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UNIVERZITET U BEOGRADU
SRBIJA

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KONZORCIJUM ZA BIOSIGURNOST
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MINHEN, NEMAČKA



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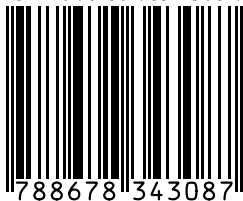
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FYKE NETS SELECTIVITY FOR BLACK BULLHEAD (*AMEIURUS MELAS*) IN SAVA LAKE

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SELEKTIVNOST VRŠA U IZLOVU CRNOG AMERIČKOG PATULJASTOG SOMA (*AMEIURUS MELAS*) U SAVSKOM JEZERU

Apstrakt

Istraživanje populacione dinamike crnog američkog patuljastog soma *Ameiurus melas* (Rafinesque, 1820) u Savskom jezeru realizovano je u periodu od avgusta 2009. do decembra 2012. godine. U cilju pronalaženja načina za smanjenje i kontrolu brojnosti populacija ove invazivne alohtone vrste (pre svega u stajaćim vodama), važno je ispitati i selektivnost ribolovnog alata (vrša). Selektivnost vrša procenjena je na osnovu odnosa ulovljenih jedinki crnog američkog patuljastog soma i drugih vrsta riba, za svaki mesec pojedinačno. Ukupno je uhvaćeno 13866 jedinki, od čega su jedinke crnog američkog patuljastog soma činile 94.2%, grgeča (*Perca fluviatilis*) 3.2% i sunčice (*Lepomis gibbosus*) 2.1%. Ulov štuke (*Esox lucius*), deverike (*Abramis brama*), babuške (*Carassius gibelio*), šarana (*Cyprinus carpio*), bodorke (*Rutilus rutilus*), smuđa (*Sander lucioperca*) i glavoča (Gobiidae) bio je na nivou statističke greške (< 1%). Rezultati istraživanja pokazuju da se vrše mogu primenjivati u kontroli brojnosti populacija crnog američkog patuljastog soma, jer osim što su selektivne, efikasne i lake za rukovanje, imaju minimalan negativni uticaj na druge vrste riba.

Ključne reči: crni američki patuljasti som, selektivnost ribolovnog alata, vrše, kontrola populacija

Keywords: black bullhead, fish gear selectivity, fyke nets, population control

INTRODUCTION

The impacts of non-native invasive species are immense and usually irreversible, and their adverse effects to native species and ecosystems can be compared to those caused by

the loss and degradation of habitats (IUCN, 2000). Introduction of non-native species can have a serious negative impact on the environment, diversity of native species, economic resources, and human health (Clavero & García-Berthou, 2005; Shirley & Kark, 2006). A large number of non-native fish species were introduced into freshwater ecosystems on a global scale (Leprieur et al., 2008), and at least 134 exotic/translocated fish species are introduced in Europe (Holčík, 1991). The black bullhead *Ameiurus melas* (Rafinesque, 1820), native to North America, is one of the most abundant and successful non-native fish species in European freshwater ecosystems (Cucherousset et al., 2006b). It poses a major problem for fisheries management throughout Europe, which has led to many attempts to apply selective fishing of this species (Cucherousset et al., 2006b; Louette & Declerck, 2006). The first record of the black bullhead in Serbia was in 2005 (Cvijanović et al., 2005), and according to Lenhardt et al. (2011), it is one of the dominant non-native species in Serbian waters.

The aim of this research was to investigate the efficiency of fyke nets as a sampling tool for population assessment, as well as their selectivity for population control and mass removal of this species, considering that there are only a few studies published on the efficiency of black bullhead trapping and mass removal (Cucherousset et al. 2006a; Louette & Declerck, 2006).

MATERIALS AND METHODS

Sava Lake is a reservoir formed in 1967 by damming a right-hand branch of the Sava River in Belgrade (Serbia), near the Ada Ciganlija river island, as a facility for water supply, water sports, and recreation. It is a mesotrophic to eutrophic lake in the process of succession on the site of a former river ecosystem (Janković & Janković, 1987). The lake has the status of a special fishing waterbody ("catch-and-release fishing").

