DIET OF TWO CYPRINID SPECIES, WHITE BREAM (*BLICCA BJOERKNA*) AND COMMON ROACH (*RUTILUS RUTILUS*) IN THE DANUBE RIVER, BELGRADE

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Abstract

Food and feeding habits of white bream (Blicca bjoerkna) and common roach (Rutilus rutilus) specimens sampled from the Belgrade section of the Danube River in April 2021 were investigated. Stomach contents of 20 individuals of both cyprinid fish species were analyzed and no individual had an empty stomach. There was a small difference in the stomach contents of these two analyzed fish. The food items in stomach showed a wide spectrum, ranging from crustacean, molluscs to aquatic insects. Therefore, analyzed fish species displayed an omnivorous feeding. Based on the obtained data, the indices of frequency, abundance and significance for each of the identified prey categories were calculated. Trichoptera (aquatic insects) and Gammaridae (Crustacea) were found to be the most common and abundant prey utilized by all analyzed species. The attained results, since these are relatively small samples collected during one monthly outing (April), can be considered preliminary and require further research.

Keywords: Cyprinid fish, feeding, stomach content, urban river locality, biotic indices

INTRODUCTION

Fish have different habits and food needs, depending on age, physiological condition of fish, time of day or season. The food and diet knowledge is very important for fish biology [1]. Fish dietary ecology and feeding habits can be useful in searching the distribution of a fish population for successful management of fishery [1]. Few factors can influence fish diet composition and make variation in intestine content among analyzed individuals, like the fish size and its feeding habits.

European cyprinids are characterized by a variety of diets and feeding modes and have specialized representatives as zooplanktivores, herbivores, piscivores and benthivores [2]. Although none of the cyprinids are strictly monophagous, many may feed on only one type of food organism, depending on its availability [2].

White bream (*Blicca bjoerkna*) and common roach (*Rutilus rutilus*) are omnivorous cyprinid freshwater fish species found in Europe and Asia, autochthonous in Serbian freshwater ecosystems. They feed on plankton, benthic invertebrates and plant material [3].

The white bream does not have any commercial value because of its unpleasant taste [4] and great number of intermuscular bones [5]. However, it is an important food supply for predator species inhabiting aquatic habitats.

Data regarding the biology, including feeding of cyprinids in Serbia/Serbian Danube are scarce. Krpo-Ćetković *et al.* [6] published a paper concerning the biology of *Aspius aspius* (Linnaeus, 1758), while Đikanović [7] analyzed intestinal parasites and feeding biology of the 14 fish of the Belgrade region. Also, Egerić *et al.* [8] have published notes of feeding preference of 4 cyprinid fish species in the Danube River, downstream from Belgrade city.

This study was conducted on the Danube River locality Visnjica, which is exposed to the discharge of the largest wastewater collector in the city of Belgrade.

The main aim of this study was to investigate diet spectrum of white bream and common roach by analyzing the stomach contents and present (available) food resources at Visnjica locality, Serbia, and to compare our results with findings of the previous studies. The samples represents a part of the study related to the use of biomarkers in order to determine the impact of wastewater discharge at the Visnjica locality.

MATERIALS AND METHODS

A total number of 20 specimens of white bream and common roach (ten individuals of each species) were collected by professional fishermen in April 2021 at the locality Visnjica, situated on the right bank of the Danube River (1162 river kilometre).

Figure 1 Location map of the Visnjica locality, Serbia

Specimens were measured for their total body length (Lt, cm) and total body weight (M, g). For dietary analyses a complete digestive tract was examined. Dietary analyses were performed using a binocular microscope (Zeiss Stemi 508) for the determination (mainly order level was observed) and counting of ingested organisms. It has shown that intestine content analysis was difficult as regards identifying and counting prey, given that tissues were masticated or digested.

Sampling of benthic fauna was also performed at the same locality. The samples of aquatic macroinvertebrates were collected by a benthic hand net (mesh size 500 μm) in shallow water (at depths up to 1.5 m) and by an Ekman dredge (225 cm^2) in deeper water (up to 10 m), according to the EN 27828 Standard. Part of the sampled material was examined on site and the rest was preserved in 70% ethanol and processed at the laboratory. The collected individuals were identified using the appropriate identification keys.

