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DIVERSITY OF AQUATIC MOLLUSC COMMUNITIES OF THE RIVER CETINA

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Beran, L.: Diversity of aquatic mollusc communities of the river Cetina. Nat. Croat., Vol. 35, No. 1, 123-134, 2026, Zagreb.

The Balkan region is inhabited by hundreds of endemic freshwater molluscs, mainly small hydrobiids, and is considered a hotspot of global biodiversity. On the other hand, data about their distribution as well as data about distribution of more common and widespread molluscs have been still sparse and complete inventories of the mollusc communities of many areas are missing. The river Cetina is the largest river in the Adriatic part of Croatia. Aquatic non-marine molluscs of this river were studied in 2009, 2018-2022 and 2024. The quantity of distributional data were obtained thus the main objective of this study was to summarize and analyse recent distributional data on freshwater and brackish molluscs with special focus on endemic or threatened species. In total 35 aquatic molluscs were found at 26 sites at Cetina including its the biggest tributary Ruda. Mollusc communities at individual sites were usually composed of 5-15 species. Molluscs *Theodoxus fluviatilis*, *Holandriana holandrii*, *Bithynia tentaculata*, *Radomaniola* spp., *Emmericia patula*, *Stagnicola fuscus*, *Physa fontinalis*, *Ancylus fluviatilis*, *Euglesa casertana* and *E. subtruncata* were the most often recorded taxons found at least at half of studied sites. Notable is the occurrence of gastropods *Dalmatinella simonae*, *Horatia klecakiana*, *Islamia* sp. and several species of genus *Radomaniola*. No bivalves from the family Unionidae were found in the main stream of Cetina or Ruda. Numerous populations of non-native gastropod *Potamopyrgus antipodarum* in Cetina were found. The most serious impact is the change in the water regime caused by the construction of dams, which most likely had an impact on changes in the mollusc communities.

Key words: endemics, threatened species, Croatia

Beran, L.: Raznolikost zajednica vodenih mekušaca rijeke Cetine. Nat. Croat., Vol. 35, No. 1, 123-134, 2026, Zagreb.

Balkansku regiju naseljavaju stotine endemskih slatkovodnih mekušaca, uglavnom malih hidrobida te se smatra žarištem globalne bioraznolikosti. S druge strane, još uvijek su rijetki podaci o njihovoj rasprostranjenosti, kao i podaci o rasprostranjenosti češćih i rasprostranjenijih mekušaca, a nedostaju i potpuni popisi zajednica mekušaca mnogih područja. Rijeka Cetina najveća je rijeka u jadranskom dijelu Hrvatske. Vodeni nemorski mekušci ove rijeke proučavani su 2009., 2018.-2022. i 2024. godine. Prikupljena je velika količina podataka o rasprostranjenosti, stoga je glavni cilj ove studije bio sažeti i analizirati te nedavne podatke o rasprostranjenosti slatkovodnih i bočatih mekušaca, s posebnim naglaskom na endemske ili ugrožene vrste. Ukupno je pronađeno 35 vrsta vodenih mekušaca na 26 lokacija na Cetini, uključujući njezinu najveću pritoku Rudu. Zajednice mekušaca na pojedinačnim lokacijama obično su se sastojale od 5-15 vrsta. Mekušci *Theodoxus fluviatilis*, *Holandriana holandrii*, *Bithynia tentaculata*, *Radomaniola* spp., *Emmericia patula*, *Stagnicola fuscus*, *Physa fontinalis*, *Ancylus fluviatilis*, *Euglesa casertana* i *E. subtruncata* bili su najčešće zabilježene svojte na barem polovici proučavanih lokaliteta. Značajna je pojava puževa *Dalmatinella simonae*, *Horatia klecakiana*, *Islamia* sp. te nekoliko vrsta roda *Radomaniola*. U glavnom toku Cetine i Rude nisu pronađeni školjkaši iz porodice Unionidae. U Cetini su pronađene brojne populacije alohtonog puža *Potamopyrgus antipodarum*. Najozbiljniji utjecaj je promjena vodnog režima uzrokovana izgradnjom brana, što je najvjerojatnije utjecalo na promjene u zajednicama mekušaca.

Ključne riječi: endemi, ugrožene vrste, Hrvatska

INTRODUCTION

Cetina is the longest Mediterranean river in Croatia and together with Zrmanja, Krka and Neretva belong to the largest rivers of the Adriatic part of Croatia.

