Ichthyofaunal diversity of the Drinjača catchment area

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Abstract
The last decades witnessed the widespread degradation of the freshwater ecosystems, mainly by anthropogenic activities and improper management. Sustainable water management is possible only if we have knowledge about the ecosystem ecological status, community structure and species diversity. We have investigated ichthyofaunal diversity of rivers of the Drinjača catchment area. Rivers Zeleni Jadar and Studeni Jadar are main tributaries of the river Jadar, which is the left tributary of the river Drinjača. Electrofishing was performed in December 2016. The highest species diversity was observed in river Drinjača where eight fish species were determinated. In river Jadar we identified six fish species, while in Studeni Jadar only one species was present. All identified fish species were autochthonous, while no allochthonous or invasive fish species were detected. According to saprobic system, Drinjača and Jadar were categorized as β-mesosaprobic (water quality class II) and Studeni Jadar was assessed as oligosaprobic (water quality class I).

Keywords: Drinjača, ichthyofauna, biomonitoring, diversity, ecosystem

Introduction

Aquatic communities are very sensitive to changes in the environment and represent reliable indicators of the relative health of aquatic ecosystems. Fish are widely ased as bioindicators because of their sensitivity to pollution. They exhibit different behavioural, morphological and ecological adaptations to their natural habitat (McCormick et al., 2000). Fish community structure is of great importance in biomonitoring because it depends on environmental variables. The last decades witnessed the widespread degradation of the freshwater ecosystems, mainly by anthropogenic activities and improper management. Actions are necessary to improve assessment procedures for the exploration of the ecological impact of

pollution on aquatic environment. Sustainable water management is possible only if we have knowledge about the ecosystem ecological status, community structure and species diversity. We have investigated ichthyofaunal diversity of rivers of the Drinjača catchment area. Rivers Zeleni Jadar and Studeni Jadar are main tributaries of the river Jadar, which is the left tributary of the river Drinjača. Jadar is a mountain river 64.7 km long, with an area of approximmately 893 km^2 (. The river Drinjača is the left tributary of the river Drina. The main spring is located below Konjuh Mountain. It flows into the river Neretva in Posušje. Drinjača is a fast flowing river with an average water level of 63 cm (Zubčević, 1974).

The aim of our study was to to determine ecological status of Drinjača catchement area and to investigate ichthyological diversity of rivers Jadar, Drinjača and Studeni Jadar.

Material and Methods

We sampled four sites in Drinjača catchement during December 2016 in order to make characterization of fish communities and their connections with environmental conditions. Electrofishing in river Jadar was performed at site Raševo (44° 14' 20.42" N and 19° 5' 52.95" E). Sampling on river Drinjača was performed at two localities- Ušće (44°16'44.49"N and 19° 6'24.29"E) and Jasen (44°13'37.28"N and 18°51'27.63"E). River Studeni Jadar was investigated in Milići Municipality (44° 9'23.07"N and 18°58'54.03"E).All fishes captured were identified to species and released alive after sampling was completed. Quantitative structure of fish communities was also analyzed. Morphometric parameters were measured for brown trout (Salmo trutta) samples and Fulton's condition factor was calculated using following formula:

$$K = W \times L^{-3} \times 100$$

K – condition factor,
W – body mass,
L – standard lenght.

Results

During the sampling in Deceber 2016, we captured 10 different fish taxa in Drinjača catchment (Table 1). Fish communities were structured according to environmental gradients of water temperature and river flow.

The sampling site with the highest number of identified fish species was on Drinjača river, while in Studeni Jadar only one taxa was recorded. No *allochthonous species were captured during the investigation of this catchment.* Electrofishing surveys conducted during December 2016 indicated that schneider (*Alburnoides bipunctatus) was* the numerically dominant species in samples collected in Jadar and Drinjača. European chub (*Squalius cephalus*) had consistently the highest biomass percentage in electrofishing these sampling sites (Table 2). In river Studeni Jadar, only one species was captured – the brown trout (*Salmo trutta*). Morphometric parameters measured in trout (*Salmo trutta*) collected in Studeni Jadar are presented in Table 3. Average mass of fishes was 21.97 g, although mass of the captured samples varied significantly.

