



FIRST RECORD OF HUCHEN *Hucho hucho* (Linnaeus 1758) IN THE GRZA RIVER: HUMAN-CAUSED INTRODUCTION FROM ITS NATIVE HABITAT IN SERBIA

Vojislav D. Sokolović*, Ana D. Marić, Vera P. Nikolić, Tamara A. Kanjuh, Dubravka V. Škraba Jurlina,
Predrag D. Simonović

Department of Morphology, Systematics and Phylogeny, University of Belgrade, Faculty of Biology, Studentski
trg 16, 11000 Belgrade, Serbia

*Corresponding Author: vojislav.sokolovic@bio.bg.ac.rs

ARTICLE INFO

Received: 02 March 2024
Accepted: 26 April 2024

Keywords:

Danube salmon
Endangered species
Unauthorized stocking
Apex predator
Velika Morava catchment area

How to Cite

ABSTRACT

Huchen or Danube salmon *Hucho hucho* (Linnaeus 1758) is one of the largest salmonid species in the world and the largest species native to the Danube basin in Europe. In Serbia, this species inhabits the Drina river system, as well as the upper reaches of the River Ibar. It has already been introduced into the rivers Moravica and Đetinja, which are part of the Zapadna Morava catchment area. Most recently, huchen was stocked from its native habitat into the rivers Jerma and Nišava in the Južna Morava river system, and into the River Mlava which flows into the Danube. Huchen is listed as an endangered (EN) species on the IUCN Red List of Threatened Species and is protected in Serbia, and a Conservation Action Plan has already been adopted. In this report, we present the first record of this species in the River Grza, which is a part of the Velika Morava river system, outside its native range. The ichthyofauna of this recipient river consists of brown trout *Salmo trutta* L. and Eurasian minnow *Phoxinus phoxinus* L. In a small river of a fragile ecosystem such as this, the introduction of huchen as an apex predator can seriously harm the species of the native fish community, which warns of the illegal stocking measures currently in process.

Sokolović, D. V., Marić, D. A., Nikolić, P. V., Kanjuh, A. T., Škraba Jurlina, V. D., Simonović, D. P. (2024): First record of huchen *Hucho hucho* (Linnaeus 1758) in the Grza River: Human-caused introduction from its native habitat in Serbia. Croatian Journal of Fisheries, 82, 79-83. DOI: 10.2478/cjf-2024-0010.

INTRODUCTION

Danube salmon or huchen *Hucho hucho* (Linnaeus 1758) is the largest fish species of the family Salmonidae. It is native to the Danube basin. According to the IUCN Red List of Threatened Species (Freyhof et al., 2008), it is classified as an endangered (EN) species. The present distribution of huchen encompasses only a part of its former range (Weiss et al., 2018). Holčík (1990) first reported that huchen inhabits only 33.4% of its original habitat. Considering that threats such as habitat alteration (dams), overfishing, and pollution are constantly affecting the remaining huchen populations (Witkowski et al., 2013), Holčík's data (1990) seem to be outdated. In fact, the situation is currently even worse, considering that only 42% of the 34 river sections studied in the Western Balkans can support stable populations (Freyhof et al., 2015). In Serbia, with few exceptions, the native range of huchen is mainly restricted to the Drina river system, comprising the rivers Trešnjica, Rogačica, Lim, Uvac and Vapa in addition to the main course. Huchen occurs also in the upper reaches of the River Ibar and has been released in the rivers Moravica and Đetinja, which are tributaries of the River Zapadna Morava (Hegediš et al., 2005). In addition, huchen was introduced into the rivers Jerma and Nišava (the Južna Morava catchment area) and into the River Mlava, which flows directly into the Danube (Marić et al., 2022). This article reports the first finding of huchen in the River Grza, outside its already-known range in Serbia.

MATERIALS AND METHODS

Ethics statement regarding sample collection

The sampling activity for this article was covered by the License to Fish for Scientific Purposes and Electrofish and License for the Exploration of Strictly Protected and Protected Species for Scientific Purposes (No. 324-04-007/2023-04 issued on 2 March 2023 and No. 353-01-81/2023-04 issued on 22 February 2023 by the Ministry of Environmental Protection of the Republic of Serbia), as well as by a personal License for Recreational Fishing issued to the VDS No. 0011256 by Rasina plus D.O.O. on 15 February 2023.