Groundwaters and springs in the Cetina basin have recently been intensively investigated (e.g. Beran *et al*. 2014; Grego *et al*., 2018; Falniowski *et al*., 2021; Delicado & Hauffe 2022; Hofman *et al*., 2022) and several new species have been described here, such as *Horatia ozimeci* Grego & Falniowski, 2021 and *H. stygorumina* Grego & Rysiewska, 2021 (Falniowski *et al*., 2021), *Kerkia stellata* Grego & Falniowski, 2022 (Hofman *et al*., 2022), *Montenegrospeum sketi* Grego & Glöer, 2018 (Grego *et al*., 2018), *Radomaniola szarowskae* Delicado and Haufe, 2022 (Delicado & Hauffe, 2022) or *R. frauenfeldiana* Beran et Jaszczyńska, 2025 (Jaszczyńska *et al*., 2025). The population of the non-native and invasive bivalve *Sinanodonta woodiana* (Lea, 1834) was discovered in the oxbow of this river (Beran, 2020). On the other hand the main stream of the river was rather overlooked. *Bithynia cettinensis* Clessin, 1887 was described from this river but Pešić *et al*. (2019) showed in their molecular genetic study that it is possible that *B. cettinensis* and *B. tentaculata* (Linnaeus, 1758) are conspecific.

Author studied aquatic molluscs of this river with special focus on endemic or threatened species, during the years 2018-2022 and 2024 (with some visits also in 2009). In addition to the new species *Dalmatinella simonae* Beran et Rysiewska, 2021 (Beran *et al*., 2021) or *Radomaniola cetinensis* Grego et Beran, 2025 (Jaszczyńska *et al*., 2025) found also in the river Cetina, data on the occurrence of other species were collected and are summarized in this study and should thus contribute to the knowledge of the malacofauna of this river.

MATERIAL AND METHODS

Data were obtained by author in the years 2009 and 2018-2022, 2024. The freshwater and also brackish part of the river Cetina and its biggest tributary Ruda were studied at 26 sites (Fig. 1). Only main streams of these two rivers were studied. The main sampling method used was washing vegetation and sediments using metal sieves (diameter 20 cm, 0.8 mm mesh and/or diameter 10 cm and mesh 0.5 mm) combined with collections by hand from the surfaces of stones, wood and artificial materials (e.g. plastic bags and bottles). Snorkelling in shallow parts (ca. to 3 m deep) was also used. Molluscs were identified using shell characteristics or dissected and then identified using their copulatory organs if the identification only based on shells was impossible. Specimens for dissection were killed in hot water and then fixed in 80% clean ethanol while specimens for further DNA analysis were directly fixed in 80% clean ethanol. Selected material of shells and specimens fixed in 80% ethanol is deposited in the author's collection.

Study area

The river Cetina with the lenght of 106 km is the longest Mediterranean river in Croatia and its basin covers an area of 1,463 km^2. Apart from its visible basin, Cetina also receives a lot of water from the west Bosnian karst field via underground routes so the total drainage area of the catchment is more extensive. The main spring (Mi-

laševo jezero) is located 50 km from the coast and its mouth into the Adriatic Sea is located in the town of Omiš. Ruda is the largest tributary of this river.

Cetina is regulated; there are five hydroelectric power plants in the river basin (HPP Peruča, HPP Đale, HPP Kraljevac, HPP Zakučac and HPP Orlovac) and three reservoirs (Peruča, Đale and Prančevići) (Vučković *et al*., 2009). Lake Peruča with surface of 13 km^2 and maximal depth of 64 m is the second largest artificial lake in Croatia. The flow regulation and construction of hydroelectric power plants and reservoirs significantly changed this river and its floodplain.

List of investigated sites

Data in the list are as follows: site number, geographical coordinates, name of the nearest settlement, description of the site, date of investigation. Sites are depicted in Fig. 1.

Cetina

1 – 43,4473N, 16,6943E, Omiš, the river Cetina between two tunnels, **a)** 18. 6. 2009, **b)** 28. 8. 2018;

2 – 43,4512N, 16,6973E, Omiš, Cetina near the inflow of a canal from the hydroelectric power plant (Fig. 2), 18. 6. 2009;

3 – 43,4438N, 16,7267E, Omiš, Cetina 3 km upstream of its inflow into the sea, **a)** 8. 7. 2021, **b)** 12. 7. 2022;

4 – 43,4373N, 16,7576E, Podašpilje, Cetina to the north of Podašpilje, **a)** 18. 6. 2009, **b)** 27. 8. 2018, **c)** 19. 8. 2020, **d)** 12. 7. 2022;

5 – 43,4416N, 16,8122E, Kostanje, Cetina to the west of Kostanje, 31. 8. 2018;

6 – 43,4277N, 16,8536E, Podgrađe, Cetina 800 m downstream of the bridge, 8. 7. 2021;

7 – 43,4305N, 16,8625E, Podgrađe, Cetina by the bridge (Fig. 3), 12. 7. 2022;

8 – 43,4306N, 16,8678E, Jerčići, Cetina 300 m upstream of the bridge, 27. 8. 2018;

9 – 43,4814N, 16,8407E, Blato na Cetini, Cetina in the camp, **a)** 30. 8. 2018, **b)** 21. 8. 2019;

10 – 43,4896N, 16,8166E, Trnbusi, Cetina to the east of the hill Gradina (308 m a. s. l.), **a)** 26. 8. 2018, **b)** 22. 8. 2019;

11 – 43,5329N, 16,7448E, Nečaj, Cetina by the bridge, **a)** 26. 8. 2018, **b)** 12. 7. 2022;