Table 1. Taxa and status (N- native) of fishes captured in Drinjača catchment.

Species	Family	Status
Gobio gobio	Cyprinidae	*N*
Alburnoides bipunctatus	Cyprinidae	*N*
Barbus balcanicus	Cyprinidae	*N*
Squalius cephalus	Cyprinidae	*N*
Barbatula barbatula	*Balitoridae*	*N*
Cobitis elongatoides	Cobitidae	*N*
Gobio obtusirostris	Cyprinidae	*N*
Alburnus alburnus	Cyprinidae	*N*
Chondrostoma nasus	Cyprinidae	*N*
Salmo trutta	*Salmonidae*	*N*

Table 2. Relative abundance and biomass percentage of fish species caught in Drinjača catchment.

Sampling site	Jadar		Drinjača		Studeni Jadar	
Species	Relative abundance (%)	Biomass (%)	Relative abundance (%)	Biomass (%)	Relative abundance (%)	Biomass (%)
Gobio gobio	1.4	1.3				
Alburnoides bipunctatus	74.5	27.4	56.3	26.5		
Barbus balcanicus	4.1	2.8	1.0	0.8		
Squalius cephalus	18.6	68.1	8.9	42.7		
Barbatula barbatula	0.7	0.2	0.5	0.6		
Cobitis elongatoides	0.7	0.2	1.6	1.8		
Gobio obtusirostris			0.5	0.2		
Alburnus alburnus			30.7	24.3		
Chondrostoma nasus			0.5	3.1		
Salmo trutta					100	100

Table 3. Morphometric characteristics of brown trout (Salmo trutta) collected in Studeni Jadar.

	Total length (cm)	Standard length (cm)	Mass (g)	Fulton's condition factor
Mean value	12.99	11.43	21.97	1.38
Standard deviation	1.98	1.72	9.06	0.07
Minimum	9.10	8	3.49	1.27
Maximum	15	13.3	33.82	1.49
Coefficient of variation	15.24	15.03	41.24	5.29

Discussion

Waterstreams are characterized by a variety of physicochemical components, and diverse aquatic organisms such as fish, insects and plants co-exist here (Allan, 1985). In aquatic ecosystems, the impact of any disturbance has more significant impact in comparison to terrestrial ecosystems (Ricciardi and Rasmussen, 1999).

The ichthyofauna of Drinjača catchment is characterized by several dominant species which reside in the system during the year. Relative abundance and biomass are commonly used for estimating community structure. Although fish community composition is different between rivers Jadar and Drinjača, numerically dominant fishes and taxa with the highest percentage of biomass in sample are identical in both rivers.

We identified 10 fish taxa in Drinjača catchement, all of which were native from family Cyprinidae. Our reasearch revealed that physical properties of habitat play a crucial role in the distribution of fishes. Even though all three sampling sites are geographically close, river Studeni Jadar is characterized by vastly different habitat properties and community structure. Only species identified at this sampling site is brow trout (Salmo trutta) from family Salmonidae. The weight–length relationship (WLR) and Fulton's condition factor (K) are two main parameters used in fishery research, and have been closely related since they were first proposed (Froese, 2006). According to measured morphometric characteristics and Fulton's condition factor, all collected individuals were classified as well-proportioned and in good condition. The value of K (Fulton's condition factor) depends on fish sex, age, season, stage of maturation, type of food consumed, amount of fat reserve and degree of muscular development.

Knowledge about fish community structure is not only important for giving insight in present status of aquatic ecosystem but also for creating protective measures for restoring a waterstream. Fish sampling and ichthyofauna investigation represent classic tools for examining and implementing strategies concerning conservation of biodiversity (Wichert and Rapport 1998, Fausch et al. 2002). It would be of great importance in future to investigate seasonal and spatial variation in species diversity, abundance and distribution.

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