

AGE STRUCTURE OF POPULATION OF ENDEMIC SPECIES *CHONDROSTOMA PHOXINUS* HECKEL, 1843 (TELEOSTEI: OSTARYOPHYSI, CYPRINIDAE) FROM BUSKO LAKE

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UZRASNA STRUKTURA POPULACIJE ENDEMIČNE VRSTE *CHONDROSTOMA PHOXINUS* HECKEL, 1843 (TELEOSTEI: OSTARYOPHYSI, CYPRINIDAE) IZ BUŠKOG JEZERA

Apstrakt

Raspolažući aktualiziranim podacima o kvantitativnom i kvalitativnom sastavu različitih ribljih populacija u Buškom jezeru, kao i činjenicom opasnosti od dominacije alohtonih ribljih vrsta nad autohtonim, posebna pažnja je i u pogledu analize dobne i spolne strukture ciljano usmjerena prema endemskim ribljim vrstama jezerskog ekosistema među kojima je svakako posebno mjesto imala vrsta *Chondrostoma phoxinus*.

Vrsta *Chondrostoma phoxinus* Heckel, 1843 (poznatija kao podbila) je opisana na osnovu primjeraka iz Sinja (Hrvatska), a nešto kasnije je pronađena i na teritoriji Bosne i Hercegovine, preciznije rečeno u Buškom jezeru (vještačkoj akumulaciji formiranoj 1974. godine na južnom dijelu Livanjskog polja), koja je prethodno postojala kao prirodni hidrografski, močvarni ekosistem.

Materijal, vrste *Chondrostoma phoxinus* Heckel, 1843, je sakupljan periodično od aprila 2003. do septembra 2004. godine te tokom 2007. i 2008. godine standardnim ihtiološkim metodama. Izlov je rađen na prethodno označenim i pristupačnim lokalitetima gdje je postavljeno ukupno 200 m mreže različitih promjera okaca. Detaljnija obrada ihtiomaterijala, sastojala se u utvrđivanju uzrasnih kategorija pregledom krljušti, skidanje skleritnih prstenova rađeno je pomoću binokularnog mikroskopa *Binokulares LED Schulmikroskop BA 658*. Za statističku obradu podataka korišten je softverski program „SPSS for Windows 15,0“. Činjenice jesu da u piramidi brojnosti pojedinih uzrasnih klasa, najmlađe uzrasne klase, pod normalnim uslovima su rasprostranjenije, dok kod

starijih, prirodna smrtnost ili, pak, smrtnost prouzrokovana spoljašnjim uticajima smanjuje brojnost jedinki (Georgiev, 1986).

Pregledom svih jedinki podbile (252), izlovljene u periodu istraživanja, samo 5 je izlovljeno u uzrasnoj klasi 1⁺, pri čemu su to 4 mužjaka i jedna ženka. U uzrasnoj klasi 2⁺ izlovljeno je ukupno 17 jedinki – 12 mužjaka i 4 ženke. U uzrasnoj klasi 3⁺, brojnost izlovljenih jedinki je veoma visoka i iznosi 44, od čega su 32 mužjaka i 12 ženki. Struktura spolova u brojčanom omjeru se naglo mijenja u višim dobnim klasama, te je tako u uzrasnoj klasi 4⁺, od ukupno 79 jedinki, 60 jedinki ženskog spola, a samo 19 jedinki muškog, itd. Detaljnija statistička analiza, uz korištenje χ^2 , pokazuje postojanje statistički značajne razlike između posmatranih jedinki podbile određenog spola i utvrđene starosne dobi. Za ovu analizu uzete su samo jedinke podbile kod kojih je određena i spolna i uzrasna kategorija, što se odnosi na 205 jedinki te vrste. Također su logički grupirane uzrasne klase prema reproduktivnom periodu na nivou mlađih jedinki, reproduktivno zrelih i starijih jedinki s izraženim periodom stagniranja. Statistička analiza u ovom slučaju, pokazuje granicu značajnosti ili signifikantnosti kod istraživanih jedinki podbile na nivou 0,004, ili 99,6 %.