Sample collection

The sampling area is located on the upper reaches of the River Grza, a left tributary to the River Crnica in eastern Serbia, near the village of Izvor, in the municipality of Paraćin (Fig. 1). Huchen was caught with a standard lure angling gear. The mass and standard length (SL) of the fish were measured with the fishermen's scale and measuring tape, respectively. A photo was taken (Fig. 1) and then the fish was returned to the river alive. The anal fin was clipped and preserved in 96% ethanol for DNA analysis. Basic water parameters were measured using the Multi 340i handheld meter (WTW, Germany).

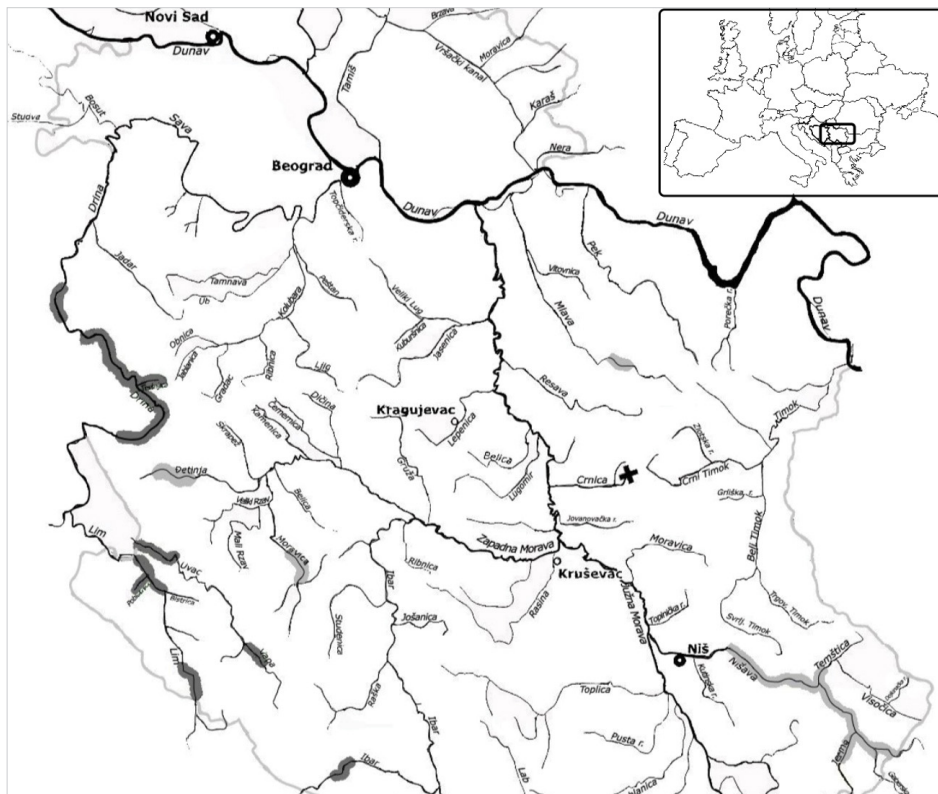


Fig 1. Distribution area of huchen in Serbia (native habitat of the huchen populations is presented in dark grey, reports of translocated huchen are shown in light grey, and those for River Grza are marked with x)

RESULTS

Huchen was caught on 26 March 2023 at a small upper reservoir located about 50 m downstream from the spring of the River Grza (Fig. 1). It had a standard length of 386 mm (SL) and weighed 763 g (Fig. 2).



Fig 2. Specimen of huchen *Hucho hucho* (L.) caught in the River Grza

Water temperature in the River Grza was 10.6 °C, conductivity was 453 $\mu\text{S}/\text{cm}$, and dissolved oxygen content was 12.0 mg/l. The water was slightly alkaline (pH 8.06). Additional records about the hitherto unreported recent catches of huchen in the rivers Jerma (in 2019) and Mlava (2022 and 2023) (Figures 3 and 4, respectively) in the Velika Morava catchment area were supplied from the photo documentation by P.S. who was informed by reliable sources from local anglers in the town of Pirot and in the Homolje region.



