

AQUACULTURE IN SERBIA

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Abstract

Serbian aquaculture is practiced in warmwater (carp) farms, coldwater (trout) farms, cage systems, recirculating aquaculture systems (RAS) and fish tanks. The total area under carp farms (ponds) registered by the Statistical Office of the Republic of Serbia (SORS) in the last fourteen years has varied between 6,192 and 8,940 ha, while under the area under trout farms was between 33,255 m² and 81,411 m². Total fish production over the last fourteen years varied between 5,070 tons, recorded in 2017 and 8,195 tons of market fish, recorded in 2010. Fish production is dominated by common carp and rainbow trout (about 90% of total production). In addition to these two species, several other species are cultured at carp farms, such as catfish, pikeperch, pike, silver carp, bighead carp, grass carp, Prussian carp and tench. In trout farms, additional cultured species are usually brook trout, huchen and grayling, while cultured fish species in RAS systems are sterlet and Russian sturgeon.

Keywords: aquaculture, fish farm, fish rearing, Serbia

Historical background

Dositej Obradović, one of the greatest Serbian educators, brought the idea of carp production from his journey to Hungary in the 18th century. The first record of the existence of fish farms originates from 1860, when the first fish farm was established in the northern province of Serbia, Vojvodina (Marković and Poleksić 2009). The beginnings of contemporary aquaculture in Vojvodina are linked with the establishment in 1894 of the oldest and biggest fish farm in Serbia, the Ečka fish farm, when a regulation for use of White Lake (Belo Jezero) was completed.

In the period before the Second World War, the few fish farms were privately owned. After the introduction of the socialist system in 1945, these farms became state owned. After the Second World War, aquaculture production increased slightly. The period between the seventies and nineties was marked by the expansion of fish farms. Farms of higher capacity were built by state companies, while smaller farms, primarily family businesses, were built by private individuals. Carp farms arose on Vojvodina's plains, trout farms in the mountainous regions of Serbia, south of the rivers Danube and Sava, near springs of suitably large capacity.

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After the break-up of Yugoslavia in the 90s when former Yugoslavian countries gained independence, Serbia as an independent state saw the development of private entrepreneurship. Privatization of the state-owned fish farms started in 2003. Nowadays, Serbia's fish farms are mostly privately owned (Marković 2019).

Aquaculture in Serbia

Aquaculture in Serbia is practiced in warmwater (carp) farms, coldwater (trout) farms, cage systems, recirculating aquaculture systems (RAS) and fish tanks. The number of fish farms registered by the Veterinary Directorate is 149, of which 77 are carp farms, 68 are trout farms and 4 are farms for rearing sterlet (RAS systems). Fish culture in fish tanks is mainly practiced as a hobby with a small number of specialized breeders and three small public aquaria.

The total area under carp farms registered by the Statistical Office of the Republic of Serbia (SORS) in the last fourteen years has varied between 6,192 and 8,940 ha, while the area under trout farms was between 33,255 m² and 81,411 m² (Figs. 1 and 2).

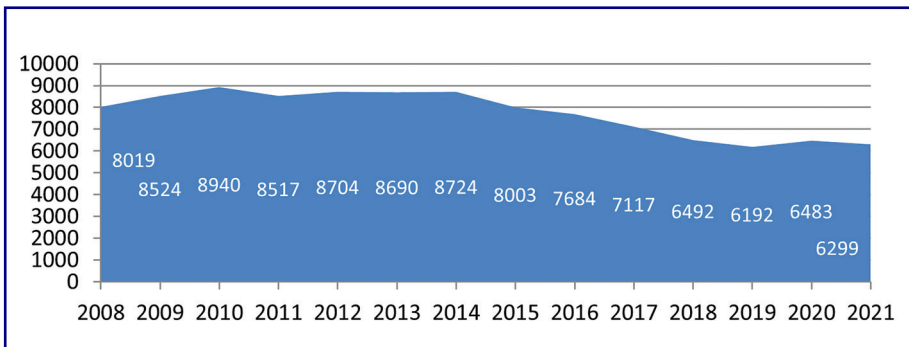


Figure 1. Total area (ha) under carp farms during the period 2008 – 2021 (Source: SORS)

