THE ROLE AND IMPORTANCE OF CENTERS FOR GENETIC IMPROVEMENT IN CONSERVATION AND SUSTAINABLE EXPLOITATION OF SALMONID FISH STOCKS

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ULOGA I ZNAČAJ CENTARA ZA GENETSKO UNAPREĐENJE U OČUVANJU I ODRŽIVOM KORIŠĆENJU RIBLJEG FONDA SALMONIDA

Apstrakt

Cilj ovog rada je da ukaže na potrebu znatno većeg učešća naučno zasnovanih principa u procesu poribljavanja salmonidnih ribolovnih voda na području Srbije. Rad ukazuje na potrebu za izgradnjom i unapređenjem objekata za uzgoj riblje mlađi u kojima će se ona proizvoditi u adekvatnim uslovima, odgovarajućim biotehnološkim procesima i bez genetičke kontaminacije. Rezultati rada dobijeni su na osnovu proučavanja podataka o poribljavanju ribolovnih voda koji su prikazani u Programima upravljanja ribarskim područjima na teritoriji Srbije. Kao primer uzeta su područja u zaštićenim oblastima kao što su: Nacionalni park "Kopaonik", Park prirode "Stara planina" i Predeo izuzetnih odlika "Vlasina". Dosadašnja praksa poribljavanja voda u Srbiji neadekvatnom ribljom mlađi doprinela je narušavanju prirodne ravnoteže i potiskivanju autohtonih vrsta riba što se odrazilo na potencijal ribolovnih voda, kako u biološkom tako i ekonomskom smislu. Do poboljšanja bi moglo da dođe ukoliko bi se u Srbiji proizvodila kvalitetna riblja mlađ u dovoljnim količinama u centrima za reprodukciju (reprocentrima). Reprocentri za razliku od postojećih ribnjačkih mrestilišta obezbeđuju riblju mlađ koja je adekvatna za ekosisteme koji se poribljavaju.

Osnovne razlike između reprocentara i ribnjaka jesu što reprocentri uzgajaju ribu sa proverenim genetskim poreklom i što na odgovarajući način pripremaju riblju mlađ za život u prirodi.

Ključne reči: centri za reprodukciju, poribljavanje ribolovnih voda Srbije, konzervacija, salmonidni riblji fond
Keywords: centers for genetic improvement of fish stock, restocking of Serbian fishery waters, conservation, salmonid fish stock

INTRODUCTION

As populations of exploited fish continue to decline worldwide (Food and Agricultural Organization of the United Nations, l999), fishery managers have adopted three general strategies for rebuilding depleted stocks: regulating harvests, restoring or preserving essential habitats, and increasing recruitment through the use of hatcheries (Blankenzhip & Leber, 1995).

Conservationist in early 80's of the last century represented scientifically based attitude that restocking of natural waters in the classical way has no ecological justification and generally has a negative impact on wild populations. In order to reduce the negative effects of classical hatchery practice of restocking natural waters, conservationists propose a different approach to the introduction of cultivated populations in natural ecosystems (Van Dyke, 2010). The basis for this approach is different production technology of cultivated organisms, in this case, fish fry, based on the genetic characteristics of natural populations and aimed at preserving genetic diversity and natural ecological habits of cultivated populations. Facilities of this kind of controlled breeding and growing organisms are called reproduction centers or centers for genetic improvement of fish stock.

Fish produced in this kind of centers were reared and selected on a scientific manner prescribed. These fish do not lead to genetic contamination of natural populations, and can reduce the harmful effects of existing genetic contamination in the water. In this way is provided stability of ecosystems and their greater cost-effectiveness in terms of use as fishing waters (Sevä, 2010).

The aim of this paper is to point out the need for much greater participation of science-based principles in the process of restocking salmonid fishery waters in Serbia.

MATERIAL AND METHODS

Results and materials were obtained from the data of the restocking of fishing waters, which is displayed in the management of fishing areas in Serbia. As example are represented parts of protected areas such as National Park «Kopaonik», Nature Park «Stara Planina» and «Vlasina», nature preserve of special interest at category I. We examine the relationship between potential production and real production of *Salmo trutta* in fishing waters of protected areas as well as the relationship between the predicted amount and optimal amounts of juvenile fish for restocking.

In addition to the management plans also were investigated the origin of parental flocks and technological production process of fry of *Salmo trutta* in hatcheries in Serbia.

RESULTS AND DISCUSSION

Results of relation between real and potential production and optimal quantity of fry for restocking of fishing waters of some protected areas in Serbia, are summarized in the Table 1.

The example illustrated in Table 1. shows the following: the estimated potential production of *Salmo trutta* in all fishing waters is more than real, which gives the possibility of stocking salmonid waters with suitable quantity of fry of this species.

