FISH BIODIVERSITY IN THE RIVER KRUŠNICA

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BIODIVERZITET RIBA U RECI KRUŠNICI

Apstrakt

Ribe su rasprostranjene u vodama širom svijeta i većina ih se upotrebljava u ljudskoj ishrani. Osim toga, ribe se sve intenzivnije danas izučavaju sa različitih aspekata biologije i drugih primjenjenih nauka, ali i rekreativnog sporta i turizma. Zbog sve intenzivnijeg antropološkog uticaja na životnu sredinu, monitoring ribljih populacija je neizostavan iz više praktičnih razloga: razumjevanja mehanizama zagađenja, prikupljanja podataka o prirastu ribljih vrsta koje se koriste u uzgoju i akvakulturi, procjenu stanja vodenih biotopa i dr. Sposobnosti osjetljivih ribljih vrsta za bioakumulaciju zagađenja, koje nastaje kao posljedica ljudskih aktivnosti, danas je veoma primjenljivo u zaštiti i unaprijeđenju životne sredine onih biotopa koji su se našli na udaru raznih hemijskih i drugih polutanata. Polazne osnove za bilo kakvo fiziološko, genetičko, ekološko ili bilo koje drugo stanovište proučavanja populacija određenih vrsta jeste određivanje biodiverziteta nekog užeg ili šireg područja vodenog staništa. Ihtiofauna Bosne i Hercegovine je relativno dobro proučena, o čemu svjedoči veliki broj objavljenih radova, što se ne može reći za sliv rijeke Une, pogotovo njene manje pritoke, u kojim inventarizacija ihtiofaune ni do danas nije u potpunosti urađena. Uzevši u obzir činjenicu da je ihtiološko ispitivanje ribljih populacija u rijeci Krušnici, desnoj pritoci rijeke Une, važno za ovaj predio Bosne i Hercegovine gledajući iz različitih uglova, provedna su istraživanja tokom perioda jesen-zima 2001. godine i proljeće-ljeto 2002. godine. Praćena su kvantitativna i kvalitativna obilježja izlovljenih ihtiopopulacija u ovom vodenom biotopu sa ciljem registrovanja prisutnih i najbrojnijih vrsta riba. Dio izlovljenog materijala se direktno analizirao na terenu, kratko odmah nakon izlova, a veći dio je fiksiran i prenesen u laboratorij Biotehničkog fakulteta, Univerziteta u Bihaću, gdje su nastavljena morfološko-anatomska istraživanja. Ispitivanja osnovnih pokazatelja kvalitativnog i kvantitativnog sastava ihtiofaune rijeke Krušnice provedena su na tri lokaliteta, izvo-

rištu rijeke, na srednjem toku i u području ušća. Pri tome praćene su fizičko-hemijske karakteristike vode, temperatura, pH, tvrdoća vode, prisustvo otopljenih soli, količina kisika, količina ugljične kiseline, osnovne osobine režima vode, mikroklimatske karakteristike područja, prikupljeni su uzorci fitobentosa i zoobentosa koji su također važni za određeni ekosistem, jer od sastava planktonskih vrsta i bentosa ovisi i sastav ribljih vrsta. Izlovljeno je ukupno 108 jedinki, osam različitih vrsta riba koje su klasifikovane prema standardizovanim ključevima za određivanje slatkovodnih vrsta riba u pet familija: *Salmonidae, Thymallidae, Cyprinidae, Esocidae* i *Cottidae.* U radu su primijenjene standardne statističke metode obrade podataka. Kod svih ulovljenih vrsta riba, njihova relativna brojnost, morfološke, ekološke i druge karakteristike, unatoč evidentnim inavazivnim uticajima ponajviše nezakonitog ribolova, predstavljaju zadovoljavajuće rezultate do kojih se došlo ovim radom.