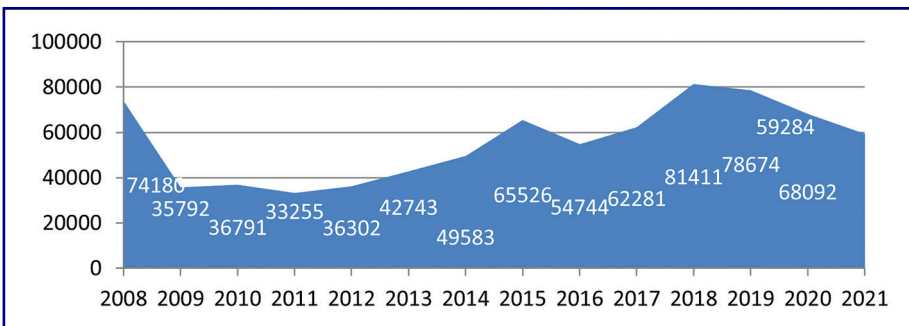


Figure 2. Total area (m²) under trout farms during the period 2008 – 2021 (Source: SORS)

The number of employees in the aquaculture sector in the last fourteen years has varied between 730 and 934 (Table 1).

Table 1. Number of employees in the fisheries sector (2008 – 2021)

	Year													
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of employees in the aquaculture sector	920	878	934	798	751	948	837	910	900	730	765	748	765	839

Source: SORS

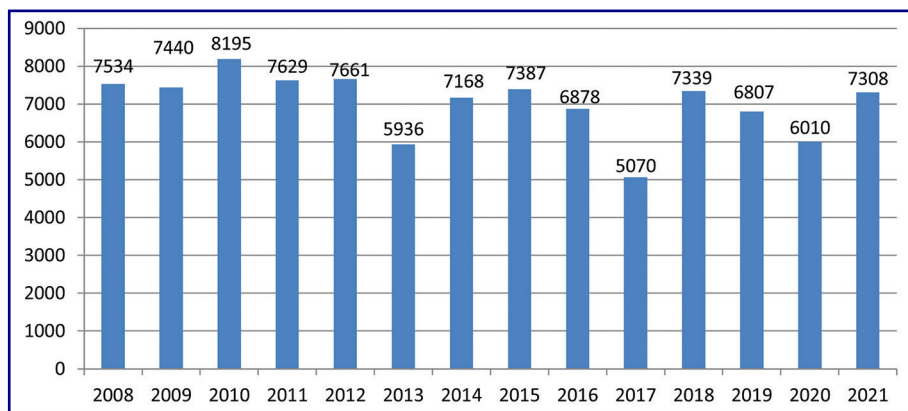


Figure 3. Total consumable fish production (t) during the period 2008 – 2021 (Source: SORS)

Total fish production over the last fourteen years varied between 5,070 tons recorded in 2017 and 8,195 tons of market fish, recorded in 2010 (Fig. 3).

When the total quantity of fish produced in Serbia in 2008 was compared with the EU member states, production in Serbia was around average, meaning that 12 EU member states produced lower quantities of fish than Serbia (Fig. 4).

Fish production is dominated by common carp and rainbow trout (over 90% of total production). In addition to these two species, several other species are cultured on carp farms, such as catfish, pikeperch, pike, silver carp, bighead carp, grass carp, Prussian carp and tench. On trout farms, additional cultured species are usually brook trout, huchen and grayling, while the predominant cultured fish species in RAS systems are sterlet and Siberian sturgeon.

