

Aquaculture development in Bosnia and Herzegovina

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ABSTRACT

Bosnia and Herzegovina has a very long and rich tradition in aquaculture. Important advantages that the country possesses for the development of aquaculture include abundant clean water, high-quality, educated and cheap labour, high capability of fish processing factories, and the high quality of its hatcheries. Thanks to these and other factors, Bosnia and Herzegovina has a great potential for increasing national aquaculture production. During the war period of 1991–1995, the majority of the fish farms were destroyed along with their entire infrastructure. After the war, the process of privatization started, leading to an increase in fish production. The privatization of the fish farms, which since 1995 were in the possession of the State, has broadened the possibilities for aquaculture development in the country, including the use of new technologies, the expansion of capacity and the production of high-quality feeds. The export of fish and fish products from Bosnia and Herzegovina to European Union markets as officially permitted by EU Decision 2008/156/EC is the most important success of Bosnia and Herzegovina's agriculture sector in the post-war period.

INTRODUCTION

Bosnia and Herzegovina is located in the Western Balkans region and has a total surface area of 51 209.2 km², of which land accounts for 51 197 km² and sea accounts for 12.2 km². Air distance by latitude and longitude is 314 km north to south (2°43'30'') and 309 km from east to west (3°53'41''). The national border is 1 538 km long, of which 774 km is land border, 751 km is river border and 13 km is sea border. The longest river is the Drina, being 346 km long, and the largest lake is Buško Blato, with an area of 55.8 km², an elevation of 716.6 m above sea level and a maximum depth of 17.3 m.

The first written data on organized fishing in Bosnia and Herzegovina dates back to the late nineteenth century. During that time, fishing was under the control of the Forestry Directorate and taxes were imposed on professional fishermen as a so-called "fishing fee" (e.g. in the nature park Hutovo Blato). The organized protection of water bodies and legal regulations were introduced by Decree in 1886. Founded in 1892, "Fischerei-Verein fur Bosnien-Herzegovina" was the first fishermen's association in

Bosnia and Herzegovina. The “Fishermen Association” was the first sport fishermen’s association, and was established in Sarajevo in 1906.

The introduction of fish culture to Bosnia and Herzegovina is associated with the establishment of the fish farm “Vrelo Bosne” near Ilidža in 1894. A new hatchery, the largest and the most modern hatchery in the region at the time, was built in 1898 with a capacity of 600 000 pieces of fry. It played an essential role in the development of salmonid fish culture and associated stocking programmes. Development of cyprinid fish culture in the country began in 1902 when a Polish citizen, Viktor Burda, purchased 300 acres of barren land near Prijedor and 600 acres near Bosanska Gradiška from the Government and constructed fish farms producing 300–400 and 100–150 kg/acre, respectively (Hamzić, 2003).

During the Yugoslavia Kingdom (1919–1941), development in the area of aquaculture in Bosnia and Herzegovina was in stagnation; however, during the period of the Federal Yugoslavia (1946–1991) significant development occurred. During 1946–1982, a new and more intensive model for the culture of fish and other aquatic organisms developed rapidly. A system using floating cages in lakes and reservoirs using high stocking densities and highly nutritious pelleted feeds was developed, leading to significantly higher production.

During the same period, cyprinid fish species (grass carp, silver carp and bighead carp) were introduced and produced. At the same time, the production of salmonid species achieved full expansion. In 1952, the Institute for Fishery was established. It subsequently merged with the Sarajevo University Institute of Biology, which conducted extensive scientific activities and played an important role in the development of ichthyology and fisheries, in particular salmonid and cyprinid fish production, in Bosnia and Herzegovina.

The Center for Fishery was established in 1959 as a part of the School for Scientific and Technological Cooperation of the Veterinary Faculty of the University of Sarajevo. This center had a huge impact in the field of disease diagnostics, prevention and management in controlled salmonid and cyprinid culture.

In 1964, BiH had 13 salmonid farms with a total surface area of 38 000 m². In 1982 salmonid farms produced 1 086 tonnes per year, and by 1990 the country had a production of approximately 3 000 tonnes of fish for consumption (Hamzić, 2003; Arthur and Reantaso, 2007).

During the war of 1991–1995, the majority of fish farms were destroyed along with their entire infrastructure (Arthur and Reantaso, 2007; FAO, 2007). After the war, a process of privatization was started, leading to an increase in fish production. The privatization of fish farms, which in 1995 were in possession of the State, has broadened the opportunities for aquaculture development in Bosnia and Herzegovina through the adoption of new technologies, expansion of production capacity and the use of high-quality feeds.

