THE POSSIBILITY OF CONSERVATION AND SUSTAINABLE USE OF NOBLE CRAYFISH *ASTACUS ASTACUS* IN SERBIA

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MOGUĆNOST KONZERVACIJE I ODRŽIVOG KORIŠĆENJA PLEMENITOG RAKA *ASTACUS ASTACUS* U SRBIJI

Apstrakt

Dekapodni rakovi su ključna komponenta biodiverziteta reka, jezera i močvara u kojima žive. Imaju važnu ekološku ulogu u pravilnom funkcionisanju slatkovodnih ekosistema. U svetu, trećini do polovini populacija slatkovodnih rakova preti smanjenje brojnosti, čak i iščezavanje. Isto se dešava i sa autohtonim populacijama plemenitog raka (*Astacus astacus*) širom Evrope, a posledica je klimatskih promena, zagađenja, degradacije staništa i račije kuge.

Ni populacije ove vrste u slatkovodnim ekosistemima Srbije nisu izostavljene. Situacija je prilično ozbiljna kada se ima u vidu da im je brojnost opala: više od 65% u poslednjih 50 godina. Inače, plemeniti rak je jedna od tri vrste autohtonih, dekapodnih rakova koji naseljavaju slatkovodne ekosisteme Srbije. Nekada brojne populacije, sada su ograničene na fragmentisana staništa. Za razliku od drugih evropskih zemalja, u Srbiji ne postoji kultura konzumiranja ove vrste u ishrani, ne uzgaja se u akvakulturi i shodno tome izostaje ekonomski značaj. Jedino je ribolovci koriste kao mamac za lov riba, pa je tom prilikom nekontrolisano prenose iz jednog vodenog ekosistema u drugi.

Poznato je da rakovi imaju ekološku, ekonomsku i društvenu vrednost, pa je razumljivo povećano interesovanje širom sveta za njih i stanje njihovih populacija poslednjih godina. Shodno tome, veliki broj naučnih radova je objavljen u vezi strategije očuvanja, menadžmenta/upravljanja i održivog korišćenja populacija plemenitog raka. Mogućnost za eksploataciju i ekonomska vrednost, kao i rekreativna korist možda će uticati da se lokalno stanovništvo više pozabavi zaštitom ove vrste.

Cilj ovog rada je da ukaže na potrebu za održivo korišćenje i očuvanje vrste plemenitog raka.

Ključne reči: Astacus astacus, konzervacija, menadžment, Srbija
Keywords: Astacus astacus, conservation, management, Serbia

INTRODUCTION

Crayfish are key components of biodiversity in rivers, lakes and wetlands; with crucial ecological role for the appropriate functioning of freshwater ecosystem they inhabit (Gherardi, 2011). Worldwide one third to one half of the freshwater crayfish species are threatened with population decline or extinction (Schrimpf, 2013). Native population of noble crayfish, *Astacus astacus* (Linnaeus), throughout Europe have been greatly reduced or become extinct due to climate changes, pollution, habitat degradation and crayfish plague (infection by the fungus *Aphanomyces astaci*) (Fevolden & Hessen, 1989). The populations in freshwater ecosystems in Serbia have not been omitted as well. The situation is quite serious when one takes into account that the population of the noble crayfish declined, according to Simić *et al.* (2008), by more than 65% in the past 50 years.

It is known that crayfish have ecological, economical, social and cultural values, therefore the increasing awareness in recent years is understandable. In relation to that a lot of scientific papers were published concerning conservation strategies, management and sustainable use of this species (Souty-Grosset *et al.*, 2003; Schrimpf *et al.*, 2011; Kozák *et al.*, 2011; Gherardi, 2011; Bohman & Edsman, 2011; Zimmerman, 2012). We can use Europeans' experience in this field, adapt them to our conditions and apply to our own species. The possibility for exploitation along with economical value as well as recreational benefits may make local inhabitants more eager to protect the species (Taugbøl, 2004; Jones *et al.*, 2006).

Serbia is at the beginning of this process. Simić *et al.* (2015) developed a conservation strategy for crayfish from the Astacidae family whose populations inhabiting the aquatic ecosystems of the Central Balkans. We also started researches in genetic of this species.

The aim of this article is to is to point out the probable ways of further research and indicate the need for sustainable use and conservation of this species.

