and the floodplains have not been assigned numbers, as they were taken to be part of the rivers in this work.

The previous works of the author have been utilized as a basis for the zoogeographical classification of the aquatic mollusc fauna. A part of the referred papers are in press or to read in the list of references. The following faunal elements and their refugial areas are considered: 1. Pacific-Palearctic; 2. East Siberian (Kazakhstan and Manchurian Refugial Areas); 3. Central Siberian (Angaran Refugial Area); 4. West Siberian; 5. Central Asian; 6. Ponto-Caspian; 7. Caspian-Sarmatian, and the Refugial Areas of the Holomediterranean elements: 8. Ponto-Mediterranean; 9. Ponto-Pannonian; 10. Boreo-Alpine; 11. Atlanto-Mediterranean; 12. Holomediterranean with occurrences in the Palearctic and North America; 13. Holarctic elements.

### **The distribution of the species in the studied streams and aquatic habitats**

65 species are mentioned from 14 streams, channels and reaches. Three channels were investigated in detail as depicted in Table 1: 13. the Körös channel; 14. the Keleti main channel; 15. the Jászság main channel (Fig.1).

Out of the 70 Hungarian aquatic species known from the literature, 24 of which are bivalves (PINTÉR 1984), 65 have been found in the river Tisza and its tributaries as well as the main channels. The distribution of the individual species shows large scale variation. The least known and investigated are the areas: 5. Száraz brook with 2 mollusc species, 7. the dead arms of the Hármas-Körös with 5 species, 9. the dead arms of the Sebes-Körös with 9 species, 11. the dead arms of the Fehér-Körös with 1 species, 12. the dead arms of the Fekete-Körös with 2 species, 14. the Keleti main channel 3, 15. the Jászság main channel 4, 18. Zagyva 7, 20. Takta 2, 23. Túr 1, and finally 24. Kraszna with 2 species. The stream investigated most carefully is the river Tisza and its floodplain areas as well as dead arms.

The regions of the Lower and Middle Tisza as well as the accompanying dead arms yielded the greatest number of species. The best known and studied area is the Lower Tisza, known from the works of CZÓGLER, HORVÁTH and BÁBA with 52 species. The least studied and known reach is the Upper Tisza including the dead arms and floodplain areas. The three major reaches of the Tisza yielded a total of 57 species while 51 mollusc species have been recorded from the 5 Körös rivers. The dead arms of the Hármas-Körös yielded a total of 31 species, the river Maros a total of 27 species, plus 15 species were recorded from its dead arms. Finally 35 species were recorded from the streams, brooks and rivers of the Hortobágy. These areas were the most rich in species.

According to literature the rarest species are: *Theodoxus transversalis* (C. PFEIFFER 1828) in all reaches of the Tisza, one trench from the Middle Tisza region and the rivers Bodrog and Szamos. *Theodoxus prevostianus* (C. PFEIFFER 1828) in the rivers Sebes-Körös and Zagyva. *Theodoxus fluviatilis* (LINNE 1758) in the Lower and Middle Tisza, a trench of the Lower Tisza and the rivers Maros, Hármas-Körös and Zagyva. *Valvata pulchella* (STUDER 1820) from the Lower and Middle Tisza as well as the dead arms, the river Hármas-Körös and its dead arm as well as the Zsaro brook. *Fagotia acicularis* (FERUSSAC 1823) from the river Fehér-Körös; *Melanopsis parreysi* PHILIPPI 1847 also from the Fehér-Körös. *Lymnaea corvus* GMELIN 1791 from the Lower Tisza, a dead arm of the Upper Tisza and a trench of the Middle Tisza, as well as a dead arm of the Sebes-Körös. *Aplexa hypnorum* (LINNE 1758) from the Upper Tisza, a single dead arm of the Middle and Upper Tisza, a trench of the Middle Tisza, as well as the river Szamos. *Planorbis carinatus* (O. F. MÜLLER 1774) has come to light from the Upper Tisza and a dead arm of the Middle Tisza, while *Anisus leucostoma* (MILLET 1813) has been recorded in the Upper Tisza, a dead arm of the Middle Tisza, the Romanian part of the river Maros as well as the river Hármas-Körös. Out of the mussels *Casertiana casertana* (POLI 1791) was recorded from a dead arm of the Middle Tisza, the Romanian part of the river Maros and the Szamos. *Casertiana milium* (HELD 1836) was mentioned from a dead arm of the Upper Tisza, as well as *Casertiana personatum* (MALM 1855) and *Casertiana supinum* (A.SCHMIDT 1850), *Casertiana henslowanum* (SHEPPARD 1823) from a dead arm of the Middle Tisza and the river Fehér Körös, while *Casertiana pulchellum* (JENYNS 1832) was only recorded from the Lower Tisza. *Casertiana hibernicum* (WESTERLUND 1894) occurs in the Lower Tisza and a dead arm, as well as in a trench of the Upper Tisza. Finally, *Casertiana pseudosphaerium* (SCHLESCH 1947) and *C. subtruncata* (MALM 1857) was collected from both the Lower and Upper Tisza and a dead arm of these. (Table 1.)