Data analyses included calculation of the percentage of occurrence (F), percentage share (Cn - numerical abundance) and significance index (PV - prominence value) as follows: %F=(N_i/N_t)x100; where N_i is the number of fish with food item i, N_t is the total number of

fish in the sample with stomach content; %A=(ΣS$_i$/ΣS$_t$)x100 where S_i is the number of food item i, and S_t the total number of food items in the entire sample [9] and PV=Cn$\sqrt{F}$; then PV(%)=(PV/ΣPV)x100 [10,11]. **The Ivlev's index** was applied to assess the preferences of cyprinid fishes to available prey in the local habitat. The following equation was used: E=(ri–pi)/(ri+pi), where *'E'* is the measure of selectivity for various prey items in the fish rations; *'ri'* is the relative abundance of prey category *'i'* in the digestive tract (as a proportion or percentage of all digestive tract contents); and *'pi'* is the relative abundance of this prey in the environment. The values of this index range from −1 to +1, with negative values indicating rejection or inaccessibility of the prey, zero values – random feeding, and positive values – active selection.

RESULTS AND DISCUSSION

Cyprinid fish white bream (*Blicca bjoerkna*) and common roach (*Rutilus rutilus*) from the Belgrade section of the Danube River were collected and examined. The total length (TL) range was 22.0–28.0 cm, while the body weight (W) range was 190.0–390.0 g (Table 1). All sampled fish specimens had intestines filled with food items. The examination of the stomach contents revealed that white bream at the studied localities fed mainly on aquatic insect of Trichoptera larvae (68.97%), followed by crustaceans belonging to the family Gammaridae, and one individual of Mollusca. In addition, representatives of the Bivalvia, Gastropoda and Gammaridae have dominated in the stomach contents of common roach specimens, with a share of about 30% of each category. The Trichoptera (5.81%), Mollusca (17.44%) and one juvenile crab were also identified in the common roach diet (Table 2). In total, 144 food items have been determined and counted in the fish stomach contents. For white bream 58 food items have been counted, and for common roach 86, respectively.

Table 1 The total length (TL) and body weight (W) of the examined two cyprinid fish species in the investigated locality. The parameters are presented with a mean value, standard deviation (±SD), and a range of the values (in parentheses)

Fish species	Total body length (cm)	Total body weight, with stomach content (g)	Stomach content (g)
Blicca bjoerkna	26.0 ± 2.14 (22.0–28.0)	285.71 ± 73.68 (190.0–390.0)	7.71 ± 2.43 (4–10)
Rutilus rutilus	26.07 ± 1.79 (24.0–29.0)	272.86 ± 70.41 (200.0–400.0)	6.57 ± 2.07 (3–9)

Analyses of the stomach content of two cyprinid fish species applying selected biotic indices is performed. The percentage number/share (Cn), frequency of occurrence (F) and significance index/prominence value (PV, PV %) of identified food items are given in the Table 2.

Table 2 Analysis of identified stomach prey items of white bream and common roach sampled in investigated locality, applied biotic indices

Species/Taxonomic group	Percentage frequency	Percentage share	Significance index	
			PV	PV (%)
Blicca bjoerkna				
Trichoptera	71.43	68.97	4926.11	85.11
Gamaride	28.57	29.31	837.44	14.47
Mollusca	14.29	1.72	24.63	0.43
Rutilus rutilus				
Trichoptera	14.29	5.81	83.06	2.33
Bivalvia	42.86	29.41	1260.50	35.33
Gastropoda	28.57	24.42	697.67	19.56
Gammaridae	57.14	22.35	1277.31	35.80
Mollusca	14.29	17.44	249.17	6.98
crab juvenile	14.29	1.16	16.61	

According to present results, representatives of Trichoptera were dominant in the stomach contents of examined white bream specimens, while diet of common roach consisted mostly of Bivalvia (*Dreissena* spp.) and Gammaridae.

The qualitative and quantitative composition of the diet of two cyprinid fish species and bottom macroinvertebrate fauna at the sampling locality were compared and the results are presented in the Tables 3 and 4. Ivlev's index of prey selectivity indicated the different preference for food items of collected fish. The results showed that *Blicca bjoerkna* exhibited strong dietary preferences for Gammaridae, while *Rutilus rutilus* had preferences for Bivalvia and Gammaridae (Table 3). Oligochaeta were dominant taxa group in bottom fauna in the environment, followed by representatives from family Chironomidae (Diptera) (Table 4).

