The role of allochthonous (non-native) fish species in Serbian aquaculture

Uloga alohtonih (introdukovanih) ribljih vrsta u akvakulturi Srbije

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Abstract

Fish farming is the only type of aquaculture in Serbia. Fish farming is mostly carried out in cyprinid and salmonid (trout) fishponds (over 95% of the total fish produced), with considerably lower ichthyoproduction being practiced in cages and some bodies of open water such as reservoirs and channels.
Serbian aquaculture currently includes 12 fish species, 4 of which are allochthonous (non-native). With the exception of the rainbow trout (*Oncorhynchus mykiss*) and, to a certain extent, grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Hypophthalmichthys nobilis*), allochthonous fish species have no economic importance. The presence and abundance of certain allochthonous species in fishponds and open waters have a negative effect on the total ichthyoproduction.

Keywords: Serbia, allochthonous (non-native) fish species, aquaculture

Rezime

Gajenje riba jedini je oblik akvakulture u Srbiji. Skoro u potpunosti realizuje se u šaranskim i salmonidnim (pastrmskim) ribnjacima (više od 95% ukupne riblje produkcije), dok se značajno manja ihtioprodukcija ostvaruje u kavezima i nekim otvorenim vodama (akumulacijama i kanalima).
Akvakultura Srbije trenutno uključuje 12 ribljih vrsta, od kojih su 4 alohtone (introdukovane). Izuzev kalifornijske pastrmke (*Oncorhynchus mykiss*) i, u određenom stepenu, belog amura (*Ctenopharyngodon idella*), belog tolstolobika (*Hypophthalmichthys molitrix*) i sivog tolstolobika (*Hypophthalmichthys nobilis*), druge alohtone vrste nemaju ekonomskog značaja. Prisustvo i masovnost pojedinih alohtonih vrsta u ribnjacima i otvorenim vodama ima negativan uticaj na ukupnu ihtioprodukciju.

Ključne reči: Srbija, alohtone (introdukovane) riblje vrste, akvakultura

Detaljan rezime

Na teritoriji Republike Srbije (površine 88361 km^2) postoje povoljni hidroekološki uslovi za ihtioprodukciju. U ihtiofauni Srbije prisutno je 95 vrsta iz 27 porodica, od kojih su 23 vrste iz 11 porodica alohtone (introdukovane iz drugih područja). Različiti su razlozi za introdukciju - gajenje u akvakulturi, borba protiv planktonske i makrofitske eutrofikacije, poribljavanje u svrhu sportskog ribolova i drugi. Generalno, introdukcije većine ribljih vrsta imaju negativan efekat na autohtonu ihtiofaunu.

Gajenje riba predstavlja jedini oblik akvakulture u Srbiji, sa zanemarljivim gajenjem drugih akvatičnih organizama (rakova i žaba). Ostvaruje se u šaranskim i salmonidnim (pastrmskim) ribnjacima (ukupne površine oko 14000 ha sa procenjenom godišnjom ihtioprodukcijom od 15000 t) i značajno nižom produkcijom riba u kavezima i otvorenim vodama (akumulacijama i kanalima). U akvakulturi Srbije trenutno egzistira 12 vrsta riba, od kojih su 4 alohtone.

Kalifornijska pastrmka (*Oncorhynchus mykiss*) je alohtona vrsta koja ima najveći komercijalni značaj. Broj pastrmskih ribnjaka procenjen je na 130 (ukupne površine 13–14 ha) sa godišnjom produkcijom od 1500–2000 t. Uprkos velikim količinama vode I klase kvaliteta, ostvaruju se niski prinosi (10–15 kgm^{-3}), prvenstveno uslovljeni činjenicom da nekoliko ribnjaka velikih površina trenutno nisu u funkciji, da se na pojedinim ribnjacima javlja problem nedostatka vode u periodima niskih voda i da na malom broju ribnjaka rade školovani tehnolozi, umesto kojih su angažovani nedovoljno stručni kadrovi. Aktuelne su aktivnosti na intenziviranju ovog oblika ribnjačarstva.

