

# The State and Perspective of Danube huchen (*Hucho hucho*) in Bosnia and Herzegovina

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**Abstract.** This paper focuses on the historical and present occurrence of Danube huchen, *Hucho hucho* (L.), in Bosnia and Herzegovina. Danube huchen currently inhabits all large river systems in Bosnia and Herzegovina that it inhabited in the past, except for the Bosna River, from which it disappeared in the 1970s because of intense water pollution. Nevertheless, some populations of this species survive in Fojnička rijeka, Lašva and Krivaja, which are small, mountainous tributaries of the Bosna River. Bosnia and Herzegovina has never participated in the IUCN Red Book of freshwater fishes, but, since the Danube huchen is endangered in its distribution area, protection, conservation, and enhancement measures must be undertaken throughout the area in which this noble fish occurs.

**Keywords:** *Hucho*, distribution, river, salmonids, species conservation

## Introduction

The Danube huchen, *Hucho hucho* (L.), well-known in the Western Balkans region under the folk name *mladica*, is an iconic fish species in Bosnia and Herzegovina of great historical and cultural value

and socioeconomic importance. It is exceptionally highly-appreciated fish species and the most attractive fish for sport fishing. The largest salmonid and one of the largest freshwater fish species in Bosnia and Herzegovina, the Danube huchen can grow to considerable lengths and weights of up to 1.5 m and 50 kg, although, it is usually considerably smaller at up to 10 kg (Vuković and Ivanović 1971, Vuković 1977, Aganović 1979, Sofradžija 2009). The largest recorded specimen of Danube huchen was caught in 1938 in the Drina River near the town of Foča and weighed about 58 kg (Sofradžija 2009).

Salmonids, as one of the most numerously represented groups of fish in Bosnia and Herzegovina, are relatively well studied. In most cases, studies have included indigenous salmonid species of the Adriatic basin: *Salmo obtusirostris* (Heckel), *Salmo marmoratus* Cuvier, *Salmo dentex* (Heckel), etc. (for example: Čurčić 1938, Janković 1961, Kosorić and Vuković 1969, 1971, Berberović et al. 1970, Mikavica et al. 2002, Snoj et al. 2002, 2010, Glamuzina and Bartulović 2006, Glamuzina et al. 2010), or they have been included in some general studies about salmonids. Nevertheless, there is an insignificant number of papers about Danube huchen, and data about this species can be obtained only from studies that focus on fish populations in some river systems of the Danube river basin.

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## Distribution and population structure

The hydrographic system of Bosnia and Herzegovina is well developed. The total length of watercourses in Bosnia and Herzegovina is about 20,919 km (average  $0.41 \text{ km km}^{-2}$ ), of which almost half (9,011 km) are watercourses longer than 10 km. Runoff waters from Bosnia and Herzegovina flow in two directions: toward the Danube River – Black Sea Basin (75.7%) and to the Adriatic Sea – Adriatic Basin (24.3%) (Barbalić et al. 1998).

Danube huchen is widespread in the river systems of the Danube River basin in Bosnia and Herzegovina (Fig. 1). They inhabit the upper and middle courses of large mountain rivers, and move to small rivers and streams only during spawning. They spawn in the spring in March and April and sometimes in May (Vuković and Ivanović 1971, Vuković 1977, 1982, Aganović 1979, Mikavica 1987, Sofradžija 2009). In general, Danube huchen is distributed in all the waters of Bosnia and Herzegovina that are inhabited by common nase, *Chondrostoma nasus* (L.), which is its basic food.

Danube huchen currently inhabits all large river systems in Bosnia and Herzegovina that it inhabited in the past, except for the Bosna River, from which it disappeared in the 1970s because of intense water pollution. Nevertheless, some populations of this species survive in Fojnička rijeka, Lašva and Krivaja, which are small, mountainous tributaries of the Bosna River. Today, Danube huchen can be successfully angled in the main courses of the Una, Sana, Vrbas, and Drina river systems and some of their tributaries (Table 1) (Vuković 1977, 1982, Aganović 1979, Sofradžija 2009).

In studies conducted from 2000 to 2012, it was determined that Danube huchen populations were stable in all of the habitats of their natural distribution (see Appendix for list of studies). The exception is the Bosna River, which is quite polluted.