Ključne riječi: riba, populacija, rijeka
Keywords: fish, population, river

INTRODUCTION

Ichthyofauna of water systems in Una-Sana basin is considered to be vaguely explored, making them interesting for research. The Krušnica River is a right tributary of the Una river and rises near the village Gudavac, municipality of Bosanska Krupa, below the mountain massif of Grmeč. Krušnica is 6,8 km long, with an average width of 20 m, and average depth 5–7 m. Freshwater ichthyofauna of former Yugoslavia includes relatively large number of species–135 (Vuković i Ivanović, 1971), and Bosnia and Herzegovina 108 species (Vuković, 1977). The research of stream bed of the Una river (Fishing Report for Fishing area "UNA I" 1984) identified a large number of animal species, more precisely 68 species. The research of zoobenthos in the Krušnica river published in Fishing Report for Fishing area "UNA I" in 1984, provided data on 138 individual animals of different systematic categories. The newest comprehensive research on biological community of phytobenthos (Sofradžija et al., 2002) included quantitative analysis on content of phytobentos in the Una river and provided data on the presence of 36 species. The references on the Krušnica River provide data on presence of 4 families: *Salmonidae*, *Thymallidae*, *Cyprinidae* i *Cottidae*. *Salmonidae family* is presented by 2 species: *Salmo trutta morfa fario* and *Hucho hucho*. *Thymallus thymallus* is a representative of *Thymallidae* family. Three species of *Cyprinidae* family are registered: *Leuciscus cephalus*, *Barbus barbus* and *Rutilus pigus virgo. Esox lucius* is the only representative of *Esocidae* family.

MATERIALS AND METHODOLOGY

The field research was conducted in October–November 2001, and by the end of May 2002. Qualitative and quantitative structure of ichthyofauna in longitudinal profile of this river was determined at three locations–source-location of Vranjska, middle course-Zalug and river mouth-Pazadžik. Catching was conducted by means of a fixed net. A small number of caught fish was field tested, while the rest was fixated and transferred to the laboratory of Biotechnical faculty of University of Bihać for further examination. Determination of caught fish was conducted according to the relevant reference books

on freshwater fish, Vuković i Ivanović (1971). The total body length of fish was measured with ichthyometer, and laboratory scale was used to determine the weight. Age determination of caught fish was conducted by counting natural growth rings (annuli) on the scales taken from the area below the dorsal fin. Gender determination was conducted after dissection by examination of gonads. The obtained data served to calculate number and mass portion of populations of certain fish species, providing relative (percentual) figures of number and mass, for each location, as well as for the entire river course. Water quality parameters were determined according to standard methods for the examination of waters and wastewaters that are in compliance with the Law on water resources. The results were statistically elaborated according to Petz (1985). Ichthyofaunal heterogeneity of the examined ecosystem was evaluated according to Kerovec (1988) based on two parameters: diversity index (d) using the equation d=S/N (S=number of species, N=number of individuals in specific area) and coefficient of similarity (QS) using the form QS=(2cx100)/(a+b) (c=number of similar fish species in certain ecosystems, a=number of species in ecosystem *a*, b=number of species in ecosystem b).

RESULTS AND DISCUSSION

Many authors (Zelikoff, 2000; Farkas et al., 2003; Lukin et al., 2003; Licata et al. 2003.) consider monitoring of water biotope to be important, since it provides data on the state of an ecosystem. The source of the Krušnica river corresponds to bonitation class I, except for the oxygen saturation level which amounts to 83,2% and an increased amount of ammonium (0,12 mg/L in the first and 0,11 mg/L in the second season) at the river mouth, which can be considered as relatively low amounts, however indicating the presence of anthropogenic influence. According to all other physical and chemical characteristics, waters of all location correspond to bonitation class I. The temperature of water at the examined area is balanced at all locations and corresponds to the climate of the area. According to Northcote (1995) optimal water temperature for sustenance of *Salmonidae* species, including grayling is 8-10ºC. *Salmonidae* species are able to tolerate changes of temperature in maximum decrease to 5ºC in winter period to an increase up to 18ºC in summer periods. This facts confirms the statement that the examined waters are salmonid (Sofradžija et al., 2002), which was proved by this research. Physical and chemical characteristics of the Krušnica river are in great measure similar to those of the Test river (United Kingdom) which is considered to be one of the most suitable salmonid rivers in the world (Ajanović, 1999). Being an indicator of conditions in water ecosystem (Mol, 1982), zoobenthos was examined in 24 samples, where 14 taxons with 786 individuals were determined. Ichthyological research conducted at three locations resulted in number of 108 individuals of different fish species. A number of 30 fish was caught in the season of autumn-winter, and 78 individual fish of different species in season of spring-summer. Two species of family *Salmonidae* were found in the Krušnica: brown trout-*Salmo trutta morfa fario* (Linnaeus, 1758), caught in both seasons, and rainbow trout-*Oncorhynchus mykiss* (Walbaum, 1792) caught only in autumn-winter season 2001. Only one species of *Esocidae* family was found: pike-*Esox lucius* (Linnaeus, 1758) caught only in spring–summer season 2002. The representative of *Thymallidae* family was grayling-*Thymallus thymallus* (Linnaeus, 1758) and was caught in both seasons. According to the number of recorded species, most frequent is family *Cyprinidae* with three species–chub-*Leuciscus cephalus* (Linnaeus, 1758), common minnow-*Phoxinus phoxinus* (Linnaeus, 1758), and the Danube roach-*Rutilus*

