

## AQUACULTURE AND FISHERY IN SERBIA – STATUS AND POTENTIALS

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### AKVAKULTURA I RIBARSTVO U SRBIJI – STANJE I POTENCIJAL

#### *Apstrakt*

Akvakultura u Srbiji se najvećim delom realizuje u objektima akvakulture: pastrmskim i šaranskim ribnjacima. Ukupna površina pod šaranskim ribnjacima je oko 14 000 hektara, od čega je oko 20% van funkcije. Pod pastrmskim ribnjacima je oko 14 hektara od čega je oko 15 % van funkcije. U šaranskim ribnjacima se proizvodi šaran, beli i sivi tolstolobik, beli amur i grabljičice: som i smuđ. U pastrmskim ribnjacima se proizvodi kalifornijska (dužičasta) pastrmka. Na malom broju ribnjaka se proizvodi mlađ toplovodnih (deverika, linjak, zlatni karaš, šaran divljak) i hladnovodnih vrsta riba (potočna pastrmka, mladica, lipljan) za poribljavanje tekućih i stajaćih vodenih ekosistema. Ukupna proizvodnja u poslednjih dve godine se kreće u količini od oko 15 000 tona, od čega oko 2 000 tona kalifornijske pastrmke (od čega konzumne pastrmke oko 75%), i oko 13 000 tona toplovodnih vrsta riba (oko 11 000 tona šarana i oko 2 000 tona pratećih vrsta riba), od čega 70 do 75% konzumne ribe.

Svi vodeni ekosistemi u Srbiji, sem objekata akvakulture (pastrmskih i šaranskih ribnjaka) i hidroakumulacija čije su prioritetne namene vodosnabdevanja se svrstavaju u ribolovne vode. Ukupna dužina svih potoka i reka je 65 980 km. Broj vrsta riba koje naseljavaju vodene ekosisteme u Srbiji je 89, svrstanih u 57 rodova i 20 familija. Od košljoriba koje naseljavaju vode u Srbiji 52 vrste se love rekreativnim i privrednim ribolovom. Privrednim ribolovom se bavi oko 260 privrednih ribara. Prosečan privredni ribar obavi oko 200 ribolovnih izlazaka na vodu u toku godine. Broj rekreativnih ribolovaca se u poslednjih desetak godina kreće od 58 000 (2001) do preko 100 000 (2002. godine). Prosečan rekreativni ribolovac godišnje obavi oko 50 ribolovnih izlazaka na vodu. Prema podacima RZS izlov iz reka u Srbiji je poslednjih godina između 2 000 i 3 000 tona.

Potencijal razvoja akvakulture je baziran na mogućnostima unapređenja proizvodnje na postojećim ribnjacima, povećanju proizvodnih ribnjačkih površina, proizvodnji hra-

ne za ribe, prerađivačkim kapacitetima za koje Srbija poseduje sirovine i potencijal za plasman preradjevina od ribe na tržište zemalja EU i drugih država.

Potencijal ribolova se može podeliti na onaj koji pružaju brdsko planinske tekućice i potencijal koji pružaju ravničarske reke. Potencijal brdsko planinskih tekućica baziran je na rekreativnom ribolovu, odnosno ribolovnom turizmu koji bi se razvio kao posledica želje da se dođe baš na izabrano područje. U cilju stvaranja atraktivnih ponuda, stvoren je osnov da se u narednom periodu poribljavanje obavlja sa mladi čiji su roditelji iz istog toka, čime je stvoren preduslov za očuvanje autohtonih genotipova. Potencijal ravničarskih reka je znatno veći. Baziran je na rekreativnom i privrednom ribolovu. Potencijal koji pruža rekreativni ribolov je zasnovan na činjenici da je grad sa najvećim brojem stanovnika u Srbiji – Beograd, upravo lociran na obalama dve velike reke: Dunavu i Savi, ali i na činjenici da su gradovi Novi Sad, Šabac, Smederevo... locirani na obalama velikih reka, što svakako ukazuje na činjenicu da bi broj rekreativnih ribolovaca mogao biti višestruko veći.

Veoma značajan potencijal je i u privrednom ribolovu koji bi uz unapređenje politike poribljavanja, gazdovanja i izlova ribe, ali i statusa privrednih ribara mogao predstavljati egzistenciju znatno većeg broja ljudi od sadašnjih.