Iz toga proizilazi da je najveći broj jedinki muškog spola izlovljen u starosnoj kategoriji 3⁺, što predstavlja 36,8% ukupnog broja utvrđenih jedinki muškog spola (87) u analiziranom materijalu. S druge strane, najmanji broj jedinki muškog spola zabilježen je u uzrasnoj klasi 7⁺, odnosno samo jedna, ili 1,1%. Razmatrajući zastupljenost jedinki podbile ženskog spola u određenim uzrasnim kategorijama, iznenađuje činjenica o izrazitoj brojnosti ženki starosne dobi 4⁺. Registriranih 60 jedinki, u ukupnom broju jedinki ženskog spola, ima udio od visokih 50,8%. Procentni odnos ženki u uzrasnoj klasi 4⁺, prema ukupnom broju od 79 izlovljenih jedinki u toj uzrasnoj kategoriji, prilično je visok i iznosi 75,9%. I, konačno, taj broj jedinki ženskog spola u uzrasnoj klasi 4⁺, u poređenju s ukupno izlovljenim brojem jedinki podbile (252), izražen procentualno, iznosi 23,8%. Ovaj podatak, koji se odnosi na dominaciju ženki u ukupnoj populaciji, a posebno u reproduktivno izražajnijem periodu (klasa 4⁺), daje pozitivne rezultate u trendu rasta i dinamike opstanka populacije. Slijedeći dalje rezultate analize odnosa spolova u preostalim uzrasnim kategorijama, zapaža se izrazitija brojnost jedinki ženskog spola. Tako uzrasna kategorija 5⁺ (30 ženki) u ukupnom broju registriranih ženki u izlovu čini udio od 25,4%, a u uzrasnoj kategoriji 6⁺, (11 ženki) predstavlja 9,3%.

Slična razmatranja mogu se iskazati i za jedinke muškog spola u uzrasnim klasama 2⁺, 3⁺, 4⁺, 5⁺, 6⁺. U uzrasnoj klasi 1⁺ prisutne su 4 jedinke muškog spola, u klasi 2⁺ prisutno je 12 jedinki, a 32 jedinke muškog spola prisutne su u uzrasnoj klasi 3⁺, iz čega proizilazi zaključak o nešto većoj brojnosti mužjaka u odnosu na ženke u tim uzrasnim klasama. S druge strane, nešto manje (19) jedinki muškog spola u uzrasnoj klasi 4⁺, 13 u uzrasnoj klasi 5⁺, te 6 mužjaka podbile u uzrasnoj klasi 6⁺, znači konstataciju znatnije brojnosti i zastupljenosti jedinki ženskog spola u reproduktivno zrelijoj dobi i ponovni dokaz pozitivnog trenda rasta populacije te vrste. Veća brojnost jedinki podbile ženskog spola, može se usko povezati i s mrijesnim periodom (kasno proljeće), kad je i brojčano najbogatiji izlov tokom cijelog perioda istraživanja.

S obzirom da je distribucija jedinki određenih uzrasnih kategorija vrlo usko povezana sa sezonskim pojavnostima, brojnost jedinki podbile u pojedinim izlovnim sezonama tokom dvije godine istraživanja varira – 79 jedinki dobi 4⁺, 44 jedinke dobi 3⁺, 43 jedinke u uzrasnoj kategoriji 5⁺ itd. Pri tome je posebno uočljiva brojnost jedinki izlovljenih u sezoni proljeće – ljeto, 2007. godine, gdje je opisano ukupno 70 jedinki, od kojih je najveća zastupljenost uzrasne klase 4⁺ (31 jedinka), što je vezano uz aktivnost očeki-

vanog mrijesnog perioda. Veliki broj jedinki izlovljen je i u sezoni jesen – zima, 2007. godine, tačnije, 65 jedinki skoro podjednako zastupljenih u svim uzrasnim klasama, dok je iduća proljetna sezona, 2008. godine, obilježena nešto manjim brojem registriranih jedinki (45), također s većom brojnošću jedinki starosne dobi 4⁺.