Based on the total biomass, among 20 fish species currently present in the lake, the most notable are the common carp *Cyprinus carpio* (21.2%), pikeperch *Sander lucioperca* (13.5%), common bream *Abramis brama* (8.4%), Eurasian perch *Perca fluviatilis* (6.0%), and European catfish *Silurus glanis* (4.3%). The non-native species with the highest biomass are the silver carp *Hypophthalmichthys molitrix*, bighead carp *Hypophthalmichthys nobilis*, black bullhead (5.7% each), and Prussian carp *Carassius gibelio* (5.0%) (Hegediš et al., 2008).

Black bullhead samples were collected monthly from August 2009 to December 2012 using double fyke nets (length 85 cm, diameter 50 cm, 8 mm mesh-size). Nets were positioned in three rows, with five nets placed in each row, at 3 m, 10 m, 18 m, 25 m, and 35 m distance from the shore, at depths of 1.5 m, 4 m, 5.5 m, 7.5 m, and 8 m, respectively. The distance between the rows was 15 m. Nets were left in water for 3 nights each month and checked daily.

The selectivity of fyke nets was estimated based on the ratio of the captured individuals of black bullhead and of other fish species in the total catch for each month: northern pike (*Esox lucius*), common bream, Prussian carp, common carp, roach (*Rutilus rutilus*), Eurasian perch, pikeperch, pumpkinseed (*Lepomis gibbosus*), and gobies (Gobiidae).

RESULTS

The results in 2009 and 2010 were similar, and the percentage of black bullhead individuals in the total catches was $94.6\% \pm 5.0$ and $99.9\% \pm 0.17$ (mean \pm SD), respectively. Different results were observed in 2011. May was the month in which the percentage of

black bullhead individuals was the lowest (17.3%), and it was the month when a mass mortality of the bullhead occurred in the lake. At that time, the Eurasian perch comprised the largest percentage in the catch (55.6%), followed by pumpkinseed (23.5%), common bream (2.5%), and Prussian carp (1.2%). The next month with the lowest number of black bullhead individuals in the total catch was November 2011 (64.6%), followed by pumpkinseed (24.8%) and Eurasian perch (10.6%). In July 2011, the percentage of black bullhead individuals in the total catch was 67.7%, followed by Eurasian perch (22.9%), gobies (7.3%), and pumpkinseed and common bream (1% each). The catch in other months of 2011 was uniform, and the average percentage of black bullhead individuals was $88.1\% \pm 7.3$, and of all other fish species it was $5.6\% \pm 5.6$. Not a single northern pike or common carp were caught during 2011.

March and June 2012 are characterized by a lower percentage of black bullhead in the total catch (11.5% and 36.9%, respectively). In March, individuals of Eurasian perch were dominant (87.8%), and in June, the percentage of pumpkinseed and Eurasian perch individuals were 34.7% and 27.6% respectively. During all other months of 2012, black bullhead was dominant in the total catch and its average percentage was $96.9\% \pm 2.9$, while of all other fish species it was $0.8\% \pm 1.1$. No common carp or roach were caught in 2012.

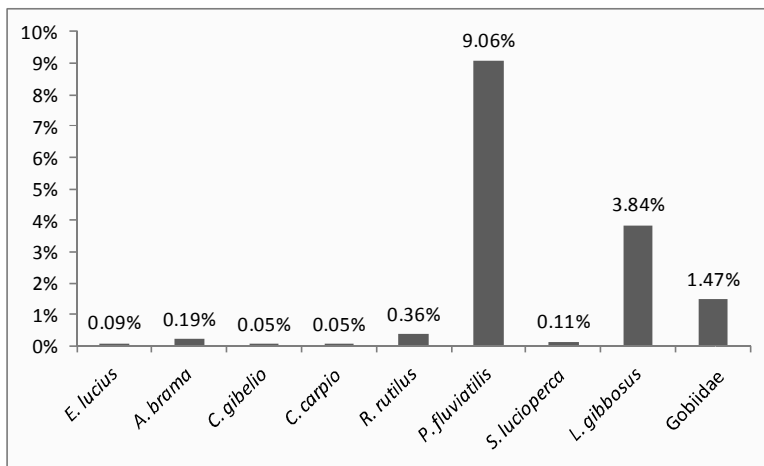


Figure 1. The average percentage of other fish species (black bullhead excluded) in the catch from August 2009 to December 2012.