Fig 3. Adult huchen (above) and 1+ fry (below) caught in the River Jerma on 3 April 2019



Fig 4. Adult huchen (above) and 1+ fry (below) caught in the River Mlava on 5 February 2022 and 27 May 2023, respectively

DISCUSSION

Local recreational fishermen have reported catching huchen several times so far in the River Grza. The length and weight of the presumably two-year-old fish (i.e. 1+) indicate that it has most likely not yet reached the first breakpoint, indicating the shift in growth mode indicative of reaching sexual maturity, although this growth-related life history trait is undoubtedly habitat-dependent, and most likely density-dependent (Simonović et al., 2000; Simonović et al., 2011). However, according to the available reports (Holčík, 1990), it has most likely already shifted to piscivore. The upper reaches of the River Grza consist of two reservoirs connected to a downstream section with free-flowing water. Due to the two dams on this river, upstream migration of fish is impossible. For this reason, any type of natural colonization is precluded. The competent Fisheries Guarding Service stated that no official stocking had taken place. Therefore, the presence of huchen in the River Grza is almost certainly the result of the illegal stocking of this valuable game fish. Information on the timing and extent of the stocking, as well as the age and origin of the stocking material, remained unknown. The long history of introduction and reintroduction of huchen dates back to the beginning of the 20th century. Although these early stocking efforts mostly ended unsuccessfully, they have taught us that huchen, when introduced, can reduce the abundance of autochthonous fish species (Holčík, 1982). Huchen is an apex predator that switches to a piscivorous diet when it reaches 50-90 mm in size (Holčík, 1990). It can grow up to 183 cm in length and weigh up to 60 kg (Holčík et al., 1988). There are reports that adult huchen prey on fish that account for up to 48% of their body length (Šubjak, 2013). Since the end of the 20th century, attitudes towards the introduction and translocation of non-native fish species have greatly changed, as great disturbances to ecosystems have been recorded worldwide, resulting in invasive effects on native fish fauna.

A long-term, perseverant attempt to justify the introduction of huchen into the Nišava river system occurred in the early 2000s when anglers falsely claimed that this fish was once native there. They referred to the communication of the famous Ottoman explorer Evliya-çelebi (1848) that he was allegedly served huchen when he stayed overnight at the inn in the village of Staničenje on the right bank of the River Nišava, downstream of the present-day town of Pirot. Thorough independent research on the translation (Šabanović, 1979) of this famous masterpiece (Evliya-çelebi, 2001), as the only one available at the moment, could not confirm this statement, which in no way supports the native status of huchen for the Južna Morava basin.

In a small and sensitive stream such as the River Grza, whose fish community consists of brown trout *Salmo trutta* L., minnow *Phoxinus phoxinus* L., and the occasional feral rainbow trout *Oncorhynchus mykiss* Walbaum (Simić et al., 2022), the introduction (translocation) of non-native huchen can seriously affect the native fish community. Moreover, uncontrolled stocking is considered an inadequate management and conservation measure for huchen populations because it can cause changes in the genetic structure of the population. Huchen from rivers Drina and Ibar are sufficiently structured at the level of mtDNA and microsatellite loci and distinct from both western and eastern huchen populations (Marić et al. 2014), due to their natural isolation. The illegal stocking and consequent eastward extension of its dispersal area could pose a threat to the native character of adjacent populations through secondary contact and introgression into its gene pool. This also increases the risk of introducing new diseases into the recipient ecosystem, as well as competition and/or predation pressure (Freyhof et al. 2015). The unauthorized introductions that took place in the last decade in the upper and middle sections of the River Nišava, its tributaries and the upper section of the River Mlava were followed by rapid naturalization of huchen in both rivers, indicating that huchen thrives there, easily incorporating into the ecosystem of the recipient streams.

Those translocations (technically speaking) were immediately reported to the Ministry of Environmental Protection, which is an administrative authority responsible for fisheries. The measures set out in the relevant papers, both at the national (Hegediš et al., 2005) and international (Freyhof et al., 2015) levels, define the measures for the conservation of this protected and vulnerable species, and the national legislation (Anonymous, 2009) allows the translocation of autochthonous species only with the permission of the Ministry, issued relying on scientific research. Findings reported in this paper showed that the negative trend of unauthorized stocking continues.