Vrste Azijskog kompleksa - biljojedi beli amur (*Ctenopharyngodon idella*), planktofagi beli (*Hypophthalmichthys molitrix*) i sivi (*Hypophthalmichthys nobilis*) tolstolobik uneti su 1963. godine u ribnjake Srbije. Gaje se u polikulturi sa šaranom (oko 5% ukupne produkcije konzumne ribe). Iskustva u gajenju ovih vrsta su pozitivna pošto povećavaju produktivna svojstva ribnjaka bez veće hranidbene kompeticije sa šaranom. Međutim, beli amur može svojom ishranom i visokim stepenom nesvarenog biljnog materijala povećati stepen organskog opterećenja i pogoršati kvalitet vode.

Druge alohtone vrste imaju mali ekonomski značaj. Prisustvo i masovnost pojedinih alohtonih vrsta, kao što su srebrni karaš (*Carassius gibelio),* amurski čebačok *(Pseudorasbora parva),* sunčanica *(Lepomis gibbosus)*, američki somić (*Ameiurus nebulosus*) i kanalski somić (*Ameiurus melas*), zbog širokog trofičkog spektra koji uključuje ikru i mlađ komercijalno značajnih ribljih vrsta, ugrožava autohtonu ihtiofaunu u ribnjacima i otvorenim vodama.

INTRODUCTION

The Republic of Serbia (88,361 km^2) occupies the central and south-eastern parts of Europe and the central region of the Balkan Peninsula. More than 97% of the country's watercourses flow directly or indirectly into the Danube (the Black Sea basin), whereas the remaining 3% belong to the Adriatic Sea and Aegean Sea Basins. The total length of watercourses is about 66,000 km. The hydrographic network of the Republic of Serbia comprises 150 reservoirs (Karadžić and Mijović, 2007). Hydroecological conditions are generally favorable for ichthyoproduction. The ichthyofauna of the Republic of Serbia includes 95 species (from 27 families), with 23 non-native (allochthonous) species

belonging to 11 families (Simonović, 2010; Lenhardt et al., 2011; Marković, 2011). Reasons for fish introductions are diverse, including aquaculture, struggle against plankton and macrophyte eutrofication, stocking for sport fishing purposes, spontaneous expansion of distributional range etc. Fish introductions generally have mainly negative effects, such as endangerment of native fish species due to competition for food and spawning sites, emergence of new parasites, water quality deterioration and other adverse effects (Holcik, 1991; Moyle and Light, 1996; Vitule et al., 2009).

Serbian aquaculture

Fish farming is the only type of aquaculture in Serbia. Farming of other aquatic organisms (crabs and frogs) is negligible. Fish farming is mostly carried out in cyprinid and salmonid (trout) ponds (over 95% of the total fish produced), with considerably lower ichthyoproduction being practiced in cages and some bodies of open water (reservoirs and channels). Fishponds in Serbia cover about 14,000 ha, with more than 99% of them being cyprinid. The total annual fish production during 2009-2010 amounted to 15,000 t, with 13,000 t of cyprinids (the dominant common carp farming exceeding 80% of the total production).

Non-native (introduced) species in Serbian aquaculture

Serbian aquaculture currently includes 12 fish species, 4 of which are allochthonous (Table 1).