*Ključne reči: akvakultura, ribarstvo, Srbija, stanje, potencijali*

### **Aquaculture in Serbia**

Aquaculture in Serbia is performed primarily in aquaculture objects: trout and carp farms (Marković and Poleksić, 2009). The total area under carp farms is about 14 000 ha, 20% being out of function. Area under trout farms is about 14 ha, of which 15 % out of function. On carp farms following species are reared: carp, white bighead, gray bighead, white grasscarp, and predators: wells and pikeperch. Rainbow trout is produced on trout farms. On some farms fry of warmwater fish: bream (*Abramis brama*), tench (*Tinca tinca*), crucian carp (*Carassius carassius*), "wild" carp (*Cyprinus carpio*) and coldwater fish species: brown trout (*Salmo trutta*), Danubian salmon (*Hucho hucho*), and grayling (*Thymallus thymallus*) are produced for stocking of running and stagnant aquatic ecosystems. Total production in the last two years varies from 15 000 tons: 2000 tons of rainbow trout (of that number market size trout is about 75%) and about 13 000 tons of warmwater species (approx. 11 000 tons of carp and 2000 tons accompanying species). 70 to 75 % of the warmwater species quantity is market size fish.

### **Fishery in Serbia**

All the aquatic ecosystems in Serbia, besides aquaculture objects (trout and carp fish farms) and reservoirs (hydro accumulations) that primarily are for urban water supply are classified as fishery waters. Total length of all rivers and water currents is 65 980 km. Rivers belong to following catchment areas: Black sea (92,46%), Adriatic sea (5,36%) and Aegean (2,18%) (Gavrilović, 2002). Fishery waters are divided in 6 fishery areas: Serbia Vojvodina, Serbia West, Serbia – South West, Serbia South, Serbia East, and Serbia Center. According to the Law on protection and sustainable use of fishery resources (Official Gazette No 36/09) fish in fishery waters are a natural resource and property of common interest. There are 89 fish species classified in 57 genera and 20 families, inhabiting aquatic ecosystems (Simonović, 2001). Among Teleost fish inhabiting Serbian waters 52 species are caught using recreational and commercial fishery. From that number economically important are: sterlet (*Acipenser ruthenus*), carp (*Cyprinus*

*carpio*), wells (*Silurus glanis*), pikeperch (*Sander lucioperca*), northern pike (*Esox lucius*), bream (*Abramis brama*), Prussian carp (*Carassius gibelio*), gray bighead (*Arystichthys nobilis*), white bighead (*Hypophthalmichthys molitrix*), barbel (*Barbus barbus*), Volga pikeperch (*Stizostedion volgensis*), white grasscarp (*Ctenopharyngodon idella*), asp (*Aspius aspius*), orfe (*Leuciscus idus*), nase (*Chondrostoma nasus*) and burbot (*Lota lota*).

Fishery in Serbia can be divided, depending on fishing purpose, on commercial and recreational (this includes sport fishery). Commercial fishery is an occupation of 260 professional fishermen. Average professional fisherman is going out on water about 200 times per year. Number of fishermen in the past ten years varied from 58 000 (in 2001) till over 100 000 (in 2002). Average recreational fisherman is going out on water about 50 times. According to the data from the Statistical Office of the Republic of Serbia catch of fish from rivers in Serbia is between 2 000 and 3 000 tons (in 2008 – 2 128 827, in 2009 – 2 171 317 kg).

### **Serbia's potential in aquaculture and fishery**

**Improvement of production on fish farms** could be carried out through programs for production improvement on carp and trout farms.

**Improvement of production on carp farms** takes place through carp feeding programs and provision of quality stocking material for carp farms. Feeding program comprises creation of several formulations, as a result of research on formulations adapted to: different age categories, pond water quality, and growing season. Additional improvement of feeding is based on feed processing in the extrusion process of feed preparation. Extrusion improves physical properties (it increases pellets durability in water, enables choice between floating and sinking pellets), chemical properties (starch gelatinization), and microbiological properties of the feed. This creates a precondition for better weight gain and better quality fish meat. Particularly important part of the program is creation of fish feed with improved fatty acid composition: with increased omega 3 content and better ratio of omega 3 and omega 6 fatty acids in carp flesh.

Provision of quality stocking material for warmwater fish farms is carried out through a program of selective breeding (family selection). It will be the basis for future carp fry production in Serbia. By the use of selected fry inbreeding is prevented, as well as restocking of ponds with fry obtained from spawning in the wild.