pigus virgo (Heckel, 1852). The Danube roach was caught in both seasons, while chub was present only in autumn–winter season of 2001, and common minnow in season spring-summer of 2002. The representative of *Cottidae* family is bullhead *Cottus gobio* (Linnaeus, 1758), present in both seasons with the largest percentage in total number of samples (Figure 1).
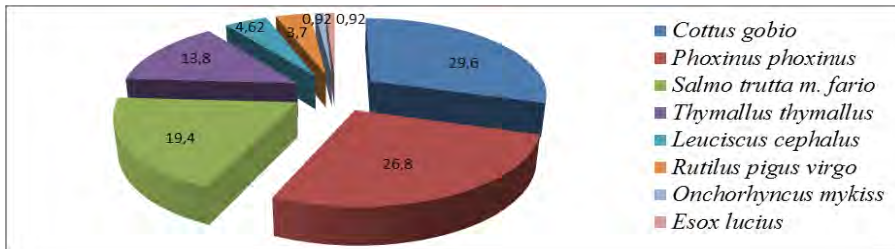

Figure 1. Relative number of certain fish species in the total sample caught from the Krušnica river within two seasons (percentages)

The highest value of diversity index was calculated at the middle course of the Krušnica d=0,31, and the lowest at the source 0,06, while at the river mouth the value was 0,23. Lower values of diversity index in a biotope indicate an decrease in optimal values of ecological conditions, which is in compliance with conclusions made in relevant resource books (Kerovec, 1988.). According to the data it is possible to conclude that ecological conditions at the source are farthest from the optimal values, while the middle course has the lowest rate of decrease in optimal values. By comparing the values of diversity factor, an influence of ecological factors on fish population can be considered as balanced. Regarding the presence of species at the locations and in research seasons, it can be stated that the grayling individuals were identified in both seasons and at all three locations of the Krušnica River. Other species are diversely distributed at different locations and in different research seasons. If we consider the coefficient of similarity, the highest level of ichthyofaunal similarity exists between locations Pazadžik and Vranjska–QS=60,0%. Ichthyofaunal similarity between locations of Vranjska and Zalug is lower than 50%, while between locations Zalug and Pazadžik QS=54,4%. The data indicates that the ecological factors at the locations are inconsiderably different, thus being rather stable.

CONCLUSIONS

According to the analysis of data obtained during the field research of fish biodiversity, the following can be stated: The most numerous family is *Cyprinidae*, represented by three species: chub-*Leuciscus cephalus*, Linnaeus 1758, Common minnow-*Phoxinus phoxinus*, Linnaeus 1758, The Danube roach-*Rutilus pigus virgo*, Heckel 1852; there were two representatives of *Salmonidae* family: Brown trout-*Salmo trutta morfa fario*, Linnaeus 1758, and rainbow trout-*Oncorhynchus mykiss*, Walbaum 1792; *Esocidae*, *Thymallidae*, and *Cottidae* families each have one representative: pike-*Esox lucius*, Linnaeus 1758, grayling-*Thymallus thymallus*, Linnaeus 1758, and bullhead-*Cottus gobio*, Linnaeus 1758.The most numerous species is bullhead–*Cottus gobio* with 29,6% of total number of samples; the least numerous species are pike–*Esox lucius* and rainbow trout-*Oncorhynchus mykiss*; brown trout-*Salmo trutta morfa fario* has the lar-

gest ichthyomass in the Krušnica with 36,3% of the total ichthyomass; and the lowest ichthyomass is that of pike–*Esox lucius*; diversity index values are rather low, while the coefficient of similarity is over 50% in two of three instances.

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