CONCLUSIONS

There are reports of two translocations of huchen due to unauthorized stocking measures for the medium-sized River Jerma, a tributary of the larger upper River Nišava, and River Mlava, both of which lie outside the native range of this species. The records revealed that huchen had acclimatized and most likely naturalized there. That implicates their successful incorporation into the ecosystem of the recipient streams, i.e. their food webs, which pose a threat to the native fish species they prey on. The latest huchen find in the River Grza is particularly alarming because of the small size of that trout stream and its fragile ecosystem which is strongly susceptible to predation. It also indicates a prolongation of illegal stocking practices that threaten the biodiversity of indigenous species in the recipient streams, so something must be done about it urgently.

ACKNOWLEDGEMENTS

Fisheries management plans for the affected catchment areas were provided by Boban Stojanović from the Ministry for Environmental Protection of the Republic of Serbia. Photos of huchen catches from the River Jerma were provided by Aleksandar Panić, and from the River Mlava by Bojan Milošević and Nenad Pistolić. Azra Bakrač from the University of Bihać and Aleksandar Fotić from the University of Belgrade provided reports and evidence of translations and the autograph of Evliya Çelebi's "Seyahatnâmesi". The paper was supported by finances from the Contract with the Ministry of Science of the Republic of Serbia No. 451-03-47/2023-01/ 200178.

PRVI NALAZ MLADICE *Hucho hucho* (Linnaeus, 1758) U RIJECI GRZI: ČOVJEKOV UTJECAJ NA ŠIRENJE OVE VRSTE IZVAN NJEZINOG PRIRODNOG HABITATA U SRBIJI

SAŽETAK

Mladica ili dunavski losos, *Hucho hucho* (Linnaeus, 1758), jedna je od najvećih salmonidnih vrsta na svijetu i najveća vrsta koja potječe iz dunavskog sliva u Europi. U Srbiji ova vrsta nastanjuje sustav rijeke Drine, kao i gornji tok rijeke Ibar. Već je unesena u rijeke Moravicu i Đetinju, koje su dio slivnog područja Zapadne Morave. U posljednje vrijeme, mladice su poribljene iz svog izvornog područja rasprostranjenja u rijeke Jermu i Nišavu u sustavu rijeke Južne Morave, te u rijeku Mlavu koja se ulijeva u rijeku Dunav. Mladica je navedena kao ugrožena vrsta (EN) na Crvenom popisu ugroženih vrsta IUCN-a i zaštićena je u

Srbiji, s već postavljenim Akcijskim planom zaštite. U ovom izvješću predstavljamo prvi nalaz ove vrste u rijeci Grzi, koja je dio sustava rijeke Velike Morave, izvan njezinog autohtonog areala. Ihtiofauna ovog recipijentskog potoka sastoji se od potočne pastrve *Salmo trutta* L. i pijora *Phoxinus phoxinus* L. U ovako malom potoku osjetljivog ekosustava, uvođenje mladice kao vrhunskog predatora može ozbiljno naštetiti vrstama izvorne riblje zajednice, što upozorava na trenutno aktualna ilegalna poribljavanja.

KLjučne riječi: dunavski losos, ugrožena vrsta, neovlašteno poribljavanje, vrhovni predator, sliv Velike Morave