The average percentage of black bullhead individuals caught during the entire sampling period was of 84.8%, and for other species it was 15.2%. The average percentage of other species was the highest for the Eurasian perch ($9.1\% \pm 18.9$), followed by pumpkinseed ($3.8\% \pm 8.5$), and gobies ($1.5\% \pm 3.6$) (Figure 1). High values of standard deviation (SD) indicate large differences between months. The average percentage in the total catch of the northern pike, common bream, Prussian carp, common carp, roach, and pikeperch were low and uniform, less than 1%, and SD values ranged from 0.2 to 1.5.

DISCUSSION

The results from Sava Lake suggest that fyke nets represent a highly selective fishing tool for black bullhead. During the four-year research, it was observed that in stable conditions (2009,

2010, the first half of 2011, and the second half of 2012), the percentage of black bullhead in the total catch ranged from 79.1% to 100%. Only from May 2011 (when the mass mortality event occurred) until the first half of 2012 (when the population stabilized), the catch of the black bullhead was variable. The percentage of other non-native invasive species that are considered undesirable, such as pumpkinseed and gobies, were higher than for native species, except for the Eurasian perch. The catch of the commercially most important fish (northern pike, common carp, and pikeperch) was at the level of statistical error. It is important that the caught individuals of these species stay alive, so that they can be returned unharmed into the water.

Other studies have also confirmed the efficiency and selectivity of fyke nets for black bullhead. In 28 lakes of South Dakota these nets proved to be very effective, especially in the catch of smaller black bullhead individuals (Hanchin et al., 2002), and this was confirmed by Pedicillo et al. (2008) for Corbara Lake (Italy). Hanchin et al. (2002) also observed that, for black bullhead population monitoring in waterbodies where black bullhead abundance is high, fyke nets provide a better estimate of the relative abundance, expressed as the mean catch-per-unit effort of stock-length (≥ 15 cm total length) bullheads, than gill-nets, probably due to faster saturation of gill-nets. Krueger et al. (1998) showed that fyke nets represent a particularly effective tool for sampling of benthic fishes, such as black bullhead, in lakes and reservoirs. A study in the De Maten Nature Reserve (Belgium), which consists of a series of interconnected small and shallow ponds, suggests that double fyke nets, when combined with the mark-recapture technique, are a very useful tool for the efficient and reliable assessment of brown bullhead populations; the recapture efficiency of fyke nets for brown bullhead was 66% and for pumpkinseed, Prussian carp, rudd (*Scardinius erythrophthalmus*), and tench (*Tinca tinca*) it ranged between 23% and 47% (Louette & Declerck, 2006). The results of the same study also suggest that double fyke nets may potentially be a cost-effective tool for the mass removal of non-native brown bullhead (*Ameiurus nebulosus*) populations from small to medium-sized shallow water bodies. It proved that double fyke nets do not damage other fish species, they are easy to use, and therefore they could help managers to reduce the number of reproductive individuals within one year. If the selective removal continues during following years, young-of-the-year individuals could be prevented from reaching sexual maturity. This could consequently lead to a reduction of abundance or even to eradication of these species from the ecosystem (Louette & Declerck, 2006). Considering the great similarity of these two species, the results of this research can be fully compared with the results from Sava Lake.

The results of fyke nets selectivity assessment for black bullhead in Sava Lake suggest that the mass removal would be most effective if conducted during the summer and autumn period (when the population density is at its peak), in the zone of the macrophyte vegetation. Juvenile individuals should be removed along with adult (reproductive) individuals. This model, with some modifications, could be applied to most lake ecosystems in Serbia. However, long-term monitoring of these ecosystems would be necessary, in order to keep track of the recruitment and possible rapid renewal of the black bullhead population. In addition to these management measures, it would be desirable to occasionally restock these ecosystems with native fish species as well as to evaluate possible habitat alterations.

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