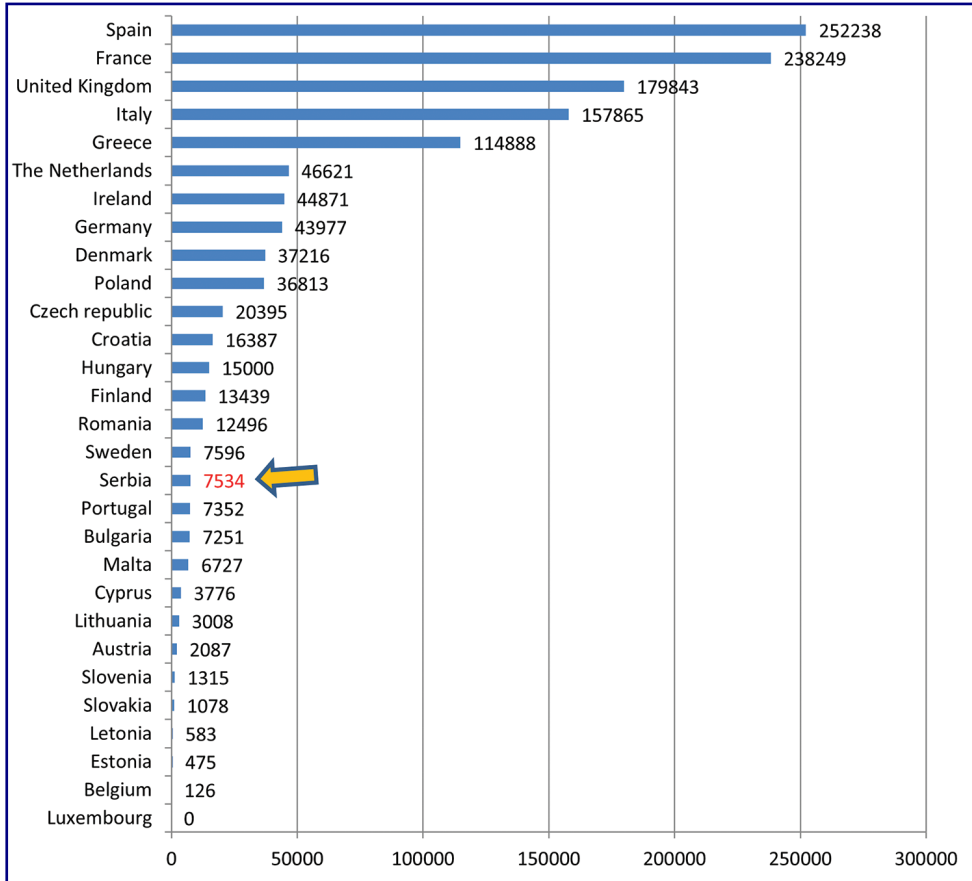


Figure 4. Aquaculture production in Serbia (t) compared to EU member states (2008)
 Source: https://ec.europa.eu/eurostat/statisticsexplained/index.php?title=Aquaculture_statistics&oldid=356961 and SORS

Fish production in warmwater (carp) farms (ponds)

About 99.9% of the surface area of all fish farms in Serbia makes up carp farms. They are located mainly (about 98% of surface area) in lowland parts of Vojvodina. Among all carp farms, 25 (6 of which have a surface larger than 500 ha) account for 85% of all carp farm surfaces that are being exploited. About 58% of the water supply comes from rivers, 39% from irrigation and drainage canals and 4% from wells.

Carp production in Serbia takes place in semi-intensive systems (more than 90%). This type of common carp production is based on the combination of natural food (zooplankton and bottom fauna) and additional feed, i.e., cereals and compound feed, extruded and pelleted (Marković et al. 2016). In Serbia, extensive production in fish ponds is almost non-existent, apart from when this is necessitated by an occasional lack of running capital that causes the absence of feeding. A very small percentage of production in carp ponds is intensive. Intensive production is usually applied in

fry production in small fish ponds, where the production reaches 4,000 to 10,000 kg/ha, using aerators and compound feed. Based on data from SORS, production in the period 2008 to 2021 varied between 4,148 tons (in 2017) and 7,322 tons (in 2010) of market size warmwater fish (Fig. 5).

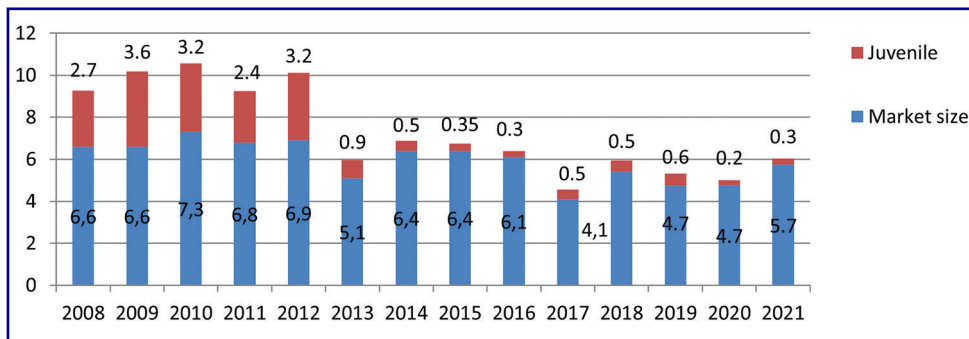


Figure 5. Total juvenile and market size fish production (000 t) in Serbian carp ponds during the period 2008 – 2021 (Source: SORS)

Carp is mainly produced in poly-culture, with the accompanying species being the herbivorous silver carp, bighead carp and grass carp and the predatory fish, Wells catfish, pike-perch and northern pike. Based on data from SORS, production in the period 2008 to 2021 varied between 3,761 tons (in 2017) and 6,156 tons (in 2010) of market size common carp (Fig. 6).