According to the survey conducted by Hamzić (2003), during the period 1999–2003 there were production increases in the various subsectors as follows:

- total production of fish and shells for consumption: 55 percent
- production of salmonid eggs: 98 percent
- production of salmonid fry: 69 percent
- production of salmonids for consumption: 82 percent
- production of cyprinid fry: 19 percent
- production of cyprinids for consumption: 11 percent
- production of marine fish and shells: 650 percent
- production per employee: 37 percent
- production capacities: 12 percent
- employment: 12 percent



Photo of Lake Buško Blato

HYDROGRAPHY OF BOSNIA AND HERZEGOVINA

The hydrological resources of Bosnia and Herzegovina belong to the river basins of the Black and Adriatic seas. Bosnia and Herzegovina has following aquatic resources:

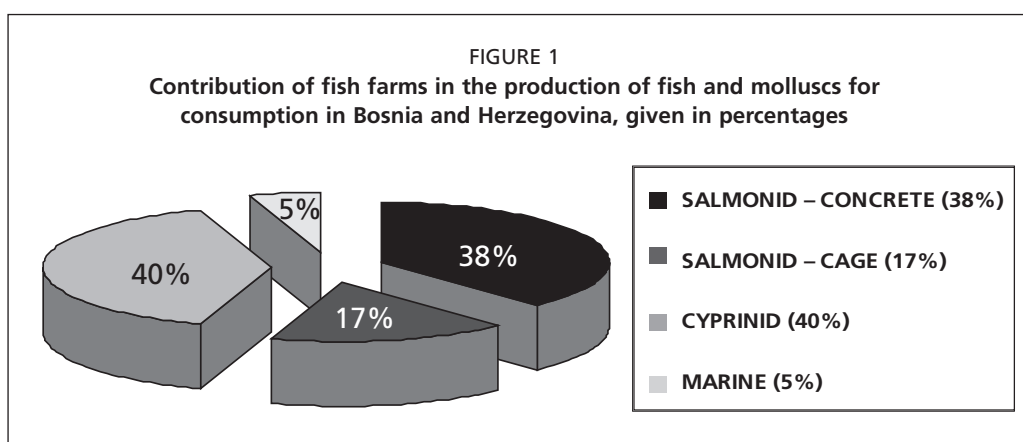
- 20 000 km of rivers and brooks (including the Sava, 355 km; Drina, 346 km; Bosna, 308 km, Vrbas, 240 km; and Una, 207 km);
- 400 ha of lakes (including Buško Blato, Višegradsko, Jablaničko, and Modrac). Buško Blato Lake (shown in Figure 1) is the largest lake in Bosnia and Herzegovina with a surface area of 55.8 km² and a water volume of 782 million m³. Currently fish production on the lake is not organized; and
- 1 400 ha of seacoast (12.2 km long).

DISTRIBUTION OF FARMING SYSTEMS AND THEIR CHARACTERISTICS

Fish farms in BiH are generally distributed in three main regions. In northern Bosnia, there are salmonid and cyprinid farms in the Neretva and Una rivers and in the Vrbas River there are salmonid farms. Additionally, marine aquaculture has developed in the Adriatic Sea at Neum.

According to data provided by the Center of Aquaculture of the Veterinary Faculty in Sarajevo, there are 30 registered fish farms in Bosnia and Herzegovina (i.e. “Martin Brod”, Martin Brod; “Klokot”, Bihać; “Tropic Ribarstvo-Ribnik”, Ribnik; “Tropic Ribarstvo-Bočac”, Crna Rijeka; “Tropic Ribarstvo-Krupa na Vrbasu”, Krupa na Vrbasu; “Tropic Ribarstvo-Jezero”, Jezero; “Ribogojilište” d.o.o., Bugojno; “Norfish”, Blagaj; “Norfish”, Salakovac; “Salmon d.o.o.”, Ljubuški; “Pastrmka”, Drežnica; “Bijela”, Salakovac; “Forele”, Salakovac; “Laks” d.o.o., Salakovac; “Drežanjka d.o.o.”, Drežnica; “Eko-Fish”, Jablanica; “Šanica”, Jablanica; “Prenj”, Jablanica; “Zeriko”, Drežnica; “Krupić”, Prozor; SPD “Kavezni uzgoj ribe”, Prozor; “Ljuta”, Konjic; PJ “Gunjani” Kreševo; “Salmon d.o.o.”, Salakovac; “Žunovnica”, “Hadžići; d.o.o.” “Ribamerc”, Krupa na Vrbasu; d.o.o. “Slapovi”, Krupa na Vrbasu; “Restoran Pečina”, Čelebići; “Butrex Ribarstvo”, Trebinje; “Jazine”, Trebinje).