According to the studies performed from 2007 to 2009, the most frequent food categories in the intestine contents of white bream and common roach in the Belgrade sector of the Danube river, were organisms of macrozoobenthos from the group Annelida and Oligochaeta. The second frequent group were Crustacea [7]. Egerić *et al.* [8] in their study noticed that Blicca bjoerkna showed a higher preference for gammarids (26%), followed by molluscs (17%).

Table 3 *Food items of examined fish based on relative abundance (%) of the identified taxonomic groups and the Ivlev's index of prey selectivity (E)*

Fish species/prey category	Relative abundance in stomach contents	Ivlev's index (E)
Blicca bjoerkna		
Trichoptera	68.97	
Mollusca	1.72	
Gammaridae	29.31	0.98
Rutilus rutilus		
Trichoptera	5.81	
Bivalvia	29.07	0.91
Gastropoda	24.42	0.75
Mollusca	17.44	
Gammaridae	22.09	0.98
crab juven.	1.16	

Table 4 *Relative abundance of identified taxa in the bottom fauna*

Taxa	Relative abundance in bottom fauna
NEMATODA	1.3
HIRUDINEA	0.3
OLIGOCHAETA	71
GASTROPODA	3.5
BIVALVIA	1.42
AMPHIPODA-Gammaridae	0.2
DIPTERA - Chironomidae	22
ODONATA	0.3

According to the data from FISHBase [12], feeding habits of common roach [13] consist mostly of zoobenthos, representatives of Mollusca (*Dreissena* spp.) and Gammaridae. In the paper of Hellawell [14] the diet of *R. rutilus* was predominantly plant-based, and the most important animal component were aquatic insect larvae. Also, the same study found that diet habits varied with age: with molluscs being important to older roach, while younger roach consumed large amounts of substrate material.

CONCLUSION

The attained results, considering that this is relatively small sample collected during one monthly outing (April), can be considered as preliminary and further research is required.

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REFERENCES

[1] V.L.M. Ramana, R.C. Manjulatha, Eur. J. Acad. Res; 2 (8) (2014) 11065–11075.

[2] E.H.R.R. Lammens, W. Hoogenboezem, Diets and feeding behaviour, In: Cyprinid Fishes, Springer, Netherlands (1991), p.353–376, ISBN: 978-94-011-3092-9.

[3] M. Kottelat, J. Freyhoff, Handbook of European freshwater fishes, Kottelat, Cornol, Switzerland and Berlin, Germany, (2007), pp.646, ISBN 978-2-8399-0298-4.

[4] S. Yılmaz, O. Yazıcıoğlu, R. Yazıcı, *et al*., J. Limnol. Freshw. Fisheries Res; 1 (1) (2015) 9–18.

[5] H.C. Okgerman, M. Elp, S. Atasağun, Turk. J. Biol; 36 (1) (2012) 125–134.

[6] J. Krpo-Ćetković, A. Hegediš, M. Lenhardt, J. Appl. Ichthyol; 26 (4) (2010) 513–521.

[7] V. Đikanović, Fauna endohelminta riba Dunava beogradskog regiona, sa osvrtom na prelazne domaćine iz grupe makrozoobentosa, PhD thesis, Faculty of Biology, University of Belgrade, Serbia (2011), p.182 (in Serbian).

[8] M. Egerić, D. Škraba, M. Ilić, *et al*., Wat. Res. Manag; 5 (3) (2015) 35–40.

[9] P.A. Amundsen, H.M. Gabler, F.J. Staldvik, J. Fish Biol; 48 (1996) 607–614.

[10] P. Hickley, R. North, S.M. Muchiri, *et al*., J. Fish Biol; 44 (1994) 607–619.

[11] M. Lorenzoni, M.Corboli, A.J.M. Dorr, *et al*., Bull. FR. Peche Piscic; 365/366 (2002) 537–547.

[12] *Available on the following link:* https://www.fishbase.se

[13] L.N. Belova, J. Ichthyol; 26 (3) (1986) 50–56.

[14] J. M. Hellawell, J. Fish Biol; 4 (4) (1972) 469–486.