REFERENCES

- Anonymous (2009-2021): Zakon o zaštiti prirode. (Službeni Glasnik Republike Srbije (36/2009-76, 88/2010-162, 91/2010-133, 14/2016-8, 95/2018-267, 71/2021-3). <https://www.pravno-informacioni-sistem.rs/SIGlasnikPortal/eli/rep/sgrs/skupstina/zakon/2009/36/9/reg> [In Serbian]
- Evliyâ Çelebi B. Derviş Mehemed Zillî, (2001): Evliyâ Çelebi Seyahatnâmesi. Topkapı Sarayı Kütüphanesi Bağdat 307 Numaralı Yazmanın Transkripsiyonu – Dizini. Hazırlayanlar Yücel Dağlı, Seyit Ali Kahraman ve sair. 5. Kitap. İstanbul: Yapı Kredi Yayınları. [In Turkish]
- Freyhof, J., Kottelat, M., (2008): *Hucho hucho*. The IUCN Red List of Threatened Species 2008. (Accessed on 02 August 2023). <https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T10264A3186143.en>.
- Freyhof, J., Weiss, S., Adrović, A., Čaleta, M., Duplić, A., Hrašovec, B., Kalamujić, B., Marčić, Z., Milošević, D., Mrakovčić, M., Mrdak, D., Piria, M., Simonović, P., Šljuka, S., Tomljanović, T., Zabrc, D. (2015): The Huchen *Hucho hucho* in the Balkan region: Distribution and future impacts by hydropower development. *RiverWatch & EuroNatur*, 30 pp.
- Hegediš, A., Mičković, B., Cvijanović, G. (2005): Akcioni plan upravljanja mladicom u ribolovnim vodama Republike Srbije. Beograd: Centar za multidisciplinarne studije Univerziteta u Beogradu. [In Serbian]
- Holčík, J. (1982): Review of experiments with introduction and acclimatization of the huchen, *Hucho hucho* (Linnaeus, 1758) (Salmonidae). In Documents presented at the symposium on stock enhancement in the management of freshwater fisheries.
- Holčík, J. (1990): Conservation of the huchen, *Hucho hucho* (L.), (Salmonidae) with special reference to Slovakian rivers. *Journal of Fish Biology*, 37. 113 - 121.
- Holčík, J., Hensel, K., Nieslanik, J., Skácel, L. (1988): The Eurasian Huchen, *Hucho hucho*. Largest Salmon of the World. Springer Dordrecht, 1-296.
- Marić, S., Razpet, A., Nikolić, V., Snoj, A., Simonović, P. (2014): Analysis of genetic structure of huchen (*Hucho hucho*) in Serbia inferred from mitochondrial and nuclear DNA. *Acta veterinaria* 64 (2): 236-244, doi: 10.2478/acve-2014-0022
- Marić, A., Špelić, I., Radočaj, T., Vidović, Z., Kanjuh, T., Vilizzi, L., Piria, M., Nikolić, V., Škraba Jurlina, D., Mrdak, D., Simonović, P. (2022): Changing climate may mitigate the invasiveness risk of non-native salmonids in the Danube and Adriatic basins of the Balkan Peninsula (south-eastern Europe). *NeoBiota*, 76: 135–161.
- Šabanović H. (1979): Evlija Čelebi i njegov putopis. Putopis. Odlomci o jugoslovenskim zemljama. Evlija Čelebi. Prevod, uvod i komentar Hazim Šabanović. Veselin Masleša, Sarajevo, 1-706. [In Bosnian]
- Simić, V., Simić, S., Petrović, A., Đoković, M. (2022):Izmene i dopune programa upravljanja ribarskim područjem „Velika Morava 1“ (2017-2026). Prirodno matematički fakultet Univerziteta u Kragujevcu, Kragujevac, 1-40. [In Serbian]
- Simonović, P., Marić, S., Nikolić, V. (2000): Growth characteristics of huchen *Hucho hucho* (L.) from Rivers Drina, Una and Sana. *Acta Biologica Jugoslavica – Ekologija Belgrade*, 35: 123-126.
- Simonović, P., Nikolić, V., Tošić, A., Marić, S. (2011): Length-weight relationship in adult huchen *Hucho hucho* (L., 1758) from Drina River, Serbia. *Biologia Bratislava Section Zoology*, 66/1: 156-159.
- Šubjak, J. (2013): Observations of food and feeding of angler-caught huchen, *Hucho hucho* (L.), in Slovak rivers in winter. *Fisheries & Aquatic Life*, 21(3) 219-224.
- Weiss, S., Apostolou, A., Đug, S., Marčić, M., Oikonomou, A., Shumka, S., Mušović, A., Škrilje, R., Simonović, P., Vesnić, A., Zabrc, D. (2018): Endangered Fish Species in Balkan Rivers: their Distributions and Threats from Hydropower Development. *Riverwatch & Euronatur*, 162 p.
- Witkowski, A., Bajić, A., Treer, T., Hegediš, A., Marić, S., Šprem, N., Piria, M., Kapusta, A. (2013): Past and present of and perspectives for the Danube huchen, *Hucho hucho* (L.), in the Danube basin. *Fisheries & Aquatic Life*, 21(3) 129-142.