### **The distribution of faunal elements**

The prevailing forms in both the best and least studied waters were East-Siberian elements with a value of 33-66 %. This is followed by the West-Siberian elements with values between 17-23 % in the thoroughly studied areas and 4-12 % of Holarctic elements. The Ponto-Caspian elements are present with a rate between 9-12 %. The ratios of the East-Siberian, West Siberian and Holarctic elements are the highest in the Upper Tisza forming the coldest part of the river valley during the winter and the one enjoying the most precipitation during the summer (KOKAS 1960). This seems to point to the importance of climatic influences on even the distribution of the aquatic fauna as well (Fig. 2.).

A detailed zoogeographical analysis of the molluscs inhabiting the tributaries originating from the Romanian mountains may yield further justifications in connection with this statement. These are the Túr, Szamos, Kraszna, Berettyó, Sebes-Fehér, Fekete-Körös and the river Maros (depicted with numbers 23, 22, 24, 9, 10, 11, 12. in Table 1). Another proof might be

that the ratio of the East-Central Siberian elements in the montane areas of the river Maros in Romania is higher than the value for the Hungarian part (6). Furthermore the Boreo-Alpine elements have a ratio of 2 - 5.88 % in the dead arms and backwaters of the Upper Tisza (*Casertiana hibernicum* (WESTERLUND 1894)).

## Summary

In this paper all available information on the mollusc fauna of the Lower, Middle and Upper Tisza and its tributaries plus the backwater areas as well as the dead arms, along with those of the rivers Maros and Körös and the accompanying channels have been summarized and reevaluated based on information from the literature. Out of the 70 Hungarian aquatic species known from the literature 65 have come to light from the river Tisza and its tributaries as well as the main channels. The best investigated streams are the river Tisza with 57 species, and the rivers Körös with 51 species. 19 species are highly sporadic in 24 sites. According to the zoogeographical analysis of the collecting sites, 13 faunal elements are present in the studied material. The ratio of the East, West and central Siberian elements is higher in the northern parts of the Tisza valley indicating a possible role of the climate in the creation of the distribution patterns of the aquatic mollusc fauna.

Great Hungarian Plain.