U ovako profiliranim radovima koji obrađuju autohtonu, a posebno endemičnu ihtiofaunu naše Zemlje, krajnji cilj u sveopćem monitoringu biološke raznolikosti jeste utvrditi stepen narušenosti ekoloških niša usljed degradacijskog učinka abiotičkih i biotičkih faktora koji su izražajni u novonastalom akumulacijskom bazenu Buško jezero. Direktna je povezanost i posljedična reakcija narušenog staništa i ugroženosti autohtonih ribljih populacija čijim smanjenjem direktno mijenjamo sliku biodiverziteta tog područja.

Ključne riječi: Chondrostoma phoxinus, podbila, dobna struktura, Bosna i Hercegovina

Keywords: Chondrostoma phoxinus, Buško lake, age structure, Bosnia and Herzegovina

INTRODUCTION

Buško Lake, former natural, hydrographical, floodplain system, the largest of its kind in the fields of Bosnia and Herzegovina, became an artificial accumulation in 1974. It forms the southern tip of the vast Livanjsko Field and belongs to the system of the River Cetina and the central part of the Adriatic catchment basin. It sits at an altitude of 700 m and exhibits pronounced oscillations in water levels, surface area and volume (the total surface of Buško Lake is 28 km² at minimum water level, whereas at maximum water level it is 56.7 km²).

The diverse ecosystem of the water basin became the original habitat of the endemic species *Chondrostoma phoxinus* Heckel, 1843 described for the first time by Heckel (1843) near Sinj in Dalmatia and somewhat later discovered on the territory of Bosnia and Herzegovina, i.e. in Buško Lake (Livanjsko Field).

All earlier statements on species of the genus *Chondrostoma* Agassiz, 1835 speak in favour of their inhabiting very specific ecological niches and occupying an important place both in the ecology and in the biosystematics and morphology of fishes. Some 18 species have been described to date, all of them in the area of Europe (except Great Britain, Scandinavia, Finland and the Northern Sea basin), the Black and the Caspian Sea drainage basin, the Orontes, the Tigris and the Euphrates.

More detailed descriptions of the *Chondrostoma phoxinus* species, the minnow-nase, in terms of biosystematics have been provided by various other authors as well, referencing Heckel and Kner's (1858) data and giving comparative overviews of results achieved by using different scientific methods (cytological, biochemical, physiological, genetic, comparative-anatomical, embryological, paleontological, and other). By studying the literature references, one comes to realise that a number of authors have been interested in the meristics and morphometrics of the species in question, i.e. its biosystematics in general, as well as the status of the minnow-nase in the area it inhabits, its feeding habits, age categories, sex ratios and other. However, despite of the data from the extensive research papers on the *Chondrostoma phoxinus* species in the waters of Bosnia and Herzegovina, there is still a lack of a more comprehensive monographic research, as well as the most recent validation of the existing results.

The earliest findings and results of the *Chondrostoma phoxinus* species research are provided by Čurčić (1916), Karaman (1923, 1928), Kišpatić (1938) Taler (1954), whereas somewhat more relevant data come from authors like Vuković (1966, 1977), Aganović (1969), Vuković and Ivanović (1971), Veledar and Kosorić (1972, 1974), Seratić - Savić (1976), Aganović et al. (1974), Aganović and Kapetanović (1978), Vuković et al. (1978), Kosorić (1985), Elvira (1987), Habeković, et al. (1987), Mikavica and Kosorić (1987), Mikavica and Zovko (1989) and others.