The largest population of Danube huchen was noted in the Una and Sana rivers in the Una sub-basin. These rivers are abundant in salmonids: brown trout, *Salmo trutta* L.; grayling, *Thymallus thymallus* (L.); Danube huchen; and cyprinids: barbel, *Barbus barbus* (L.); common nase; Danube roach, *Rutilus pigus* Lacepède. Danube huchen comprises shares from 2.9 % (Una River) to 3.8 % (Sana River) of the total fish populations. The abundance in these waters of Danube huchen is the result of good water quality in the upper and middle course of the rivers, and individual and collective protection by anglers and sport fishing associations.

The largest Danube huchen specimens are caught in the Drina River. Although three large dams were built on this river, this species has adapted and sustainable populations are observed in the newly-formed reservoirs. They can be found in almost all tributaries of the Drina River both throughout the year as well as during spawning. Danube huchen comprises less than 1 % of the total fish populations in Vrbas sub-basin. The reasons for this are multiple: low water flow during summer and fall, water pollution, weak protection measures, and the



Figure 1. Distribution of Danube huchen (*H. hucho*) in Bosnia and Herzegovina.

**Table 1**Distribution of Danube huchen (*H. hucho*) in some watercourses

Sub-basin	River	Tributary	Total length of watercourse (km)	Length of watercourse inhabited by Danube huchen (km)	
Una River system	Una	main course (1)	212.0	131.7	
		Klokot (2)	4.5	4.1	
		Krušnica (3)	7.5	6.1	
		main course (4)	140.2	108.6	
		Banjica (5)	8.1	2.5+	
	Sana	Kozica (6)	8.7	6.0+	
		Gomjenica (7)	18.7	12.0	
			399.7	271.0	
	Vrbas	main course (8)	235.0	160.0	
Vrbas River system	Vrbas	Ugar (9)	34.5	6.0	
			269.5	166.0	
		Krivaja	main course (10)	73.1	
			Bioštica (11)	17.0	
			Stupčanica (12)	29.9	
			Očevica (13)	8.7	
			Lašva (14)	47.5	
			Fojnička rijeka (15)	39.5	
				215.7	
Bosna River system	Drina		346.0	147.6	
			Čehotina (17)	261.9	
			Bistrica (18)	125.0	
			Sutjeska (19)	4.8*	
			Prača (20)	34.5	
			Lim (21)	19.5	
			Rzav (22)	59.2	
			main course (23)	220.0	
			Jadar (24)	72.0	
				39.9**	
Drina River system	Drinjaca		78.5	17.0***	
			Jadar (24)	64.7	
			919.2	44.9	
<b>Total</b>			1804.1	17.1	
				415.1	
				999.7	

Source: own studies and sport fishing association surveys

\* continue in Montenegro

\*\* continue in Serbia and Montenegro

\*\*\* continue in Serbia and Montenegro

+ enters only during spawning

mismangement of fish stocks. Studies have also shown that the habitats in tributaries where Danube huchen spawn are well preserved and that this species spawns successfully in them. Mountain streams and smaller rivers provide optimal conditions for the growth of young fish, and they can represent up to 50.0 % of the total fish population in these streams (streams no. 5,6,7,13,19, etc.).

## Habitat changes

The reasons for habitat destruction and degradation are numerous: the construction of engineering and

other projects in waters, the use of streams as roads in forest exploitation, water pollution, using streams as garbage dumps, for gravel and sand extraction, water use for irrigation, urbanization of coasts and waterbeds, etc. Each sub-basin inhabited by Danube huchen has specific types of habitat degradation, and, thus, should be considered individually.

The Drina River and its tributaries are clean and water quality is good, so the greatest problems in this region are the large dams on the Drina and a number of small hydropower facilities on its tributaries. In the near future, the Drina River might lose its course and run only in the lower plain segment. The impact of

these dams on the fish is selective. The Danube huchen is well adapted to the habitat conditions in the reservoirs (Višegrad and Perućac) on the upper course of Drina River. According to Mikavica et al. (1991) they are inhabited by up to 15 % of the total fish population in the Perućac Reservoir, as well as in the course of the Drina River in this area. In contrast, the Danube huchen has completely vanished from the Zvornik Reservoir, in the lower course of the Drina River. Many small hydropower facilities have been built on Drina River tributaries in the last twenty years, which have affected Danube huchen spawning significantly, and are especially detrimental during summer and fall when water levels are low.

The greatest habitat degradation has occurred in the Bosnia and Vrbas sub-basins located in central Bosnia and Herzegovina, which is the industrial center of the former Yugoslavia and the consequences of industrial pollution are still notable today. This area also has the densest human population, which furthers pollutes rivers with waste waters. High unemployment and poverty also leads to excessive fishing and poaching, and in many cases the fish caught are an important source of food. Minimum habitat degradation and the strictest fish protection measures are found in the Una sub-basin, where hydropower facilities are rare, pollution is minimal, and a large number of streams are protected. Additionally, in the largest part of this area salmonid "catch and release" angling is practiced.