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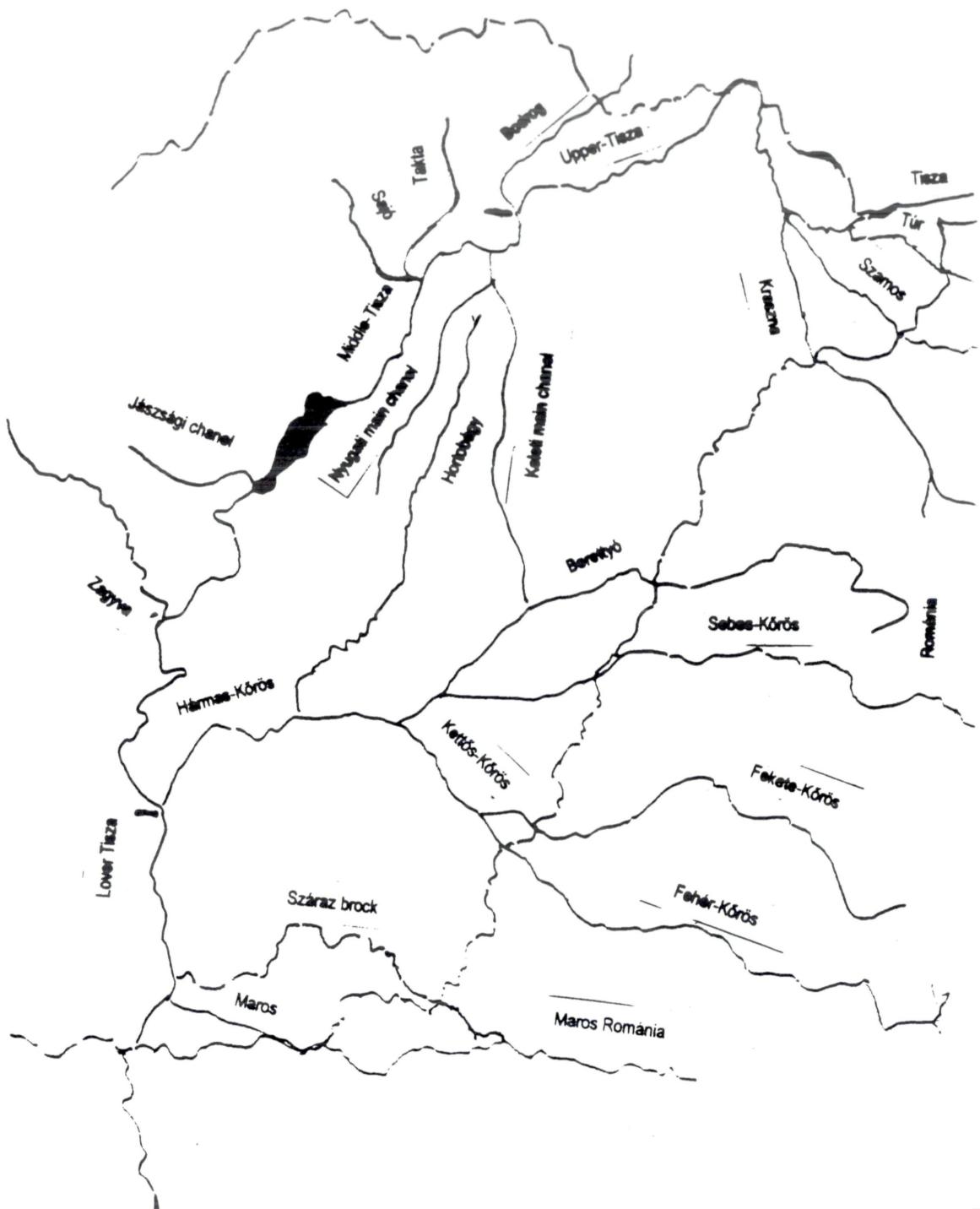


Fig. I.: The analyzed rivers, brooks, streams and channels of the Tiszaian part of the Great Hungarian Plain.