The present-day research in this field is certainly aimed at gaining a more comprehensive knowledge of this endemic species, about which not enough is known, including its endangered status and confirmation of its distribution on the territory of Bosnia and Herzegovina. Kerovec et al. (1998) published a work on the occurrence of the *Chondrostoma phoxinus* species in Croatia. Žujo (2005) in her master's thesis reveals the results on the biosystematic position and population status of the *Chondrostoma phoxinus* species in Buško Lake (Livanjsko Field). Valuable accounts from our area are provided by Mrakovčić et al. (2006) as part of the Red Book of Freshwater Fish of Croatia, in which they especially point out the endangered status of the endemic species *Chondrostoma phoxinus*. Kottelat and Freyhof (2007) specify the basic details on the morphology, distribution, habitat and biology of the species noting also its conservation status. Čaleta et al. (2009) published a work on the threatened fishes of the world with an accent on the *Chondrostoma phoxinus* species. With all of the relevant research conducted so far as the starting point of her work, Žujo Zekić (2009-2010) introduces her own research conducted as part of her doctoral dissertation in which she took a particular interest in the endemic species *Chondrostoma phoxinus*, *Telestes (Leuciscus) turskyi* and *Aulopyge huegelli* while establishing the biological diversity of the fish population in Buško Lake.

MATERIALS AND METHODS

The material, species *Chondrostoma phoxinus* Heckel, 1843, was collected periodically from April 2003 to September 2004 and during 2008 and 2009 using standard ichthyological methods. During the first visits to the site, the specimens were collected from four locations on Buško Lake: Prisoje, Pećina, Marinovac and Široka Draga where the ichthyosamples consisted of 71 specimens of the species *Chondrostoma phoxinus* Heckel, 1843 (Figure 1). The field research continued during spring-summer season in 2007 and autumn-winter season in 2007, as well as the same seasons in 2008. The representative samples of ichthyofauna for the relevant period were collected on ten marked locations: Korito Ričine, Vrbovi Panji, Marinovac, Mukišnica, Brana Kazaginac, Široka Draga, Matkovača, Kanal, Bilo Polje and Golinjevo (Figure 1). During collection of fish two types of nets were used: single bottom gillnets (so called *popunice*) with different mesh sizes ranging from 10 mm, 16 mm, 28 mm, 32 mm to 50 mm and so called "*Baracuda*" nets with the mesh size of 70 mm, 80 mm, 90 mm, 110 mm and 120 mm. An attempt was made to avoid the selectivity of ichthyomaterial samples during fishing by using different available fishing tools. The caught specimens were then fixed in 4% formaldehyde solution and transported to the laboratory for further analysis. The biosystematic identification of the caught fish was performed according to Vuković and Ivanović (1971), Vuković (1977), and Kottelat and Freyhof (2007). The detailed analysis of the ichthyomaterial consisted of determining the age categories. To analyse the age structure fish scales were collected always from the right side of the belly right

underneath the dorsal fin which were then cleaned with 10% KOH. This was followed by counting the sclerite rings (annuli) using the binocular microscope *Binokulares LED Schulmikroskop BA 658*. Software programme *SPSS for Windows 15.0* was used to perform the descriptive statistics in this paper.



Figure 1. The chart of fishing locations at Buško Lake (prepared by Drešković, N.)

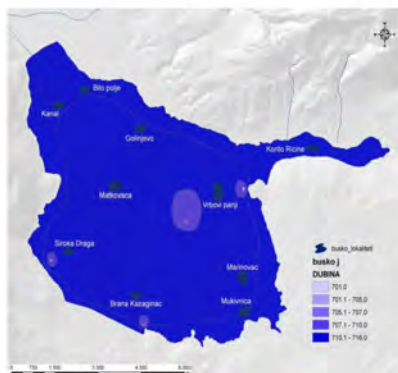


Figure 2. *Chondrostoma phoxinus* Heckel, 1843 from Buško Lake (photo: Žujo Zekić D.)

RESULTS AND DISCUSSION

In the processes of change of natural ecosystems and living conditions that govern such a water habitat, whether caused by the systematic fish stocking or damming of watercourses (construction of reservoirs), it is essential to know the quantitative and the qualitative composition of the biotic communities (fish populations) and their age and sex structure. The established age structure of the analysed ichthyopopulation is a dynamic character that indicates most clearly the growth trend and dynamics of specimens, which affects directly the status of the entire population. The age structure analysis of the random sample from specific collection locations included the total of 206 specimens. The age was established only for those specimens that had pronounced sclerite rings (annuli). In the analysis dictated in such a manner, different movement patterns and directions were observed, tracking the oscillations in the seasonal growth rates and sex attributes.