In addition, there are five registered cyprinid fish farms (i.e. doo “Ribarstvo”, Sijekovac; doo “Kušljic Commerce”, Sijekovac; AD “Saničani”, Prijedor; AD “Ribnjak Prnjavor”, Prnjavor; “Ribnjak Bardača”, Srbac) and two marine fish farms in Neum, Ancora. It is assumed that there are many of unregistered fish farms, mostly of small capacity.



Salmonid farms mainly use concrete tanks with optimal flow and high-quality water. Aeration has not been used, and a large number of these fish farms do not have filters for purification of used water. After the war, there was an expansion of cage culture in the rivers Neretva, Una and Vrbas. Today, with the help of new technology from Norway, cages with dimensions 10 x 10 x 10 m are in use in Salakovac Lake (previously their dimensions were 5 x 5 x 5 m).

Cyprinid farms using earthen ponds have a long tradition in production. Unfortunately, there are no hatcheries for cyprinid species in Bosnia and Herzegovina, and as a result, fingerlings are imported from other countries, such as Croatia and Hungary. The quality and quantity of water is satisfactory, except during periods of extreme drought.

Marine aquaculture is carried out in only two fish farms using cages located in the Adriatic Sea at Neum. Molluscs are cultivated in the traditional way.

In Bosnia and Herzegovina there are two factories for fish processing, one located in Salakovac and the other in Banja Luka. They use modern technology, produce a wide range of products and have an annual capacity of approximately 3 000 tonnes. The contribution of fish farms to the production of fish and molluscs for consumption in BiH is shown in Figure 1 (Hamzić, 2003; Hamzić and Ecimovic, 2004).

FISH AND MOLLUSCS OF BOSNIA AND HERZEGOVINA

The ichthyofauna of the country comprises approximately 120 species. The most important fish and molluscan species used in the aquaculture sector in the country are:

- Salmonids: rainbow trout (*Onchorhynchus mykiss*), brown trout (*Salmo trutta fario*) and brook char (*Salvelinus fontinalis*).
- Cyprinids: common carp (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*) and wels catfish (*Silurus glanis*).
- Marine fishes: European seabass (*Dicentrarchus labrax*), gilthead seabream (*Sparus aurata*) and common dentex (*Dentex dentex*).
- Molluscs: Mediterranean mussel (*Mytilus galloprovincialis*) and European flat oyster (*Ostrea edulis*) (Aganović, 1979; Hadžiselimović and Hamzić, 1999).

AQUACULTURE PRODUCTION, MARKETS AND TRADING PATTERNS

Data on aquaculture production have been obtained from the private sector, since there is no institution at the state level that collects and distributes data on production and type of products (see Tables 1 and 2). Because available data on the production of fish and fry in 2006 and 2007 are contradictory, they have not been included.

Traditionally, consumers in Bosnia and Herzegovina buy live freshwater fish for consumption from fish shops. Of the total production of foodfish, approximately 65 percent is from the domestic markets of the larger cities such as Sarajevo, Banja

TABLE 1
Production of foodfish by aquaculture in Bosnia and Herzegovina, 1999–2005 (tonnes)

Year	Salmonids	Cyprinids	Marine species	Total
1999	1 389	1 807	40	3 236
2000	1 785	1 602	60	3 447
2001	2 241	1 818	70	4 129
2002	2 737	2 009	190	4 936
2003	2 794	2 422	172	5 388
2004	3 085	2 811	174	6 070
2005	3 410	2 968	163	6 541

TABLE 2
Production of salmonid fry in Bosnia and Herzegovina, 1999–2005 (tonnes)

YEAR	1999	2000	2001	2002	2005
SALMONID FRY	890	830	781	1 057	1 570

TABLE 3
Summary of trade in fish and fish products in Bosnia and Herzegovina in 2005 and 2006 (kg)

	Import		Export		Transport	
	2005	2006	2005	2006	2005	2006
Fish fry	36 824	21 795	25 460	–	–	–
Fish/fish products	8 506 986	12 652 146	959 839	248 123	92 831	784 589
Live fish	150 040	368 016	227 482	2 034 779	–	–
Feed for fish	5 611 205	3 207 557	165	–	116 000	223 395

Luka, Mostar, Tuzla, Bihać and Zenica. Approximately 35 percent of the production is exported to Serbia and Montenegro and a smaller quantity to Croatia. Table 3 provides a summary of trade in fish and fish products in the country in 2005 and 2006. Data for 2007 is not given because it could not be obtained for all border crossings where transportation of fish and fish products is conducted.