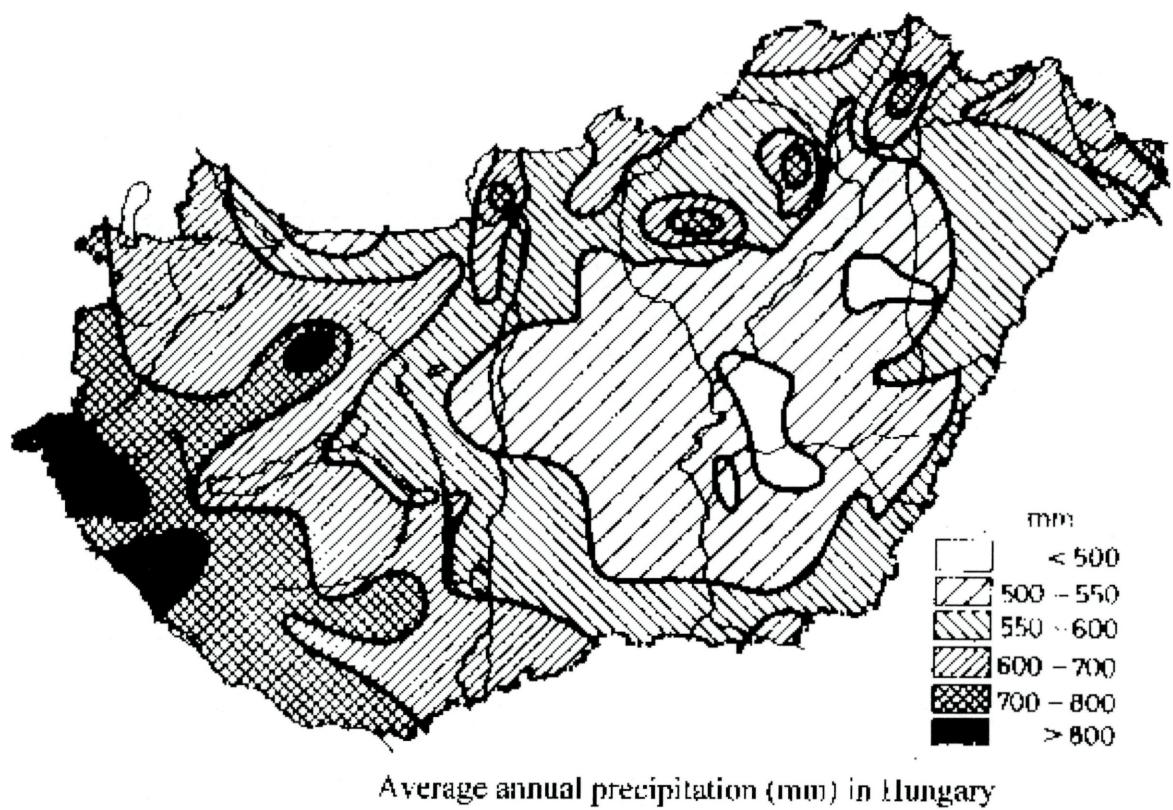


Fig. 2.: The average annual precipitation rates in Hungary.

Table 1.: The species recorded and their distribution for the individual streams.