In the first original ichthyosample (subsample) from 2003-2004, collected on four locations of Buško Lake, the age class 3⁺ was determined in the majority of the 71 analysed specimens of minnow-nase. Only three specimens belonged to the age class 4⁺. One of the most likely reasons is the selectivity of sampling using the 28 mm mesh size net. Furthermore, the length of the caught fish was considerably uniform which confirms the stated reason.

The study of the fish growth patterns, including minnow-nase growth patterns in Buško Lake waters, provides answers concerning the sexual maturity, reproductive ability and the dynamics of the researched population including also its rational fishing, which is of both theoretical and practical importance to the monitoring of the ichthyofauna.

The research period was continued during 2007, 2008 and 2009 when more precise results were determined concerning the age class of the *Chondrostoma phoxinus* specimens fished out in specific seasonal intervals during the research period (Table 1).

Table 1 – The share of *Chondrostoma phoxinus* Heckel, 1843 specimens across specific age categories during researched seasons on Buško Lake

SEASON		AGE CLASSES							TOTAL	
		1 ⁺	2 ⁺	3 ⁺	4 ⁺	5 ⁺	6 ⁺	7 ⁺		
Spring- summer	2007	No. of specimens	0	5	14	31	13	6	1	70
		% in season	0,0%	7,1%	20,0%	44,3%	18,6%	8,6%	1,4%	100,0%
Fall- winter	2007	No. of specimens	2	8	10	16	19	10	0	65
		% in season	3,1%	12,3%	15,4%	24,6%	29,2%	15,4%	0,0%	100,0%
Spring- summer	2008	No. of specimens	3	4	13	19	6	0	0	45
		% in season	6,7%	8,9%	28,9%	42,2%	13,3%	0,0%	0,0%	100,0%
Fall- winter	2008	No. of specimens	0	0	7	13	5	1	0	26
		% in season	0,0%	0,0%	26,9%	50,0%	19,2%	3,8%	0,0%	100,0%
TOTAL	Total number of specimens	5	17	44	79	43	17	1	206	
	% in all seasons	2,4%	8,3%	21,4%	38,3%	20,9%	8,3%	0,5%	100,0%	

The numbers show that of the total of 252 collected minnow-nase specimens the age class was not determined for 46 of them, for the previously mentioned reasons, and therefore the age structure analysis for that population included the total of 206 specimens of the species *Chondrostoma phoxinus*.

Given the fact that the distribution of specimens from specific age categories is closely related to seasonal processes, Table 1 lists the numbers of minnow-nase specimens of specific age in specific fishing seasons during two years of research. The presented numbers of the minnow-nase specimens of different age varies across the researched seasons – 79 specimens of the age 4⁺, 44 specimens of the age 3⁺, 43 specimens of the age 5⁺ and so on.

The numbers of the specimens collected during season spring-summer, 2007 are especially notable, where the total of 70 specimens have been described, most of them of the age class 4⁺ (31 specimen), which is directly related to the activities of the expected spawning period. The numbers of specimens fished out during season fall-winter, 2007 is also large, *i.e.* the total of 65 specimens divided almost equally across all age classes, whereas the next spring season of 2008 had somewhat smaller number of registered specimens (45), also with larger numbers in the 4⁺ age of specimens.

When observing the percentage share of the minnow-nase specimens of certain age across specific seasons, we can notice a high share of the 4⁺ age specimens, 44.3% or 31 specimens in the spring season of 2007. The percentage share of the specimens of that same age is also high during spring season of 2008 or 42.2%. The percentage of the 4⁺ age specimens is also high during fall-winter, 2008 season (50.0%), but only because of the small number of collected minnow-nase specimens in other age classes during the said season.

The table overview (Table 2), which shows seven registered age classes of minnow-nase specimens collected from Buško Lake, presents the correlation between the esta-

blished age of the specimens and their sex attributes. It can be noted that the four-year old minnow-nase specimens are the most numerous compared to the total population composition of this fish species in the relevant aquatic complex, as many as 79 specimens or 31.35%.