From the above examples can be seen that for stocking of only those fishing waters annually there is need to produce around three million fingerlings of *Salmo trutta*.

Our research shows that the current hatchery produces about 200 000 pieces of two-year *Salmo trutta* that can be used for restocking.

Because of this apparent lack of the required amount of adequate fish fry on the Serbian market, which would be genetically and phenotypically appropriate, these amounts are in management programs significantly reduced (Simić & Simić, 2012, 2012a, Simić et al. 2012).

Ideal restocking is that which does not change the genetic, its age and sex structure of natural populations of indigenous fish. Appropriate stocking would be considered that removal of the deficits of all fishing important species (Simonović, 2010).

Table 1. Relationship between real and potential production of *Salmo trutta* in some fishing waters of Serbia and the optimum quantity of fingerlings for restocking

Fishing water	Fish species	R.P[1]	P.P[2]	Est restocking	Realistically optimally restocking
NP "KOPAONIK"[1]	*Salmo trutta*	Pieces / km / ha total for the period 2012-2020			
Samokovska river	*Salmo trutta*	13.6	19.83	10 000 (2+)	25 000 (2+)
Gobeljska river		2.4	15.4	15 000 (2+)	30 000 (2+)
"VLASINA"[2]	*Salmo trutta*	2.34	27.8	125 000 (2+)	700 000 (2+)
Vlasina lake					
NP "STARA PLANINA"[3]	*Salmo trutta*	2.5-7.8	10-40	500 000 (2+)	2 000 000 (2+)
Zavojsko Lake Rivers: Visočica, Toplodolska, Crnovrška, Golema					

[1]Simić & Simić, 2012; [2]Simić & Simić, 2012a; [3]Simić et al., 2012

Once a decision has been made to incorporate artificial propagation into a recovery plan, its implementation involves several important considerations. The intent of such a plan should be to facilitate recovery of the natural population, minimize its risk of further decline, and restrict genetic changes resulting from artificial propagation. To reduce the potential for these risks to arise, the use of artificially propagated fish to supplement a listed natural population should be held to the minimum necessary for sustained recovery. As part of a recovery plan, artificial propagation might require the collection of natural broodstock, the culture of progeny from those adults, and the release of the progeny at appropriate localities to supplement the natural population. Without adequate precautions, these activities

may have negative effects on listed species, including deleterious ecological and genetic interactions between hatchery fish and natural fish (Hard et al.,1992).

By eliminating the many causes of natural mortality, hatcheries do offer scope for increasing the survival of progeny to any life stage. The potential gains are substantial and the gains increase in proportion to the length of time for which the fish are retained before their release. After release, further gains in the survival rate of stocked fish compared with wild fish are possible, using judicious stocking protocols to ensure that levels of competition in receiving streams are kept low (Youngson, 2007).

Potential gains from hatcheries:

1. Potential spawners removed from rivers as brood stock are subsequently protected from mortality due to predation, angling or poaching.
2. Survival rates of progeny in hatcheries are potentially much greater than in the wild. Depending on how long hatchery-reared fish are kept before their release, they are not susceptible to natural mortality due to the following causes : Any destruction of eggs caused by over-cutting of redds, egg predation by parr at spawning time, washout of redds during incubation, egg mortality due to siltation of, or groundwater intrusion to redds, the effects of any acid episodes in geologically and geographically susceptible catchments, natural mortality among free-swimming stages, including predation of fry or parr by their own or other species.
3. By judicious stocking, natural levels of competitive mortality among fry or parr, after their release can be reduced by the following means: hatchery fish can be stocked into areas of stream that do not contain potential competitors or contain sub-optimal numbers of natural progeny, any given number of hatchery fish can be stocked at low average density, over correspondingly large areas of stream, in any given area of stream, any given number of hatchery fish can be stocked out at low initial densities by using a correspondingly large number of planting or introduction sites (Youngson, 2007).

The previous practice of restocking the waters of Serbia, as inadequate fingerlings contributed to the disruption of the natural balance, suppressing native species of fish which reflected on the potential of fishing waters, both in biological and economical terms. The improvement may come if the Serbia-quality young fish produced in sufficient quantities in the centers for genetic improvement of fish.

There, unlike the existing hatchery ponds, are provided juvenile fish that is adequate for the ecosystems that are stocked. The main differences between the reproduction center and ponds are that first bred fish with proven genetic background and properly preparing juveniles to life in nature.

CONCLUSION

It is necessary to secure funding increased investment, personnel training, and better information to the public, especially to users of fishing areas on the importance of stocking water in Serbia with quality fish fry obtained under controlled conditions which allows centers for genetic improvement of fish stock. Better supply of fish for stocking would contribute to the work of the users of fishing areas and allow them to have a greater economic benefit from the issuance of a number of licenses at profitable prices.

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