12 – 43,5625N, 16,7177E, Donja Rošca, Cetina in the Prančevići reservoir, 29. 8. 2018;

13 – 43,6113N, 16,7246E, Trilj, Cetina downstream of Trilj, 18. 8. 2020;

14 – 43,6204N, 16,7316E, Trilj, Cetina in Trilj, 29. 8. 2018;

15 – 43,6430N, 16,7218E, Košute, Cetina to the northeast of Košute, 16. 8. 2020;

16 – 43,6889N, 16,7153E, Otok, Cetina by the bridge, **a)** 21. 8. 2019, **b)** 16. 8. 2020;

17 – 43,7352N, 16,6772E, Obrovac Sinjski, Cetina upstream of Obrovac Sinjski (Fig. 4), **a)** 18. 8. 2020, **b)** 12. 7. 2022;

18 – 43,7758N, 16,6316E, Rumin, Cetina by the bridge, 6. 7. 2021;

19 – 43,8901N, 16,4374E, Grabići, the northwestern edge of the Peručko jezero reservoir (Fig. 5), 16. 8. 2020;

20 – 43,9359N, 16,4423E, Vinalić, Cetina by the bridge, 21. 8. 2020;

21 – 43,9603N, 16,4300E, Cetina, the river Cetina ca 2 km to the south of Cetina, 30. 3. 2024;

22 – 43,9768N, 16,4301E, Cetina, the spring of Cetina (Milaševo jezero, Fig. 6, 21. 8. 2020;

Ruda

23 – 43,6406N, 16,7479E, Grab, the river Ruda by a bridge to the southwest of Grab, 8. 7. 2021;

24 – 43,6600N, 16,7510E, Grab, the river Ruda by a bridge to the north of Grab, 8. 7. 2021;

25 – 43,6708N, 16,7808E, Ruda, the river Ruda by a bridge (Fig. 7), 12. 7. 2022;

26 – 43,6688N, 16,7943E, Ruda, the spring of the river Ruda, 12. 7. 2022.

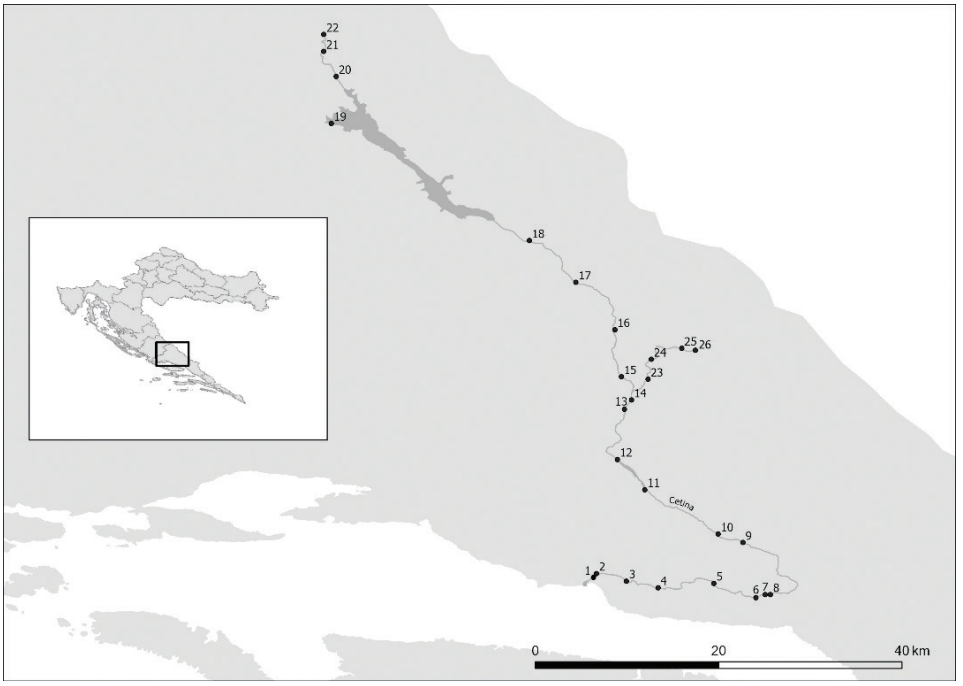


Fig. 1. The map of the rivers Cetina and Ruda with the geographical distribution of the sampling sites. Drawing J. Beran.



Fig. 2. The confluence of the main stream of the Cetina and a canal from the hydroelectric power plant (loc. 2) near the inflow of the Cetina into the sea.



Fig. 3. The lower part of the Cetina by the bridge near Podgrađe (loc. 7).



Fig. 4. The Cetina upstream of Obrovac Sinjski (loc. 17).



Fig. 5. The northwestern edge of the Peručko jezero reservoir (loc. 19).



Fig. 6. The spring of the river Cetina (Milaševo jezero, loc. 22).



Fig. 7. The river Ruda (loc. 25).