Improvement of production on existing carp farms could result in production increase for 50 to 70 %. Thus, production in Serbia will reach 2 tons per hectare on average. Duration of the production period to obtain the market size carp will be shortened from 3 to 2 years.

**Improvement of production on trout farms** takes place through recently established selective breeding program, based on crossings of broodstock obtained in Serbia. By monitoring fry growth families with best growth rate and diseases resistance will be selected. That way production will increase and fish health protected against diseases that can be imported with imported fertilized eggs.

In order to increase fish farm area in trout aquaculture sufficient water quantity and first class quality is essential, as well as space for farm establishment. Compared to existing area, it can be increased 3 to 5 times.

Contrary to relatively small potential for increase of surface area under trout farms, available surface for carp farms is ten, even several tenths times greater. Thus, a rationa-

the use of surfaces with low fertility located near rivers and canals will be provided. New surfaces under fish farms will significantly increase carp production in Serbia.

Potential for **fish feed production** is based primarily on raw material produced in Serbia, in Vojvodina (Northern part of Serbia). In the extruded feed for semi-intensive carp production, a relatively small quantity (3 – 6 %) of fish meal is added but main components are soy, corn, wheat, barley, crops that are mainly exported from Serbia. It is much better to export fish feed or carp. Available resources for fish feed production in Serbia lie in 3 production companies producing carp feed. Their total capacity exceed 5 to 6 times actual need for fish feed in Serbia.

Concerning **fish processing**, capacities existing in Serbia are primarily related to carp. Since trade of carp in Europe is mainly connected with live fish. This largely increases the price of transport and stocking, thus a change in placement method is needed. These changes are related to the need to gradually include in carp trade chilled vacuum packed long lasting (20 to 40 days) packages. Since consumers easily accept smoked products, smoked carp vacuum packed in family (150 to 600 g) packages could be a challenging option for placement of this fish. In order to increase a range of products, a smoked carp could be combined with dry plums (traditional in Serbia), mushrooms, spices vegetables and herbs (Marković et al., 2011). Such processed carp could become much more attractive compared to live carp that loses battle against semi prepared other fish species.

EU is one of the biggest importers in the world. Annual deficit EU for the year 2008 is 1 550 000 tons of fish (Varadi, 2010). It represents a chance and a need to offer a smoked carp with added plums, mushrooms, herbs to European consumers. Such a product could find a market in countries that traditionally consumes carp (Germany, France, Poland, and Czech Republic). Additional improvement of the fatty acid content in carp flesh by the use of extruded feed will contribute to better selling of carp.

### **Potential of fishery in natural waters**

Fishing potential could be divided on hilly mountain water currents potential and potential of the lowland rivers.

Potential of the hilly mountain water currents is based on recreational fishing, fishery tourism that will be developed for particular places. In order to create attractive offers, in the future restocking with fry obtained from parents from the same water body, thus preserving autochthonous genotypes. This will be possible by keeping record and master data on broodstock from the mountain water currents and by establishment of the data base on every broodstock. This is planned to be realized this year. In order to additionally improve the activity it is necessary to increase the number of new hatcheries based on spawning of autochthonous fish species.

Potential of lowland rivers is higher than the potential of mountain water currents. It is primarily based on rivers: the Danube, 588 km long in Serbia, with average flow of 2 413 m<sup>3</sup>/s; the Sava 206 km in Serbia and average flow of 1 640 m<sup>3</sup>/s; and the Tisza 164 km long in Serbia and average flow of 870 m<sup>3</sup>/s. It is based on recreational and commercial fishery. Potential offered by recreational fishery is based on the fact that the city with the largest population, the capital Belgrade, is located on the banks of two largest rivers: Danube and Sava, as well as other big cities such as Novi Sad, Šabac, Smederevo... located on big river banks, pointing out that the number of recreational fishermen could be multiplied. Very important potential is in commercial fishery. By improving stocking policy, management and fish catch, and also the status of commercial fisher-

men, commercial fishery could represent better existence to a higher number of people. Particularly important segment and precondition for improvement of fish catch is organized buying up of the catch, as well as increased diversification of species caught. Part of fish caught could be further processed, or offered on fish markets. Thus, a number of persons and families involved in businesses connected with fishery will be increased.

### ACKNOWLEDGMENT

The present study was supported by project: Improving production capacity of carp (*Cyprinus carpio* L.) through nutrition and selective breeding programs (No. TR-31075) by Ministry of Education and Science, Republic of Serbia.

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