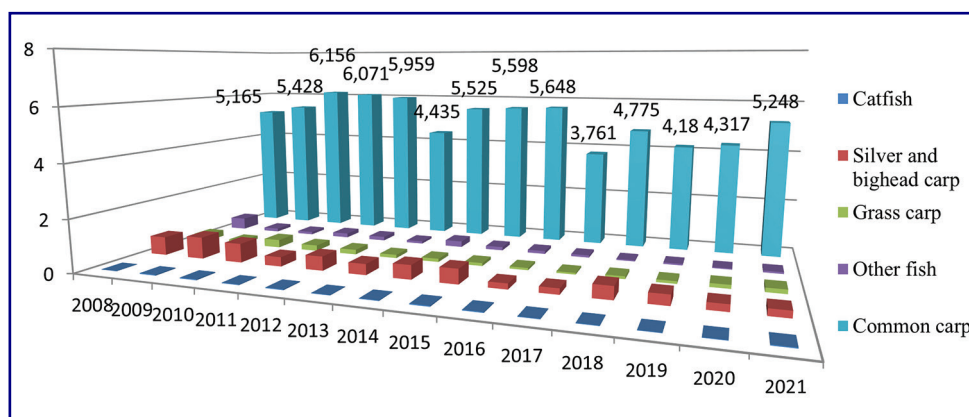


Figure 6. Production of market size fish (t) by species in Serbian carp ponds during the period 2008 – 2021 (Source: SORS)

Fish production in coldwater (trout) farms

Trout farms are located in the hilly mountainous regions of Western, Eastern, and Southern Serbia. The main farmed species in coldwater farms is rainbow trout. There are only a few fish farms where species such as brown trout, grayling and huchen are cultured, and these are produced only in small quantities. Based on data from SORS,

production in the period 2008 to 2021 varied between 736 tons (in 2014) and 2,079 tons (in 2019) of market size trout (Fig. 7). Variations in production are primarily the consequence of drought. For example, 2012 was very dry, and so the flow of water into the water supply for trout farms was minimal. Despite the fact that intensive farming systems are applied, on average, a very small amount of fish per cubic meter is produced on these farms (from 12 to 30 kg/m³ water). The reason is the fact that a large number of trout farms operate at only part of their constructed capacity. This induces fish farm dependence on spring and river capacities, whence their water supply is derived. However, in the last decade, systems for water aeration with oxygen have been increasingly used. This enables steady production, significantly higher than the average production in Serbia (up to 50 kg/m³ water). Unlike feed for carp, which is obtained only from Serbian factories, feed used on trout fish farms is usually imported.

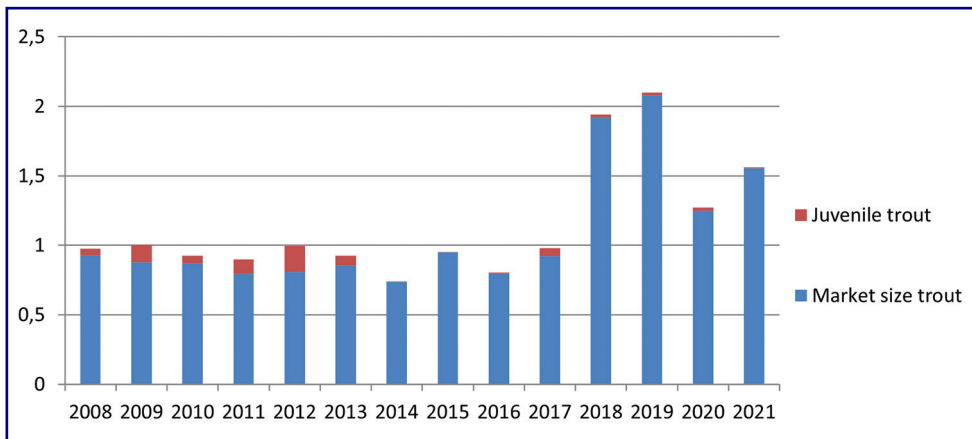


Figure 7. Total juvenile and market size fish production (000 t) in Serbian trout farms during the period 2008 – 2021 (Source: SORS)