DISCUSSION

Freshwater crayfish species are among the largest and longest-living of freshwater or land invertebrates. Their keystone impacts on community structure play a role in maintaining biodiversity of lentic freshwater systems (Reynolds & Souty-Grosset, 2003). They are used as indicator species for good water quality (Richardson, 2012).

Five crayfish species are present in freshwater ecosystems of Serbia. The noble crayfish (*Astacus astacus* (Linnaeus)) is one of the three indigenous species, along with two non-indigenous species. It is listed as "vulnerable" in the IUCN Red List of Threatened Species and "endangered" on the Serbian Red List (Official Gazette of the Republic of Serbia No. 5/2010 i 47/2011).

Habitat alteration, river engineering, water pollution, (eutrophication and acidification, in particular), along with non-indigenous species (that are carriers of many pathogens and diseases) seem to be the most important factors causing decline of populations and the reason why the populations became restricted to fragmented habitats. Additionally, research

of Simić *et al.* (2008) indicates that *Astacus leptodactylus* behaves in an expansive way and substitutes *Astacus astacus* in some habitats.

In our country there is no culture of consumption in the diet of this species, only the local people used it occasionally as a food, however, anglers use it as a bait for catching fish and that is the reason of uncontrolled translocations from one to another aquatic ecosystem (pers. communication with anglers).

It is not cultivated in aquaculture, so there is no economic importance in Serbia. In Europe is quite different situation. Noble crayfish are mainly used in culture in the Nordic and Baltic countries and also in Germany, France, Switzerland and Austria. This species is commercially important, for ages recognized as a delicacy in gastronomy, with high demand on markets (Swahn, 2004; Gherardi, 2011). Since reaching high prices in the markets, there is a clear economic value. For instance, it is estimated that in Sweden the annual catch of crayfish in lakes and rivers is approximately 1500 tonnes and the value of the annual catch is 30 – 40 million Euros (wholesale price) (Bohman & Edsman, 2011). Perhaps this could be the initial motive to start with crayfish production in aquaculture, in our country, for future restocking and commercial exploitation. We should definitely have in mind that the European market is large and has huge demands for the noble crayfish.

In Europe, reintroductions are common conservation actions for noble crayfish (Šmietana *et al.*, 2004; Sint & Füreder, 2004; Taugbøl, 2004; Taugbøl & Peay, 2004; Jussila *et al.*, 2008; Erkamo *et al.*, 2010; Kozák *et al.*, 2011). In the past, conservation programmes for a given species consisted of restoring the habitat and translocating individuals without the knowledge of their taxonomic status, but today, conservation genetics aims to maintain the genetic specificity of populations (genetic integrity principle) and the genetic diversity within and between populations (biodiversity principle), these basic principles being considered both at the level of protection measures and management measures (Souty-Grosset et al., 2003). The guidelines for the protection of threatened species recommend the identification of evolutionary significant units (ESU, Ryder, 1986). In restocking programs, it is recommended to use donor populations from the same ESU whenever possible, to conserve the local specificity and maintain the maximum within-species diversity (Schrimf, 2013). Therefore we started genetic studies and analysis. According to them we will be able to localize ECU.

Sustainable use is deemed to be a valuable tool to promote conservation of biological diversity, since in many instances it provides incentives for conservation and restoration because of the social, cultural and economic benefits that people derive from that use (Gherardi, 2011).

CONCLUSION

Aquatic environments are strongly affected by changes in the terrestrial environment, whether from natural or anthropogenic causes. The noble crayfish is the largest macroinvertebrate in Serbian aquatic ecosystems. It plays an important role in the food chain and has many effects on the community of aquatic organisms.

It is necessary to inform local population about crayfish (especially on the noble crayfish), to point out their importance for the proper functioning of freshwater communities, and the need of their conservation, in order to preserve the overall biodiversity of freshwa-

ter ecosystems, but also due to the possibility of using this species in aquaculture and the possible economic benefits.

An important goal is to strengthen research resources and establishment of collaboration with colleagues and institutions in Europe and the world, through joint research and practice.

Encouraging relevant institutions to introduce stimulating measures and promote freshwater crayfish farming (astaciculture) also required.

It is our responsibility to conserve this species for future generation.

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