The 3⁺ age class has 44 minnow-nase specimens, with males prevailing, whereas the 5⁺ age class registers 43, predominantly female, specimens. Expressed in percentages, the aforementioned values total 17.46% and 17.06%, respectively. Considerably lower number of minnow-nase specimens was registered in the second and the sixth age class, whereas the number of specimens in the age classes 1⁺ and 7⁺ is insignificant. While examining the presence of female minnow-nase specimens in specific age categories, it was surprising to find a large number of females in the age class 4⁺. 60 registered specimens, of the total number of female samples, comprise a value of 50.8%. The percentage share of females of the age class 4⁺ in the total number of 79 collected specimens in that age category is rather high and amounts to 75.9%. Finally, the number of female specimens in the age class 4⁺, compared to the total number of collected minnow-nase specimens (252), amounts to 23.8% in percentages. This piece of data, which reflects the dominance of females in the total population, especially during a reproductively significant period, gives positive results with regard to the growth pattern and the population's survival dynamics. When examining further results on the ratio of sexes in other age categories, we can observe that the female specimens are more numerous. The age category 5⁺ (30 females) comprises 25.4% of the total number of registered females in the collected sample, and the age category 6⁺ (11 females) comprises 9.3%.

Similar reflections can be given for male species in age classes 2⁺, 3⁺, 4⁺, 5⁺, 6⁺. The age class 1⁺ has 4 male specimens, the age class 2⁺, 12 male specimens and the age class 3⁺, 32 male specimens. A conclusion can be made that in the said age classes males are somewhat more present than females. On the other hand, a slightly lower number (19) of male specimens in the age class 4⁺, 13 males in the age class 5⁺, and 6 minnow-nase males in the age class 6⁺, leads to a conclusion that females are more numerous and more represented in the reproductively more mature age, which is another proof of positive growth trend of the population of this species. Higher numbers of female minnow-nase specimens can be closely related to the spawning period as well (late spring), when the largest number of samples was collected compared to the entire research period. By examining all minnow-nase specimens (252) collected during the research period, only 5 specimens belong to age class 1⁺, with 4 males and one female. The total of 17 specimens – 12 males and 4 females – was collected in the age class 2⁺. Very large number of specimens, 44 in total, was collected in the age class 3⁺ of which 32 are males and 12 are females. The structure of sexes in terms of ratio changes abruptly in higher age classes and therefore in the age class 4⁺ of the total number of 79 specimens, there are 60 females and only 19 males, etc. A more detailed statistical analysis by using χ^2 test can demonstrate the existence of a statistically significant difference between observed minnow-nase specimens of a particular sex and established age. Only the minnow-nase specimens specified in terms of their sex and age category have been included in this analysis, the total of 205 specimens. The age classes have been also logically grouped according to their reproductive age, i.e. younger specimens, reproductively mature specimens and older specimens with a pronounced stagnation period. The statistical analysis in this case demonstrates the significance level for the tested minnow-nase specimens of 0.004 or 99.6 %.

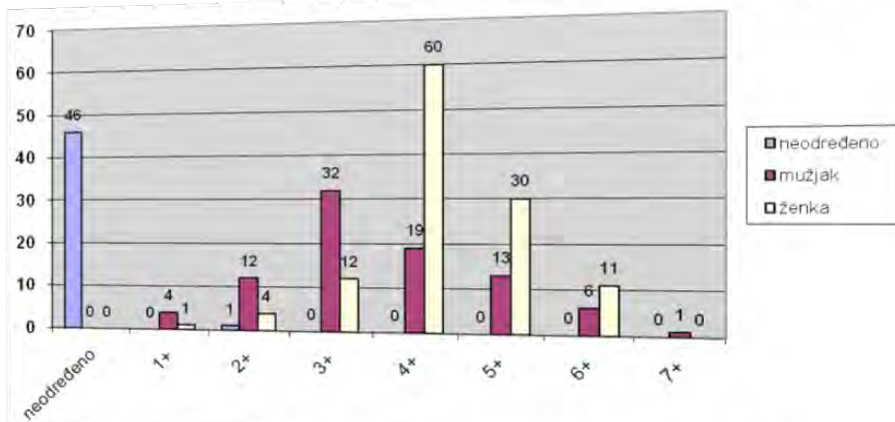


Diagram 1. Correlation of age and sex structure of *Chondrostoma phoxinus* specimens

