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A Contribution to Data on Chub (*Leuciscus cephalus* L., *Cyprinidae*, *PISCES*) Diet in River Conditions

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Abstract: The paper presents the results of an analysis of the trophic spectrum of the chub (*Leuciscus cephalus* L.), a subdominant species in the Zapadna Morava river ichthyofauna. Chub is the only predatory fish present in all river profiles and is an important trophic chain member. The analysis conducted points to the omnivorous nature of diet and its zoo-phyto-planktophagous feature.

Key words: Chub, diet, the Zapadna Morava river

Introduction

The chub (*Leuciscus cephalus* L. *Cyprinidae*, *PISCES*) is a wide-spread fish species in different European freshwater ecosystems (Kottelat 1997; Simonovic 2001). The Zapadna Morava (Serbia, the Danube basin) river is characterised by a great abundance of this species. This river (298 km long, 15849 km² basin area) is the central component of the West Serbia hydrosystem. The river bed in its upper and middle courses is rocky and here and there pebbly, while sand-muddy substrate dominates in two reservoirs (Ovcar-Kablar and Medjuvrsje) and in the downstream course. The chemical quality of water is variable – occasional pollution by ammonia, nitrites, nitrates and certain heavy metals has been recorded (Spasojevic et al., 2005).

The diversity of hydro-ecological conditions affects the development of different biocenoses including ichthyofauna. The fish assembly of the Zapadna Morava river consists of 25 species from 8 families with a pronounced dominance of the Cyprinidae family representatives. The dominant species are bleak (*Alburnus alburnus*) comprising 20.72% of the total ichthyofauna number, nase (*Chondrostoma nasus*) with 10.79% and chub (*L.cephalus*) with 10.48%. Chub is the only predatory

fish abundantly present in all river profiles and an important trophic chain link (Markovic and Veljovic 2005).

Material and Methods

Over the 2000-2004 period, 119 chub individuals from four different river profiles were sampled for examination of feeding characteristics of the species. In 18 individuals the gut was found to be empty. The individuals sampled were from 0+ to 9+ years of age, with the total length ranging from 56 to 430 mm and the total weight from 5.4 to 1160.1 g.

The fish trophic spectrum was based on the gut content analysis. MBS-2 and MBDS-10 binoculars and a »Studar« microscope were used for different magnification needs. Single components identification was accomplished according to Hindak (1978) and APHA (1985).

Results and Discussion

The results are presented in Tab. 1.

Tab. 1. The gut content of chub in the Zapadna Morava river (in %)

Group	Spring (n = 31)	Summer (n = 38)	Autumn (n = 32)	Total (n = 101)
<i>Cyanobacteriophyta</i>	< 0.1	0.7	1.2	0.7
<i>Pyrrhophyta</i>	-	< 0.1	-	< 0.1
<i>Bacillariophyta</i>	5.1	9.2	13.2	9.1
<i>Chlorophyta</i>	3.6	13.6	14.9	10.8
Macrophytes	3.1	3.3	3.3	3.2
<i>Rotatoria</i>	-	< 0.1	0.2	0.1
<i>Nematoda</i>	0.3	< 0.1	0.1	0.1
<i>Mollusca</i>	2.1	2.6	2.6	2.3
<i>Oligochaeta</i>	1.2	< 0.1	0.2	0.4
<i>Amphipoda</i>	0.7	-	-	0.2
<i>Ephemeroptera</i>	9.9	6.1	8.9	8.2
<i>Odonata</i>	10.4	8.9	5.6	8.3
<i>Heteroptera</i>	-	0.6	-	0.2
<i>Coleoptera</i> (aquatic)	1.4	-	0.3	0.5
<i>Diptera</i> – <i>Chironomidae</i>	4.4	1.0	1.2	2.0
<i>Diptera</i> – <i>Ceratopogonidae</i>	-	1.9	-	0.7
<i>Diptera</i> – <i>Tipulidae</i>	5.2	0.3	-	1.6
<i>Diptera</i> – <i>Tabanidae</i>	1.9	0.4	2.1	1.4
<i>Diptera</i> – <i>Syrphidae</i>	0.9	-	-	0.3
<i>Trichoptera</i>	20.6	21.6	10.8	17.8
<i>Insecta</i> (terrestrial)	15.7	11.9	10.0	12.6
<i>Bryozoa</i>	-	3.6	1.4	1.6
<i>Pisces</i>	1.1	8.7	2.3	4.4
<i>Amphibia</i>	-	1.4	-	0.5
Detritus	12.3	9.3	21.7	13.5

The analyses of the trophic features of chub in different rivers of Europe suggested the omnivorous character of the species adapted to productive relationships in a specific ecosystem (Geldiay and Balik 1973; Mann 1976; Adamek et al., 1987; Frankiewicz et al., 1991; Magalhaes 1993; Balestrieri et al., 2006; Markovic et al., 2007).

The trophic spectrum analysis of 101 chub individuals caught in the Zapadna Morava river indicated the diverse diet character and macrozoobenthos predominance (because of the low number of individuals caught in particular research years, only overall results are presented).

During spring (March-May), macrozoobenthos (57.6% of the gut content) was mostly comprised of *Trichoptera*, *Diptera*, *Odonata* and *Ephemeroptera* larvae. The late spring feeding aspect was characterised by a high presence of terrestrial insects. The plant material (11.9% of the gut content) contained *Bacillariophyta* representatives the most (Tab. 1.).

Chub nutrition during summer (June-August) was more diverse. Macrozoobenthos domination (43.3% of the gut content) was less pronounced, *Trichoptera* were constantly highly present and *Odonata* and *Ephemeroptera* larvae were present to a smaller degree. An important feeding component in this period of the year included terrestrial insects and fish, and an occurrence of organisms which were absent in the spring diet (*Bryozoa*, *Amphibia*). The plant material share (26.9% of the gut content) was increased.