Potential for development of aquaculture in Serbia

The potential for development of the aquaculture sector in Serbia is huge, and significant resources are available. The most important resources are: large, open barren areas of land in Vojvodina that cannot be used for agriculture, but which are suitable for the construction of carp ponds; available water resources; abundance of raw ingredients for the production of fish feed; already existing unused capacities for the production of extruded fish feed; already developed modern common carp and rainbow trout selective breeding programs; fish processing capacities constantly increasing; potential for a significant increase in the placement of fish on the domestic market; a huge deficit of fish in the European market; continuous increase in fish consumption in Europe and worldwide. All of these facts point to the evidence that Serbia could reverse the current trend in foreign fish trade, from deficit to a huge surplus, in a short period of time.

CONCLUSIONS

Fisheries represent only a small segment of the Serbian economy. In the overall turnover (sale and income) of agricultural, forestry and fishery products, fish turnover has been around 0.5% during the last two decades. The gross added value of fisheries accounts for only 0.03 to 0.04% of GDP. The fisheries sector in Serbia operates through three branches, i.e., aquaculture (production of fish), inland freshwater fisheries for wild-caught fish, and processing of fish (Marković 2020). Serbian aquaculture is practiced in warmwater (carp) farms (ponds), coldwater (trout) farms, cage systems, recirculating aquaculture systems (RAS) and fish tanks. The number of fish farms registered by the Veterinary Directorate is 149, of which 77 are carp farms, 68 are trout farms and 4 are farms for rearing sterlet and Russian sturgeon (RAS systems). Fish production is dominated by common carp and rainbow trout (over 90% of total production). In addition to these two species, several other species are cultured on carp farms, such as catfish, pikeperch, pike, silver carp, bighead carp, grass carp, Prussian carp and tench, while on trout farms, brook trout, huchen and grayling are cultured, and cultured species in RAS systems are sterlet and Russian sturgeon. Carp farms are mainly located in Vojvodina and trout farms in the mountainous areas of Serbia. The total area under carp farms registered by SORS in the last fourteen years has varied between 6,192 and 8,940 ha, while the area under trout farms was between 33,255 m² and 81,411 m². Based on data from SORS, production in the period 2008 to 2021 varied between 4148 tons (in 2017) and 7,322 tons (in 2010) of market size warmwater fish, and between 736 tons (in 2014) and 2,079 tons (in 2019) of market size trout. There is vast potential for development of the aquaculture sector in Serbia, and the resources available for this are enormous (Marković 2019).

Acknowledgements

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AKVAKULTURA U SRBIJI

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Kratak sadržaj

Akvakultura Srbije obuhvata gajenje riba u toplovodnim ribnjacima (šaran), hladnovodnim ribnjacima (pastrmka), kaveznim sistemima, recirkulacionim sistemima akvakulture (RAS) i akvarijumima. Ukupna površina pod šaranskim ribnjacima koje je registrovao Republički zavod za statistiku (RZS) u poslednjih četrnaest godina kretala se između 6.192 i 8.940 ha, dok je površina pod pastrmskim ribnjacima iznosila između 33.255 m² i 81.411 m². Ukupna proizvodnja ribe u poslednjih četrnaest godina kretala se između 5.070 tona, zabeleženih u 2017. godini, i 8.195 tona tržišne ribe, zabeleženih u 2010. godini. U proizvodnji ribe dominiraju šaran i kalifornijska pastrmka (oko 90% ukupne proizvodnje). Pored ove dve vrste, na šaranskim ribnjacima uzgaja se još nekoliko vrsta, kao što su som, smuđ, štika, sivi i beli tolstolobik, amur, babuška i linjak. Na pastrmskim ribnjacima dodatne gajene vrste su obično potočna pastrmka, glavatica i lipljen, dok su gajene vrste riba u RAS sistemima kečiga i ruska jesetra.

Ključne reči: akvakultura, ribnjaci, gajenje riba, Srbija