Generally, all waters in Bosnia and Herzegovina are more or less burdened by industrial pollution and that from agricultural lands and facilities. The biggest water pollution problem is municipal wastewaters. Very few towns or cities have systems for sewage filtration so all wastewaters and sewage flow directly into rivers. Only in the last five years has this problem been approached seriously, with the result that separators have been installed in some cities.

## Conservation strategies

Scientific institutions, in collaboration with sport fishing associations, are endeavoring to maintain at

least the current state of salmonid populations through various projects, most of which are international in scope. However, the current difficult economic situation and the consequences of the war tend to trump notions of protecting endangered species or their habitats. Measures that are being implemented or have to be implemented in the future to protect, sustain, and improve huchen populations in Bosnia and Herzegovina are as follows:

*Habitat protection.* Although the waters of Bosnia and Herzegovina are inhabited by a large number of endemic and indigenous salmonids, there is no program at the state level for protecting endangered fish species. Habitats, however, are well protected at the local level thanks to the enthusiasm and love for salmonids of scientists and anglers, and in the past ten years protected habitats have been designated in each municipality where studies were conducted. Permanent bans on fishing and all other activities such as dam construction, gravel and sand extraction, swimming, etc. have been implemented in these habitats. Additionally, intensive huchen broodstock spawning and young fish rearing, which are monitored by scientific institutions, is supported in them.

*Artificial breeding.* Breeding salmonid species in Bosnia and Herzegovina always been of great significance. Danube huchen fry is reared using two methods: artificially in hatcheries and naturally in breeding and growing streams. Reproducing Danube huchen fry for stocking was organized as early as in 1903 on the Vrelo Bosne fish farm near Sarajevo (Harsányi 1982). In the second half of the twentieth century, many hatcheries successfully reared fry of indigenous salmonid species, and juveniles were used to stock open waters. Bosnia and Herzegovina supplied the entire territory of the former Yugoslavia with juvenile salmonids. Today, huchen fry are reared artificially in some specialized hatcheries in the Una and Drina rivers, but natural rearing in breeding and growing streams is much more widespread. Artificial insemination of broodstocks and egg incubation are done in special hatchery boxes. The hatched fry live freely in these streams and after they have grown, they descend into larger streams.

**Stocking.** According to the Law for Freshwater Fisheries, sport fishing associations are obliged to stock their fishing waters. Stocking programs are performed successfully annually under the supervision of federal and scientific institutions. One of the stocking methods employed is population translocation, which is done by transferring young into breeding streams in areas with low populations, but only within the same sub-basins. Transporting fish to other sub-basins is prohibited.

**Angler education.** This is a very important measure for protecting and improving fisheries. In addition to compulsory regulations, anglers must understand the importance of preserving habitats and indigenous fish populations. Special attention is focused on educating children, whether or not they are anglers. Lessons in school and in the field, learning about salmonid farming, and participating in stocking programs have all contributed vigorously to a growing awareness among children and youth.

**Legal regulations for Danube huchen protection.** In 2004, the Law for Freshwater Fisheries of the Federation of Bosnia and Herzegovina was adopted. Despite its many shortcomings, it has contributed to the improved protection and conservation of fish stocks and fishing waters. In 2012, the Law was adapted to comply with EU legislation, and it will come into force at the end of 2013. In this new Law, the protection of habitats, fish populations, and fish resources management are priorities. According to the Law, the Danube huchen closed season is from 1st January, to 31st May, the minimum angling length is 70 cm, and catches are limited to two huchen per angler annually. The Law also permits sport fishing organizations to implement even more rigorous measures for angling.

## Recommendation for future research

Bosnia and Herzegovina has never participated in the IUCN Red Book of freshwater fishes, but, since the Danube huchen is endangered in its distribution area, protection, conservation, and enhancement measures must be undertaken throughout the area in

which this noble fish occurs. Implementing these measures at the local level is spatially and temporally restricted. Assembling scientists and professionals from different specialties into individual teams with the goal of protecting, conserving, and enhancing populations of salmonids provides a firm foundation for more radical action. Therefore, it is essential to start compiling project documentation and developing strategies as soon as possible, and to support these efforts with basic research activities such as scientific networking, identifying fish distribution and abundance, and DNA typing to permit applying for assistance from relevant EU and international institutions (FP7, IPA, etc).

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