RESULTS

Mollusc communities

In total, 35 taxons were found at rivers Cetina and Ruda, 26 gastropods and 9 bivalves (Appendix 1). Mollusc communities at individual sites are usually composed of 5-15 species. Gastropods *Theodoxus fluviatilis* (Linnaeus, 1758), *Holandriana holandrii* (Pfeiffer, 1828), *Bithynia tentaculata* (Linnaeus, 1758), *Radomaniola* spp., *Emmericia patula*

(Brumati, 1838), *Stagnicola fuscus* (C. Pfeiffer, 1825), *Physa fontinalis* (Linnaeus, 1758), *Ancylus fluviatilis* (O. F. Müller, 1774), and bivalves *Euglesa casertana* (Poli, 1791) and *E. subtruncata* (Malm, 1855) were the most often recorded taxons found at least at half of the studied sites (see Appendix 1). Gastropod *Adriohydrobia gagatinella* (Küster, 1852) occurred only in the lower part of Cetina (brackish and freshwater) the same as e.g. gastropod *Planorbis planorbis* (Linnaeus, 1758) or bivalve *Pisidium amnicum* (O. F. Müller, 1774) which preferred rather the lower freshwater part. Some common and widespread species inhabiting rather stagnant or slowly running waters, like gastropods *Acroloxus lacustris* (Linnaeus, 1758), *Radix auricularia* (Linnaeus, 1758), *Lymnaea stagnalis* (Linnaeus, 1758) or *Hippeutis complanatus* (Linnaeus, 1758) were found occassionally at only several sites distributed intermittently on Cetina. No bivalves from the family Unionidae were found in the main stream of both rivers.

Endemic, threatened and rare molluscs

Most of recorded species belong to common molluscs listed in the current version of the IUCN Red List in the category Least Concern. Several endemic species (*Dalmatinella simonae, Radomaniola cetinensis, R. szarowskae*) have been described recently and are therefore not yet listed in the IUCN Red List. Notes to distribution, habitats and also taxonomic remarks of selected taxons are mentioned bellow. Their distribution in the studied area is depicted in Fig. 8.

Horatia klecakiana

H. klecakiana has been known from numerous springs in the Cetina drainage area (Radoman, 1983; Falniowski *et al*., 2021). During this research this species was also found in the main stream of Cetina at five sites (15-18, 21) and in the spring of Ruda (site No. 26).

Islamia sp.

Islamia is a genus of minute freshwater snails of the family Hydrobiidae. As yet unidentified species was found at sites 10 and 12.

Dalmatinella simonae

D. simonae was recently described from two sites of the river Cetina and from lake Sladinac, both situated in the southeastern part of Croatia (Beran *et al*., 2021). During further research, this species was found at another sites in rivers Cetina, Ruda and Neretva (Beran *et al*., 2022, this research). Altogether this endemic species was found at nine sites (4, 6, 7, 10-13, 15, 17) of the freshwater part of Cetina downstream of the Peručko jezero reservoir and also at two sites (24, 25) of the river Ruda. In all cases this species was found on stones in the water. Stones were usually on the banks or in shallow places (Beran *et al*., 2022; this research).

Radomaniola spp.

Radomaniola is a genus of minute valvatiform gastropods inhabiting mostly springs, but also small streams, rivers and subterranean waters in the Balkans. Dozen of species are known so far, but taxonomic status of many species (taxons) is not clear. Slight morphological differences between species make their identification problem-

atic. Two species have been known from Cetina. Delicado & Hauffe (2022) described the species *R. szarowskae* from the source of Cetina (Milaševo jezero, site No. 22 in this paper) while Jaszczyńska *et al.* (2025) described *R. cetinensis* from Kotluša spring (the westernmost major source of the river Cetina) and this species mentioned also from the source of Cetina (Milaševo jezero, site No. 22 in this paper) and from Cetina in Obrovac Sinjski (site 17 in this paper) and Košute (site 15 in this paper).

During this research usually abundant populations of this genus were found at 13 sites of Cetina and two sites of Ruda and belong to dominant gastropods in mollusc communities of these rivers.