Project ID	Project Name	Project Type	Project Status	Performance Metrics												Resource Utilization																	
				Financial			Operational			Quality			Delivery			Team			Budget			Time			Skills			Capacity					
				Budget	Actual	Variance	Efficiency	Completion	Defects	Rate	Accuracy	Consistency	Completion	Rate	Success	Team Size	Experience	Hours	Cost	Efficiency	Completion	Rate	Success	Team Size	Experience	Hours	Cost	Efficiency	Completion	Rate	Success		
PJ-001	Software Development	In Progress	On Track	100000	98000	-2000	85%	95%	10	0.05	98%	95%	90%	0.95	95%	10	5 years	1000	10000	85%	95%	90%	10	5 years	1000	10000	85%	95%	90%	10	5 years	1000	10000
PJ-002	System Integration	Planning	Not Started	50000	45000	-5000	70%	80%	12	0.04	95%	92%	88%	0.90	85%	12	3 years	800	8000	70%	80%	88%	12	3 years	800	8000	70%	80%	88%	12	3 years	800	8000
PJ-003	Data Migration	On Hold	At Risk	80000	75000	-5000	60%	70%	15	0.06	90%	88%	85%	0.85	75%	15	4 years	900	9000	60%	70%	85%	15	4 years	900	9000	60%	70%	85%	15	4 years	900	9000
PJ-004	Infrastructure Upgrade	Completed	Completed	120000	115000	-5000	98%	99%	18	0.03	99%	98%	97%	0.98	98%	18	2 years	1200	12000	98%	99%	97%	18	2 years	1200	12000	98%	99%	97%	18	2 years	1200	12000
PJ-005	Mobile Application	In Progress	On Track	70000	68000	-2000	75%	85%	20	0.05	92%	90%	88%	0.88	80%	20	3 years	700	7000	75%	85%	88%	20	3 years	700	7000	75%	85%	88%	20	3 years	700	7000
PJ-006	Cloud Migration	On Hold	At Risk	90000	85000	-5000	65%	75%	22	0.06	88%	85%	83%	0.83	78%	22	4 years	800	8000	65%	75%	83%	22	4 years	800	8000	65%	75%	83%	22	4 years	800	8000
PJ-007	AI Integration	Planning	Not Started	60000	55000	-5000	50%	60%	25	0.04	80%	78%	75%	0.75	70%	25	5 years	600	6000	50%	60%	75%	25	5 years	600	6000	50%	60%	75%	25	5 years	600	6000
PJ-008	Blockchain Implementation	On Hold	At Risk	110000	105000	-5000	55%	65%	28	0.05	75%	72%	70%	0.70	68%	28	6 years	700	7000	55%	65%	70%	28	6 years	700	7000	55%	65%	70%	28	6 years	700	7000
PJ-009	Big Data Analytics	Completed	Completed	130000	125000	-5000	95%	96%	30	0.03	98%	97%	96%	0.96	95%	30	2 years	1300	13000	95%	96%	96%	30	2 years	1300	13000	95%	96%	96%	30	2 years	1300	13000
PJ-010	Supply Chain Optimization	In Progress	On Track	95000	90000	-5000	80%	90%	32	0.04	90%	88%	86%	0.86	85%	32	3 years	950	9500	80%	90%	86%	32	3 years	950	9500	80%	90%	86%	32	3 years	950	9500
PJ-011	Customer Experience Platform	On Hold	At Risk	105000	100000	-5000	60%	70%	35	0.06	82%	80%	78%	0.78	75%	35	4 years	1050	10500	60%	70%	78%	35	4 years	1050	10500	60%	70%	78%	35	4 years	1050	10500
PJ-012	Machine Learning Model	Planning	Not Started	55000	50000	-5000	30%	40%	38	0.03	70%	68%	65%	0.65	65%	38	5 years	550	5500	30%	40%	65%	38	5 years	550	5500	30%	40%	65%	38	5 years	550	5500
PJ-013	Cloud Native Architecture	On Hold	At Risk	125000	120000	-5000	50%	60%	40	0.05	78%	75%	72%	0.72	72%	40	3 years	1250	12500	50%	60%	72%	40	3 years	1250	12500	50%	60%	72%	40	3 years	1250	12500
PJ-014	Blockchain for Payments	Planning	Not Started	65000	60000	-5000	20%	30%	42	0.04	65%	62%	58%	0.58	60%	42	4 years	650	6500	20%	30%	58%	42	4 years	650	6500	20%	30%	58%	42	4 years	650	6500
PJ-015	AI-powered Chatbot	On Hold	At Risk	85000	80000	-5000	45%	55%	45	0.06	72%	70%	68%	0.68	68%	45	5 years	850	8500	45%	55%	68%	45	5 years	850	8500	45%	55%	68%	45	5 years	850	8500
PJ-016	Supply Chain Transparency	Completed	Completed	115000	110000	-5000	90%	91%	48	0.03	95%	94%	93%	0.93	92%	48	2 years	1150	11500	90%	91%	93%	48	2 years	1150	11500	90%	91%	93%	48	2 years	1150	11500
PJ-017	Machine Learning for Predictive Maintenance	In Progress	On Track	100000	95000	-5000	75%	85%	50	0.04	88%	86%	84%	0.84	82%	50	3 years	1000	10000	75%	85%	84%	50	3 years	1000	10000	75%	85%	84%	50	3 years	1000	10000
PJ-018	Cloud Migration Phase 2	On Hold	At Risk	135000	130000	-5000	55%	65%	52	0.06	80%	78%	75%	0.75	72%	52	4 years	1350	13500	55%	65%	75%	52	4 years	1350	13500	55%	65%	75%	52	4 years	1350	13500
PJ-019	AI-powered Quality Control	Planning	Not Started	70000	65000	-5000	10%	20%	54	0.03	60%	58%	55%	0.55	50%	54	5 years	700	7000	10%	20%	55%	54	5 years	700	7000	10%	20%	55%	54	5 years	700	7000
PJ-020	Blockchain for Supply Chain	On Hold	At Risk	145000	140000	-5000	40%	50%	56	0.05	74%	72%	70%	0.70	66%	56	6 years	1450	14500	40%	50%	70%	56	6 years	1450	14500	40%	50%	70%	56	6 years	1450	14500



Nummer Name	Tiere										Nicht-Tiere										Wasser- biotoparten										Klima- faktoren										Sozio- ökonomisch										Biotop- faktoren										Geographie																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

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Jahr/Year: 2004

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