The macrozoobenthos share in the autumn nutrition (September-November) was decreased to 31.5% of the gut content, and equal dominance of *Trichoptera* and *Ephemeroptera* larvae was recorded. Of other animal components, considerable presence was registered only of terrestrial insects. The autumn chub feeding aspect was characterised by high presence of plant material (32.6%) and detritus (21.7%). Filamentous *Chlorophyta* were dominant during early autumn, whereas the domination of *Bacillariophyta* was registered in the later period.

The chub gut content analysis throughout the year showed that macrozoobenthos was a basic trophic component of the species (Fig. 1.). *Trichoptera* larvae (mostly *Hydropsyche* sp.) were present the most, followed by *Odonata*, *Ephemeroptera* and *Diptera* larvae. Other groups of benthic macroinvertebrates were less distributed.

Terrestrial insects with relatively uniform records during the year were an important animal component of chub nutrition. Among the terrestrial insects, winged insects from *Diptera* (fam. *Syrphidae*, *Muscidae*, *Tipulidae* and *Chironomidae*) and *Hymenoptera* were pronouncedly dominant. Piscivorous feeding was considerably expressed only in the summer diet aspect.

Algae were dominant among plant components, and macrophytes were negligible. There was a particularly significant presence of filamentous *Chlorophyta* and *Bacillariophyta* in the gut content of chub during summer and autumn.

The analysis of the gut content of juvenile individuals pointed to relative nutrition uniformity during the year. In individuals aged 0+, over 80% of the gut content was composed of *Bacillariophyta* representatives (most commonly found *Diatoma vulgare*, *Navicula cryptocephala* and *Synedra ulna*), with a small presence of *Chlorophyta* and individual zooplankton representatives. In the gut content of older juveniles (aged 1+), along with a pronounced domination of

Bacillariophyta, a high share of filamentous *Chlorophyta* as well as the presence of other components (macrophytes and larvae of *Diptera*) were also registered. Juvenile chub aged 2+ and 3+ consumed substantial amounts of animal-derived food. Apart from insect larvae, terrestrial insects, molluscs and other groups of organisms were also present. The feeding of juvenile individuals was plankto-phyto-zoophagous in character.

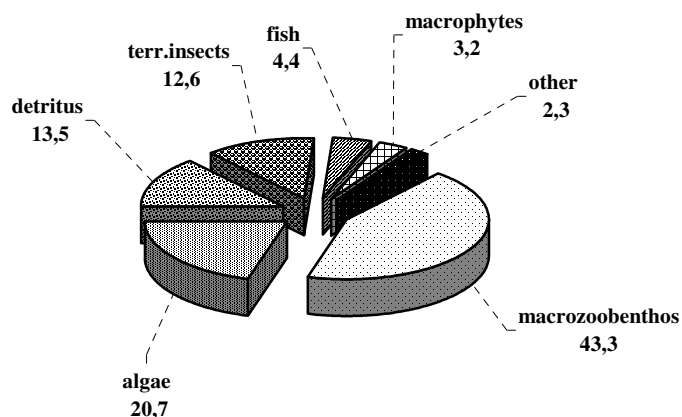


Fig. 1. Basic component in gut content of chub (*L.cephalus*)

The gut content analysis in adult individuals suggested an increase in carnivorism. Younger adults (aged 3+, 4+ and 5+) consumed mostly larvae but also adult representatives (imago) of *Trichoptera*, *Odonata*, *Diptera* and *Ephemeroptera*. Piscivorous feeding was recorded in individuals aged 6+ and older, and other animal groups (*Mollusca*, *Bryozoa*, *Amphibia*) were found in chub nutrition only in some profiles. Adult chub nutrition had a pronounced zoophagous character.

Conclusions

Generally, chub nutrition in the Zapadna Morava river exhibited an omnivorous character and pronounced zoo-phyto-planktophagous features. Carnivorism was found to be most pronounced during spring and summer, whereas the plant material was predominant in the gut content during the autumn period of the year. Apart from contributing to the knowledge of the trophic properties of the species, the study results pointed to the diversity of aquatic biocenoses in the ecosystem investigated.

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**PRILOG PODACIMA O ISHRANI KLENA (*Leuciscus cephalus* L.,
Cyprinidae, PISCES) U REČNIM USLOVIMA**

- originalni naučni rad -

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Rezime

Klen (*Leuciscus cephalus* L.) je izuzetno rasprostranjena ciprinidna vrsta u slatkovodnim ekosistemima Evrope. Brojne studije ukazuju na omnivoran karakter ishrane vrste koji je usaglašen sa produkcionim svojstvima konkretnog ekosistema.

Klen je subdominant član ihtiofaune reke Zapadne Morave (dužine 298 km, Srbija, Dunavski sliv), značajne komponente hidrosistema Srbije. U periodu 2000 – 2004. godina analizirana je ishrana 101 jedinke ulovljene na 4 rečna profila. Sumarni rezultati analize prehrambenog spektra vrste ukazuju na izrazitu ovnivornost uz ispoljen zoo-fito-planktofagni karakter ishrane. Karnivornost je najizraženija tokom proleća i leta, dok je biljni materijal dominantan u crevnom sadržaju u jesenjem periodu godine. Uočena je velika varijabilnost ishrane vrste u pojedinim profilima, periodima godine i različitim uzrasnim klasama.

Proučavanja ishrane klena su od posebnog ekološkog interesa pošto je reč o najmasovnijoj predatorskoj vrsti u analiziranom ekosistemu. Sem, toga, dobijeni rezultati doprinoste upoznavanju opšteg biodiverziteta staništa.