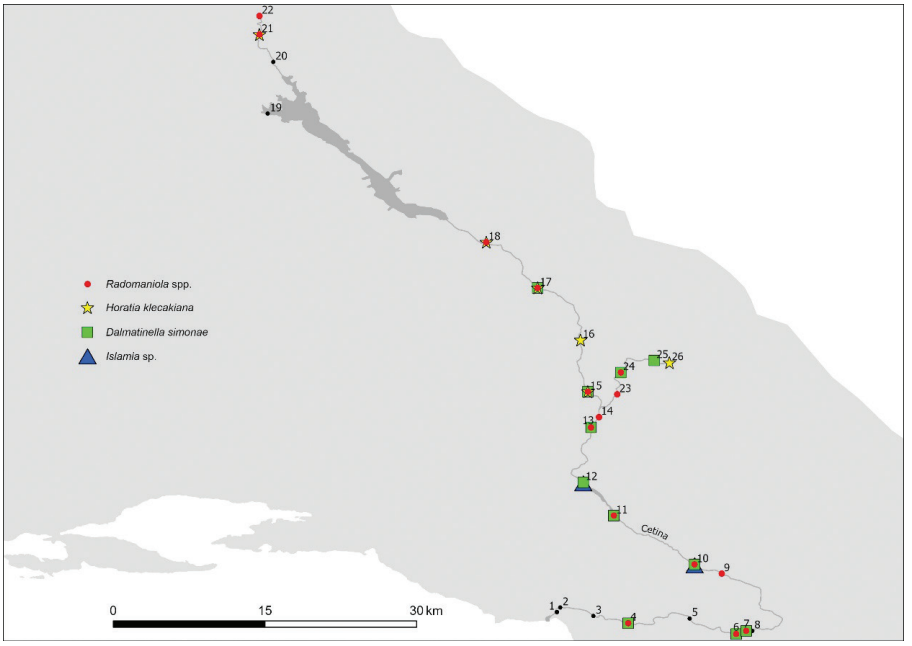


Fig. 8. The map with the distribution of threatened and endemic gastropods. Drawing J. Beran.

Non-native species

One non-native species was recorded in Cetina. *Potamopyrgus antipodarum* was found at loc. 1, 3 and 4 in the lower part of this river and also in the section downstream of the Peručko jezero reservoir (loc. 13, 15-18, Fig. 9). The spread of this species to Cetina has probably occurred in the last few years, as in many places its occurrence was only detected during repeated later visits. For example, in the lower section of this river it was not detected at all during the survey in 2009. In many localities it was found in large populations and was one of the dominant species.

The numerous population of the non-native and invasive species *Sinanodonta woodiana* (Lea, 1834) was discovered in 2019 in the oxbow outside of the main stream of this river (Beran, 2020). The oxbow is used by fishermen, the species composition of its fish fauna differs from that in the river and it is likely that most of the fish have been introduced by anglers.

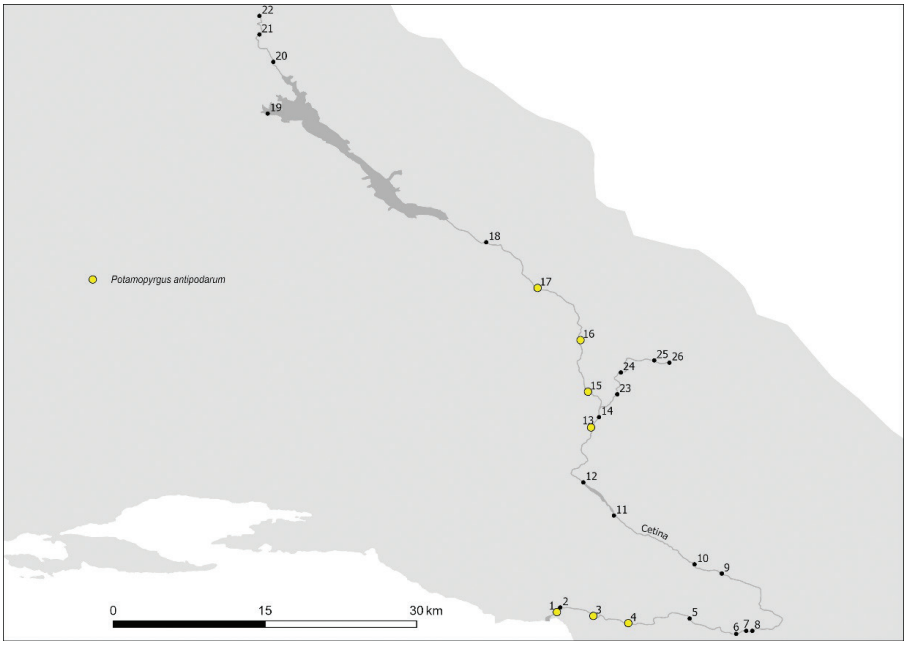


Fig. 9. The map with the distribution of non-native *Potamopyrgus antipodarum*. Drawing J. Beran.

DISCUSSION

Mollusc communities

The rich mollusc communities with several endemic species inhabit the river Cetina. These communities are similar to communities of other bigger rivers in the Adriatic part of Croatia as Zrmanja (Beran, 2021) or Krka (Beran, 2016) with one exception. It is the absence of unionids (Unionidae). While *Unio elongatulus* C. Pfeiffer, 1825 and *Anodonta exulcerata* Porro, 1838 are common in Croatian rivers flowing into the Adriatic Sea, they were not found in Cetina or Ruda. Large populations of both species are known from Zrmanja and Krupa (Beran, 2021), Krka (Beran, 2016, M. Lopes-Lima, pers. comm.) or Neretva (L. Beran and M. Lopes-Lima, unpublished records). The character of rivers is similar so reason of this absence is unknown.