The main exported species are common carp, grass carp and rainbow trout. These species are exported mainly as fresh products and iced. A smaller amount (approximately 15 tonnes) is exported as smoked fish. Rainbow trout is the most important species in aquaculture.

ANALYSIS OF AQUACULTURE IN BOSNIA AND HERZEGOVINA

Bosnia and Herzegovina has a very long tradition in aquaculture assured by its favourable geographical, hydrological and ecological conditions that are conducive to intensive production and trade in aquaculture products. Some of the important advantages that Bosnia and Herzegovina possesses include abundant high-quality water, educated and inexpensive labour, high fish processing capacity, and the high quality of its hatcheries.

However, some of the weaknesses that affect aquaculture development in Bosnia and Herzegovina should also be mentioned. The most important of these weaknesses are the existence of unregistered fish farms, a black market, an unfinished system of veterinary certification, low domestic fish consumption, a lack of domestic fish feed production, limited cold storage facilities for fish transportation, undeveloped road infrastructure, lack of adequate support for aquaculture production, poor bank loan conditions and an uncoordinated market. These disadvantages were observed in the analysis conducted in the spring of 2007. However, with the help of FAO Project TCP/BiH/3101 “Strengthening Capacity on Aquaculture Health Management” numerous activities were initiated in 2007 and 2008 that have resulted in improvement of some of these weaknesses. This was possible due to the active involvement of the relevant competent authorities and other stakeholders (the SVO and the relevant ministries, inspectorates and laboratories) in solving the ongoing problems.

The Department of Aquaculture, Veterinary Faculty of the University of Sarajevo was appointed as the National Reference Laboratory for Viral Diseases (NRL) (Jažić and Zuko, 2004). Its diagnostic performance was significantly improved through a comprehensive diagnostic training of NRL staff at the Community Reference Laboratory, Aarhus, Denmark, which was one of the major outputs of the Project. Currently, the NRL is being equipped to undertake the internationally required diagnostic method of cell cultivation. In addition, activities aimed towards certification of the NRL according to the BAS EN ISO/IEC 17025:2005 standard are also in progress.

Development of aquaculture is supported by a desirable health status of salmonids and cyprinids, especially in relation to the occurrence of bacterial and viral diseases in 2007 and 2008. Along with this, veterinary inspectors and fish farmers were trained in the control and surveillance of fish diseases. At the same time, registration of unregistered fish farms is in progress according to the relevant national legislation¹, which provides the legal basis for the registration of all facilities involved in the production and processing of fish. Entity competent authorities carry out registration of facilities for production and placing in market of fish and fish products and crabs and crab products.

According to the data obtained from the SVO, the last phase is completing the legislation and system of veterinary certificates and planning of monitoring of infectious diseases of fish in 2008. All this is supported by the relevant EU regulation², which permits exportation of fish and fish products to the EU market. In accordance with the information provided by the SVO, amendment of veterinary health certificates for live fish according to relevant new EU legislation is in progress, and it is planned to be in use very soon. As stated by the SVO officials, after permission to export Bosnia and Herzegovina aquaculture products to the EU market was received, few requests for EU export permission were submitted. During the period from May 30 to June 3, 2008 inspection by the SVO was performed with the aim to assess seven fish production facilities involved in the breeding and processing of fish and fish products. According to the inspection report, some weaknesses were found and recommendations for improvement were given to the facilities, along with the implementation deadlines.

Considering the opportunity to export Bosnia and Herzegovina's aquaculture products to the EU and regional markets, it is necessary to complete the process of updating and harmonizing state and entity legislation, achieve international accreditation and complete final equipping of the NRL, provide uniform registration of all fish farms at the national level, and maintain and improve an internationally recognized aquatic animal health surveillance and disease control system.

CONCLUSIONS

The natural resources of Bosnia and Herzegovina, such as its good geographical position, the abundance of high-quality water, and its favourable climatic, hydrological and ecological conditions provide very important conditions and a great potential for intensive aquaculture production and trade in aquaculture products. With the help of FAO Project TCP/BiH/3101 "Strengthening Capacity on Aquaculture Health Management" numerous activities were initiated in 2007 and 2008, and some key weaknesses were addressed. An active involvement of all competent authorities in solving the ongoing problems, which was initiated by official permission of exportation of fish and fish products from BiH to the EU market, contributed to these successes.

¹ Decision on veterinary-health conditions which have to be fulfilled in premises for farming, production and trading of fish and products thereof, and of crustaceans and products thereof (OJ of BiH, 5/04).

² Reg. 2008/156/EC amending Decision 2006/766/EC as regards the list of third countries and territories from which imports of fishery products in any form for human consumption are permitted (OJ L 50).

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