Table 1: Fish species in Serbian aquaculture
Tabela 1: Riblje vrste u akvakulturi Srbije

Fam. **SALMONIDAE** Rainbow trout (*Oncorhynchus mykiss* Walbaum,1792)* Brown trout (*Salmo trutta m.fario* Linnaeus, 1758)
Fam. **CYPRINIDAE** Common carp (*Cyprinus carpio* Linnaeus, 1758) Grass carp (*Ctenopharyngodon idella* Vallenciennes, 1844)* Silver carp (*Hypophthalmichthys molitrix* Vallenciennes, 1844)* Bighead carp (*Hypophthalmichthys nobilis* Richardson, 1845)* Tench (*Tinca tinca* Linnaeus, 1758)
Fam. **PERCIDAE** Pike-perch (*Sander lucioperca* Linnaeus, 1758)
Fam. **ESOCIDAE** Northern pike (*Esox lucius* Linnaeus, 1758)
Fam.**SILURIDAE** Wels catfish (*Silurus glanis* Linnaeus, 1819)
Fam. **ACIPENSERIDAE** Beluga (*Huso huso* Linnaeus, 1758) Danube sturgeon (*Acipenser gueldenstaedtii* Brandt & Ratzeburg, 1833)

* allochthonous (non-native) species
* alohtone (introdukovane) vrste

The rainbow trout (*Oncorhynchus mykiss*) is an allochthonous fish species having the highest commercial value. It was introduced into Serbian fishponds between World War I and World War II. Fish farms are built on barren land with water being supplied from major springs and mountain streams of first-class water quality. The total number of trout farms is estimated at 130 (on 13–14 ha of ponds), their annual production being 1500–2000 t (accounting for 10-15% of the total consumable fish production in Serbia). The average production is low (ranging from 10 to 15 kgm^{-3}) (Lenhardt et al., 2011). The main reasons include inactivity of several large fishponds, lack of water in some fishponds during periods of low water levels, and insufficient numbers of qualified personnel engaged in fishponds. An increase in trout fish farming production can be achieved through oxygenation in order to overcome water deficiency in the summer period as well as through selective breeding of rainbow trout for better fry production traits (Marković, et al., 2011).

The fish of Asian origin (the so-called Chinese carps) – the grass carp (*Ctenopharyngodon idella*) as a typical herbivorous species, and planktophagous silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Hypophthalmichthys nobilis*) - were introduced into Serbia for fish farming in 1963 (Janković, 1998). These species have been farmed in polyculture with the common carp *(C.carpio)* (accounting for 5% of the total consumable fish production). The Serbian aquaculture experience shows that polyculture farming of these species has ensured efficient use of the productive potential of fishponds as these species are generally not nutrient competitors to the common carp. However, the grass carp has a low food conversion ratio, with a large part of the plant material ingested being discharged with intestinal flora, additionally loading the watercourse with degradable organic matter. This results in increased sediment production, oxygen deficiency and degradation of overall water quality (Mitrović-Tutundžić, et al., 1996).

Other allochthonous species are of little economic importance in Serbian aquaculture. The presence and abundance of certain non-native species in fishponds and open waters have a negative effect on the ichthyoproduction of autochthonous species. This primarily refers to the Prussian carp (*Carassius gibelio),* topmouth gudgeon *(Pseudorasbora parva),* pumpkinseed *(Lepomis gibbosus)*, brown bullhead (*Ameiurus nebulosus*) and black bullhead (*Ameiurus melas*) due to both competition for food and spawning sites and the wide trophic spectrum involving roe, fish larvae and fingerlings. The rapid expansion of the distribution range is particularly evident with the topmouth gudgeon which has acclimated very rapidly in most Serbian reservoirs (Cakić, et al., 2004).

CONCLUSION

The presence of 4 allochthonous fish species has been recorded in Serbian aquaculture. The rainbow trout (*O. mykiss*) is a non-native fish species of the highest commercial value and an annual production of 1,500 – 2,000 t (10-15% of the total consumable fish production). Rainbow trout production is not sufficient to satisfy local market demands despite favorable hydroecological conditions in the upland regions of

Western and Southern Serbia. Activities focused on intensification of this type of fish farming have been underway.
Other non-native species, excepting the representatives of the so-called Chinese carps – the grass carp (*C.idella*), silver carp (*H. molitrix*) and bighead carp (*H. nobilis*), have no economic significance. The majority of them have been deliberately introduced and have a negative effect on the ichthyoproduction of autochthonous species.

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