Threats

There are many anthropogenic factors that threaten the occurrence of aquatic molluscs. The most serious impact is the change in the water regime caused by the construction of dams. The reservoir Peruča, built on the upper reaches of Cetina, is the second largest anthropogenic lake in Croatia and has significantly changed the character of the upper reaches of the river. Due to significant fluctuations of the water level, there has been no significant development of aquatic communities here. At the same time, the type locality of *Horatia klecakiana* was flooded (Glöer *et al*., 2022). The reservoirs below the town of Trilj (Đale, Prančevići) have changed the middle course of the river. A large part of the river flow is piped from the Prančevići reservoir to the Zakučac hy-

droelectric power plant at the mouth of Cetina in Omiš. This has significantly changed the hydrological conditions in the middle and lower reaches of the Cetina, which most likely also had an impact on changes in the mollusc communities. However, due to the absence of historical data on the malacofauna of Cetina, this impact cannot be assessed.

The density and diversity of molluscs can be also influenced by the pollution from towns, villages and agriculture. The impact of recreational activities (swimming, kayaking, rafting, sport fishing) probably have a minimal impact on molluscan assemblages. Exception can be an introduction or accelerating the invasion of non-native species. Mollusc communities of the Cetina are affected by one non-native species. Numerous populations of *Potamopyrgus antipodarum* were recorded in Cetina and this species is a dominant component of mollusc communities at several sites. Its invasion together with high abundance could have a negative impact especially on small hydrobiids like *Adriohydrobia gagatinella*. Non-native and invasive mussel *Sinanodonta woodiana* was found in an oxbow outside of the main stream of this river near the studied loc. 15 in this study. The rich fish fauna combined with warmer stagnant water offer optimal conditions for the development of the dense mussel population in contrast to the fast-flowing and cold main stream of Cetina (Beran, 2020) but it cannot be ruled out that this species will spread into the main stream of this river. Also the invasion of other non-native molluscs can be expected in the future.

Notes on the conservation status of threatened species

Several species found in Cetina probably belong to threatened molluscs. *Dalmatinella simonae* has been known from rivers Cetina, Ruda, Neretva and lake Sladinac. Numerous populations have been found in a number of studied localities. Populations in Cetina are isolated by dams, further potentional threats are e. g. over-extraction of water for existing hydroelectric power plants and also for domestic, agricultural or industrial uses and contamination of water due to inadequately regulated anthropic uses. Further research is needed for a correct risk assessment. This species has been described recently and is therefore not yet listed in the IUCN Red List. It should be considered at least as Vulnerable in the new version of the IUCN Red List. *Radomaniola cetinensis* and *R. szarowskae* have also been described recently and are therefore not yet listed in the IUCN Red List. Due to their difficulty in distinguishing them from other species of the genus *Radomaniola*, their current distribution and population size are unknown and it is appropriate to consider them in the further version of the IUCN Red List as species for which we do not yet have sufficient data (Data Deficient). *Horatia klecakiana* is mentioned as Least Concern in the last version of the IUCN Red List (Seddon, 2011). Due to the occurrence probably limited only to springs and streams in the Cetina drainage area it would be vulnerable to exploitation of the springs it inhabits and also by the change in the water regime caused by the construction of dams so it is appropriate to consider this species in the further version of the IUCN Red List in the category Vulnerable.

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REFERENCES

Beran, L., 2016: A contribution to knowledge of freshwater molluscs (Mollusca) of the Krka River in the Krka National Park (Croatia). Natura Croatica **25**(2), 295-304.

Beran, L., 2020: First records of *Sinanodonta woodiana* (Lea, 1834) and *Corbicula fluminea* (O.F. Müller, 1774) from the Adriatic part of Croatia. Folia Malacologica **28**(4), 259-302, https://doi.org/10.12657/folmal.028.024

Beran, L., 2021: Freshwater molluscs of the Zrmanja and Krupa rivers (Croatia) – the role of these rivers as a refuge of threatened and endemic species. Folia Malacologica **29**(2), 91-110, https://doi.org/10.12657/folmal.029.010

Beran, L., Bodon M. & Cianfanelli, S., 2014: Revision of *„Hauffenia jadertina"* Kuščer, 1933, and description of a new species from Pag Island, Croatia (Gastropoda: Hydrobiidae). Journal of Conchology **41**(5), 585-601.

Beran, L., Rysiewska, A., Hofman, S., Osikowski, A. & Falniowski, A., 2021: A new species of *Dalmatinella* Radoman, 1973 (Caenogastropoda: Hydrobiidae) from Croatia. Journal of Conchology **44**(1), 1-10.

Beran, L., Jaszczyńska, A. & Hofman, S., 2022: Notes to the distribution of *Dalmatinella simonae* (Gastropoda: Hydrobiidae) in Croatia and the utility of barcoding in its determination. Folia Malacologica **30**(3), 128-134, https://doi.org /10.12657/folmal.030.016

Delicado, D. & Hauffe, T., 2022: Shell features and anatomy of the springsnail genus *Radomaniola* (Caenogastropoda: Hydrobiidae) show a different pace and mode of evolution over five million years. *Zoological Journal of the Linnean Society* **196**, 393-441. https://doi.org/10.1093/zoolinnean/zlab121

Falniowski, A., Grego, J., Rysiewska, A., Osikowski, A. & Hofman, S., 2021: Two new stygobiotic species of *Horatia* Bourguignat, 1887 (Hydrobiidae) from Croatia. Subterranean Biology **37**, 89-104.