DISCUSSION

During the research of the *Chondrostoma phoxinus* population in Buško Lake we did not come across a sufficient number of new data and valid results against which the results actualised in this paper could be compared. Therefore, the final conclusions and the discussion are mostly based on some general data on the status of the minnow-nase population in Livanjsko Field watercourses.

Veledar and Kosorić (1972, 1974) present results according to which the analysed minnow-nase specimens from Livanjsko Field waters achieve the greatest body length growth rate during the second and third year of life, which was also concluded in reference to the highest weight growth rate. Furthermore, a hypothesis was stated that certain age classes were unevenly distributed across different sections of Buško Lake, which needs to be confirmed by the results of some future research planned for this reservoir.

Our research presents the seasonal dynamics of occurrence of minnow-nase specimens of specific age classes in Buško Lake reservoir. We have observed that reproductively mature minnow-nase specimens in the age classes 4⁺ and 5⁺ were more present in the spring – summer season during the two years of research, as was expected since it relates to the spawning period.

Numerous examples from the research of the age and sex structure of mixed fish populations in Buško Lake are provided by Mučibabić et al. (1973), as part of their detailed limnological research of Buško Blato reservoir. They determined the age structure for the analysed specimens of *Chondrostoma phoxinus* population in Buško Lake and found that 31.16% of minnow-nase specimens belonged to the age class 6⁺, which, according to the authors, was inexplicable. The share of the age class 3⁺ specimens was negligibly low, lower than 10%, which moreover indicates that our results present a more positive image of the actual status with significant numbers of minnow-nase specimens in the age classes 4⁺ (79), 3⁺ (44) and 5⁺ (43 specimens).

The results of similar analyses have been found in the paper by Cvijović and Kosorić (1985) who concluded that the weight growth was more pronounced in younger age

classes and that the highest growth rate was achieved in the specimens in the fourth and fifth year of life.

By analysing the age structure of Buško Lake minnow-nase, Mikavica and Kosorić (1987) established 7 age classes from 3⁺ to 9⁺, with most specimens belonging to the age class 5⁺ (50 specimens, 33,33%). As part of their paper, they recorded 70 males and 80 females from the total number of analysed specimens (150) and they concluded that females were more numerous in older age classes. Because there were no occurrences of younger age classes, the authors predicted the stagnation of the minnow-nase population in future in terms of its reproduction, which cannot be validated at present by the updated data.

CONCLUSION

Research tasks which involve monitoring of the population of *Chondrostoma phoxinus* species, as an endemic species of the Adriatic catchment area, present an invaluable scientific contribution to the ichthyological communities of both Bosnia and Herzegovina and Europe. The waters of Bosnia and Herzegovina are inhabited by a large number of species from the Cyprinidae Bonaparte, 1840 family many of which are endemic. The species of the genus *Chondrostoma* Agassiz, 1832 are particularly interesting.

By examining the referenced literature and systematically comparing the current data on the status of fish communities prior to, during and following the formation of the aforementioned Buško Lake reservoir, very obvious and concise conclusions can be made as to the partial degradation of the ecosystem and the endangered status of the endemic ichthyopopulations caused by the distinct interspecies competition encouraged in this case by human activities (uncontrolled fish-stocking – exploitation of the autochthonous fish communities).

At present, the most numerous specimens, with respect to the composition of the entire population of Buško Lake *Chondrostoma phoxinus* species, are the minnow-nases in their fourth year of life, totalling 79 specimens or 31.35%.

The percent share of females in the age class 4⁺, compared to the total number of minnow-nase specimens is quite high and amounts to 75.9%. This piece of data, which reflects the dominance of females in the total population, especially in their more reproductive period, provides positive results in terms of the population's growth trend and survival dynamics.

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