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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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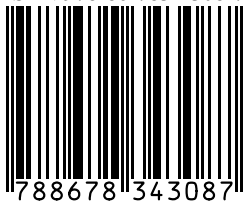
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HEALTH STATUS OF THE BLACK BULLHEAD POPULATION (*AMEIURUS MELAS*) IN SAVA LAKE

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ZDRAVSTVENO STANJE POPULACIJE CRNOG AMERIČKOG PATULJASTOG SOMA (*AMEIURUS MELAS*) U SAVSKOM JEZERU

Apstrakt

Crni američki patuljasti som *Ameiurus melas* (Rafinesque, 1820) je jedna od najzastupljenijih i najuspešnijih alohtonih vrsta riba koja naseljava kopnene vode Evrope. Istraživanja koja su sprovedena u proteklih nekoliko godina ukazuju na to da je ovo dominantna invazivna vrsta i u mnogim kopnenim vodama u Srbiji, uključujući i Savsko jezero (Jaćimović, 2015).

Zdravstveno stanje populacije crnog američkog patuljastog soma u Savskom jezeru procenjeno je na osnovu analize prevalencije i intenziteta parazitiranosti kod 2349 jedinki u uzorcima prikupljenim tokom 2011. i 2012. godine. Prevalencija parazitiranosti predstavljena je kao broj zaraženih jedinki, tj. procentualni udeo zaraženih jedinki, dok je intenzitet parazitiranosti predstavljen kao broj parazita u svakoj analiziranoj jedinki.

Osim kod jedne jedinke kod koje je nađena cista Trematoda, svi uočeni endoparaziti pripadali su razdelu Nematoda. Najverovatnije se radilo o vrsti *Philometra rischta*. Zdravstveno stanje populacije tokom 2012. godine bilo je znatno bolje u odnosu na 2011. godinu. Jedinke starosti 3+ bile su najzaraženije endoparazitima, kako u svakoj pojedinačnoj godini, tako i u celom uzorku. Iako bi se moglo očekivati da nezaražene jedinke imaju veće vrednosti Fultonovog faktora kondicije (*K*) u poređenju sa zaraženim, rezultati istraživanja u Savskom jezeru pokazali su da takva pravilnost ne postoji.

Ključne reči: crni američki patuljasti som, zdravstveno stanje populacije, prevalencija parazitiranosti, intenzitet parazitiranosti, endoparaziti

Keywords: black bullhead, population health status, parasitism prevalence, parasitism intensity, endoparasites

INTRODUCTION

Species invasion is one of the leading mechanisms of global environmental change, and the most frequently introduced aquatic species in Europe are freshwater fishes (García-Berthou et al., 2005). Non-native fishes can threaten all forms of aquatic environments and affect native ecosystems in various ways, including predation, competition, habitat alteration, hybridization, and disease transmission (Ribeiro and Leunda, 2012).

The black bullhead *Ameiurus melas* (Rafinesque, 1820) is a North American ictalurid catfish introduced in Europe (Copp et al., 2016). Its capability to live in ecosystems with poor water quality (Ribeiro et al., 2008), as well as a high flexibility of life history traits (Novomeská & Kováč, 2009), enabled this species to invade and establish viable populations in new areas (Copp et al., 2016). Several studies indicated that the black bullhead is one of the dominant invasive species in Serbian waters, including Sava Lake (Lenhardt et al., 2011; Jaćimović, 2015).

Studies on the health status of invasive species are important because when free-living non-native species are introduced into new environments, their parasites can also be introduced (Williams et al., 2013). These parasites can potentially spillover into native species, causing various changes, with probable adverse consequences for growth, survival, and fitness (Britton, 2013). The aim of this research was to assess the health status of black bullhead specimens in Sava Lake by estimating the prevalence and intensity of parasite infestation.

MATERIALS AND METHODS

Sava Lake is a former right-hand branch of the Sava River in Belgrade (Serbia) near the Ada Ciganlija river island. Twenty fish species from 19 genera, belonging to 8 families, inhabit the lake. Based on the total biomass, the most significant species are the common carp *Cyprinus carpio* (21.2%), pikeperch *Sander lucioperca* (13.5%), and common bream *Abramis brama* (8.4%); the total biomass of the black bullhead is 5.7% (Hegediš et al., 2008).

Black bullhead samples were collected monthly from April 2011 to December 2012 using double fyke nets (length 85 cm, diameter 50 cm, 8 mm mesh-size). Specimens were measured for their total length (TL) and mass (W) to the nearest 0.5 cm and 1 g, respectively, and their organs were examined for endoparasites. The prevalence of parasite infection was estimated as the percentage of infested individuals during the sampling period, and the intensity as the number of parasites in each fish. The analyses were done on a sample of 2349 specimens of the black bullhead.

Fulton's condition factor (K) was calculated to assess the general condition of individuals during different sampling seasons, using the formula $K = W / L^3 \times 100$ (Ricker, 1975). Age of the black bullhead specimens was determined by combining otolith examination (Secor et al., 1992) and Bhattacharya's method to split the age-classes from the length-frequency data, using FiSAT II software package (Bhattacharya, 1967; Gayanilo et al., 2006).

RESULTS

All detected endoparasites were from the phylum Nematoda, probably the species *Philometra rischta* Skrjabin, 1917, except for one black bullhead individual that had an en-

doparasite of the class Trematoda, in the cyst stage. The parasites were found both in the abdominal cavity and inside the stomach and intestines of the examined fish.