Glöer, P., Mulaomerović, J., Mitrović, B., 2022: Some taxonomic notes on *Horatia* spp. of the Balkans with the designation of the neotype of *Horatia knorri* Schütt, 1961 (Gastropoda: Hydrobiidae). Folia Malacologica **30**(2), 109-116, https://doi.org/10.12657/folmal.030.014

Grego, J., Glöer, P., Rysiewska, A., Hofman, S. & Falniowski, A., 2018: A new *Montenegrospeum* species from South Croatia (Mollusca: Gastropoda: Hydrobiidae). Folia Malacologica **26**25-34, https://doi.org/10.12657/folmal.026.004

Hofman, S., Grego, J., Beran, L., Jaszczyńska, A., Osikowski, A. & Falniowski, A., 2022: *Kerkia* Radoman, 1978 (Caenogastropoda: Hydroibiidae): endemism, apparently morphostatic evolution and cryptic speciation. Molluscan Research **42**295-319, https://doi.org/10.1080/13235818.2022.2129943

Jaszczyńska, A., Grego, J., Beran, L., Hofman, S., Falniowski, A. & Osikowski, A., 2025: Five new species of *Radomaniola* Szarowska, 2006 (Truncatelloidea: Hydrobiidae). Zootaxa **5716**(2), 207-233. https://doi.org/10.11646/zootaxa.5716.2.2

Pešić, V., Hofman, S., Rysiewska, A., Osikowski, A. & Falniowski, A., 2019: Species distinctness of *Bithynia cettinensis* Clessin, 1887 and *B. zeta* Glöer et Pešić, 2007 (Caenogastropoda: Truncatelloidea). Folia Malacologica **27**(2), 111-118, https://doi.org/10.12657/folmal.027.013

Radoman, P., 1983: Hydrobioidea a superfamily of Prosobranchia (Gastropoda). I. Systematics. Serbian Academy of Sciences and Arts, Monographs 547, Department of Sciences **57**, 1-256.

Seddon, M.,B., 2011: *Horatia klecakiana*. The IUCN Red List of Threatened Species 2011: e.T155963A4874971. https://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T155963A4874971.en. Accessed on 07 March 2025.

Vučković, I., Božak, I., Ivković, M., Jelenčić M., Kerovec, M., Popijač, A., Previšić, A., Širac, S., Zrinski, I. & Kučinić, M., 2009: Composition and structure of benthic macroinvertebrates communities in the Mediterranean karst river the Cetina and its tributary the Ruda, Croatia. Natura Croatica **18**(1), 49-82.

APPENDIX 1

Species	Site no.																
Gastropoda	**1a**	**1b**	**2**	**3a**	**3b**	**4a**	**4b**	**4c**	**4d**	**5**	**6**	**7**	**8**	**9a**	**9b**	**10a**	**10b**
Theodoxus fluviatilis (Linnaeus, 1758)	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xxx	xxx	xxx
Holandriana holandrii (Pfeiffer, 1828)						xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xxx	xxx	xxx
Bithynia tentaculata (Linnaeus, 1758)	x	x	xxx	xx		xx	xx	xxx		xxx	xx		xxx	xxx	xxx	xxx	xx
Adriohydrobia gagatinella (Küster, 1852)	xxx	x	xxx	xxx	x			xx	x								
Horatia klecakiana Bourguignat, 1887																	
Islamia sp.																	xx
Dalmatinella simonae Beran et Rysiewska, 2021								xx	xx		xx	x					x
Radomaniola spp.								xx	xx		xx	x		xxx	xxx	xxx	
Emmericia patula (Brumati, 1838)	x		xx	x	xx	xxx	xxx	xxx	xxx		xx						
Pyrgula annulata (Linnaeus, 1758)						x	x			xx	x	x	x	xx	xx	xx	xx
Potamopyrgus antipodarum (Gray, 1843)		xxx			xx				xxx								
Valvata piscinalis (O. F. Müller, 1774)																	
Acroloxus lacustris (Linnaeus, 1758)		x			x							x		x			
Galba truncatula (O. F. Müller, 1774)						x											
Stagnicola fuscus (C. Pfeiffer, 1821)	x	xx	xx	x		x	xx	xx		x	x		xx	xx		x	xx
Radix auricularia (Linnaeus, 1758)													xx	xxx	x		x
Peregriana peregra (O. F. Müller, 1774)																	
Lymnaea stagnalis (Linneaus, 1758)															x		
Physa fontinalis (Linnaeus, 1758)		x		xx	x	x	xx	xx	xx	xx	xx	xx	xx	xxx	xx	xx	xx
Planorbis planorbis (Linnaeus, 1758)				x		x	x	xxx	x								
Anisus leucostoma (Millet, 1813)			xx	x		x											
Anisus vortex (Linnaeus, 1758)						x	xxx	x		xxx	x	xx	xxx	xxx	xx	xx	
Gyraulus albus (O. F. Müller, 1774)										xx	x	xx	x	xx	xx		
Gyraulus crista (Linnaeus, 1758)																x	
Hippeutis complanatus (Linnaeus, 1758)						x				x			xx				
Ancylus fluviatilis (O. F. Müller, 1774)	x	x	x			xx	xx	xx	x			xx	x				
Bivalvia																	
Sphaerium corneum (Linnaeus, 1758)																	
Sphaerium lacustre (O. F. Müller, 1774)						x											
Pisidium amnicum (O. F. Müller, 1774)				x	x	xx	x	xx		xx			xx				
Euglesa casertana (Poli, 1791)			x	x	x	xx	xx					x	xx	x	x	x	
Euglesa milium (Held, 1836)							xx	x		xx	x			x		x	
Euglesa nitida (Jenyns, 1832)			x			x	x	x		xx			x	x	x		x
Euglesa obtusalis (Lamarck, 1818)						x											
Euglesa personata (Malm, 1855)			x	x												x	
Euglesa subtruncata (Malm, 1855)			x			x	x	xx	x		x	x		x	xx	x	
Number of species	6	8	11	11	8	19	15	16	11	12	13	12	14	15	13	13	10

Species																				
Gastropoda	**11a**	**11b**	**12**	**13**	**14**	**15**	**16a**	**16b**	**17a**	**17b**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**Σ**
Theodoxus fluviatilis (Linnaeus, 1758)	xxx	xxx		xxx	xxx	xxx	x	xxx	xxx	xxx	xx					xxx	xxx	xxx		20
Holandriana holandrii (Pfeiffer, 1828)	xx	xxx		xxx	xxx	xxx		xxx	xx	xx	xxx		xx			xxx	xxx	xxx		18
Bithynia tentaculata (Linnaeus, 1758)	xx	xx	xxx									xx								12
Adriohydrobia gagatinella (Küster, 1852)																				4
Horatia klecakiana Bourguignat, 1887						xx		x	x		xx			xxx					xx	6
Islamia sp.			x																	2
Dalmatinella simonae Beran et Rysiewska, 2021		xx	xxx	xxx		xx			x	x							xx	x		11
Radomaniola spp.	xxx	xx		xxx	xx	xx			xx	xx	xx			xxx	xxx	xx	xxx			15
Emmericia patula (Brumati, 1838)	xx	xxx	xx	xxx		xxx		xx	xxx							xx	xx			13
Pyrgula annulata (Linnaeus, 1758)				x	x															9
Potamopyrgus antipodarum (Gray, 1843)				xx		xxx		xxx	xxx	xxx	xxx									8
Valvata piscinalis (O. F. Müller, 1774)			xx		xx							xxx								3
Acroloxus lacustris (Linnaeus, 1758)													x							5
Galba truncatula (O. F. Müller, 1774)					xx		xx					x								4
Stagnicola fuscus (C. Pfeiffer, 1821)	x		x	xx	xx	x	xxx	xx	xx	x										16
Radix auricularia (Linnaeus, 1758)												x						x		5
Peregriana peregra (O. F. Müller, 1774)															xxx					1
Lymnaea stagnalis (Linneaus, 1758)		x	x																	3
Physa fontinalis (Linnaeus, 1758)	xxx	xxx	xxx	xx		xx	xx	x	x	x										15
Planorbis planorbis (Linnaeus, 1758)																				2
Anisus leucostoma (Millet, 1813)			x				xx	xx					x							6
Anisus vortex (Linnaeus, 1758)	xxx	xx		x	x	x														11
Gyraulus albus (O. F. Müller, 1774)												x								6
Gyraulus crista (Linnaeus, 1758)																				1
Hippeutis complanatus (Linnaeus, 1758)																				3
Ancylus fluviatilis (O. F. Müller, 1774)	x	x				x			xx	xx			x		xxx			x	xx	12
Bivalvia																				
Sphaerium corneum (Linnaeus, 1758)					x	x					xx									3
Sphaerium lacustre (O. F. Müller, 1774)			x									xxx								3
Pisidium amnicum (O. F. Müller, 1774)																				4
Euglesa casertana (Poli, 1791)		xx	x	x	xx		x	x	xx	x			x	xx	x	x	x	x		19
Euglesa milium (Held, 1836)	x												x							7
Euglesa nitida (Jenyns, 1832)	xx	x	x		x		x			x						x	x			13
Euglesa obtusalis (Lamarck, 1818)													x							2
Euglesa personata (Malm, 1855)													x		x					5
Euglesa subtruncata (Malm, 1855)		x	x		x	xx			xx	xx	xx		xx				x			14
Number of species	11	13	13	11	12	13	7	9	12	11	7	6	9	3	5	6	8	7	2	