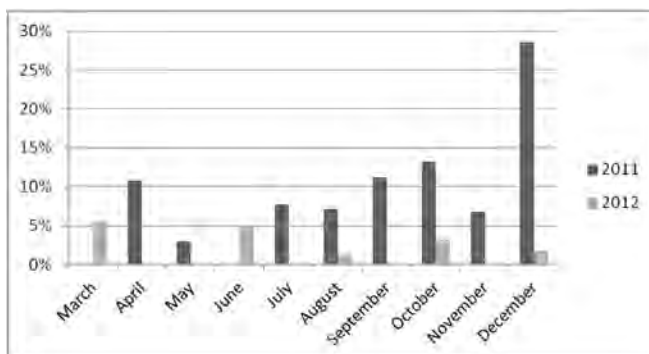


Figure 1. The prevalence of parasite infestation of the black bullhead in Sava Lake in 2011 and 2012.

The prevalence of parasite infestation of the black bullhead in Sava Lake was highest in December of 2011 (29%) and lowest in June 2011 (0%) (Figure 1). The mean intensity was highest in April of 2011 and lowest in December of 2012 (Table 1). Overall, the health status of the population in 2012 was much better compared to 2011.

Table 1. The intensity of parasite infestation of the black bullhead in Sava Lake in 2011 and 2012 – minimum, maximum, mean, and standard deviation (SD) values.

Year	Month	Min	Max	Mean	SD
2011	April	1	7	5.00	2.83
	May	1	1	1.00	0.00
	July	1	3	2.00	1.00
	August	1	4	1.55	0.93
	September	1	3	1.43	0.65
	October	1	7	2.17	1.70
	November	1	3	1.40	0.70
	December	1	4	2.17	1.17
2012	March	2	2	2.00	0.00
	June	1	3	1.40	0.89
	August	1	2	1.21	0.43
	October	1	9	1.67	2.31
	December	1	1	1.00	0.00

Black bullhead individuals 3+ years old were the most infested age class in both years (36.51% in 2011 and 41.18% in 2012), as well as in the whole sample (38.14%).

Comparing the values of the Fulton's condition factor (K) of infested and non-infested specimens during 2011, it was observed that they were higher in non-infested specimens in April, May, November, and December (Figure 2). During all other months in 2011, the K values were higher in infested individuals, particularly in September. In 2012, K values

were higher in non-infested individuals only during June. In March and especially in August, the values of K were higher in infested individuals, and in October and December these values were identical.

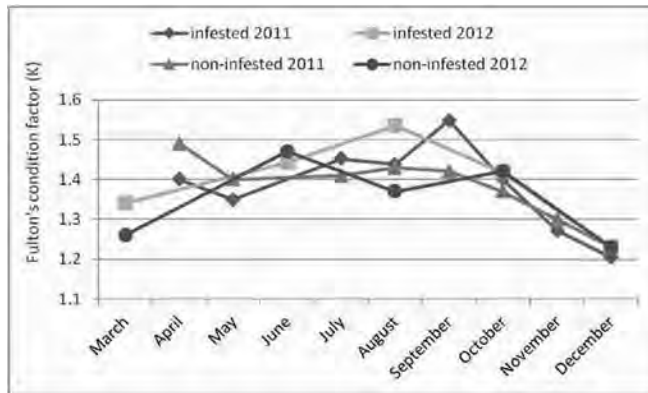


Figure 2. Fulton's condition factor of infested and non-infested black bullhead in Sava Lake in 2011 and 2012.

DISCUSSION

Fishes can be infested with a particularly diverse array of parasites at all stages of their development (Anderson, 2000). Nematodes are one of the most common groups of parasites in fish (Moravec, 2004), which was also shown in black bullhead specimens in Sava Lake.

In a study on parasites of non-native invasive fish species in Slovakia, Košuthová et al. (2009) have determined the presence of only one parasite, *Acanthocephalus anguillae*, in black bullhead specimens. The prevalence of parasite infestation was 6.3% and the intensity was 1 to 2 parasites per specimen. The prevalence in Sava Lake was 7.6% and this result is in line with the result from Slovakia, although the parasite was of a different species. Another similarity can be noticed – a low diversity of parasites. It has been observed that the parasite fauna of invasive animal species, including fish, is less diverse in non-native ecosystems, which may be due to several factors, including the reduced probability of parasites being introduced with allochthonous species, as well as the absence of other necessary hosts in a new location (Torchin et al., 2003). On the other hand, the release of introduced species from their native parasites, in addition to other factors, may contribute to their invasive success and improve their demographic performance (Torchin et al., 2003; Košuthová et al., 2009).

Individuals aged 3+ were the most infested age class in both years. A study conducted on *Paralabrax humeralis* (Serranidae) in Chile has shown that the nematode *Philometra* sp. infested the host only after it reached full sexual maturity (Oliva et al., 1992). A study on parasitism of a commercially important fish *Sciaenops ocellatus* (Sciaenidae) by *Philometra floridensis* has shown that the intensity of infestation and size and age of infested fish are positively correlated (Bakenhaster et al., 2014).

Although it could be expected that non-infested individuals would have higher values of the Fulton's condition factor (K) compared to infested ones, the results have shown that such regularity does not exist in Sava Lake. Many studies confirm that the relationship

between K and the level of parasitism can be very complex and uneven. In Parana River (Brazil), it was observed that the values of the relative condition factor were lower in individuals infested with ectoparasites and higher in those infested with endoparasites, which may be due to the fact that fish that consume larger quantities of food may also ingest more infective forms of parasites transmitted through trophic routes (Guidelli et al., 2011). A study on *Lepomis macrochirus* in England showed that the values of K and the density of parasites in infested specimens were negatively correlated (Neff and Cargnelli, 2004), and the results showed that the parasite mass was more highly correlated with K than parasite numbers.

Studies on non-native fish parasites can be useful in invasion ecology, considering that introduced fish species represent suitable hosts for both native and non-native parasites that can spillover into native host species, which consequently represents a potential threat for their populations.

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