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Short communication

THE FEEDING OF SEXUALLY MATURE EUROPEAN PERCH (*PERCA FLUVIATILIS* L.) IN LAKE KORTOWSKIE IN THE AUTUMN-WINTER PERIOD

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ABSTRACT. This study addressed the feeding of sexually mature perch (*Perca fluviatilis* L.) in Lake Kortowskie in the autumn-winter period (October-March). A total of 81 perch specimens were caught, of which 20.2% were males, 69.1% females, and 7 specimens were of unidentified sex. The composition of the perch diet was very diversified. The food contained zooplankton, insect larvae, fish, and other components. Zooplankton was the most significant in late autumn (54.9% frequency of occurrence), whereas fish and insect larvae were found to dominate in winter. Differences in feeding were observed between the sexes (there was a lack of fish in the male diet) and between specimens of different length classes (specimens with lengths over 20 cm were obligatory predators).

Key words: EUROPEAN PERCH (*PERCA FLUVIATILIS*), FEEDING, LAKE KORTOWSKIE

Late autumn is a special period in the feeding of fish in the Polish climatic zone. Numerous reports of the feeding of European perch, *Perca fluviatilis* L., in different habitats and seasons are available in the literature (e.g., Antosiak 1963, Horoszewicz 1964, Filuk and Żmudziński 1965, Terlecki et al. 1990, Terlecki 2000, Szypuła 2002, and many others). Nevertheless, publications that address the winter period are still fragmentary (Scott and Crossman 1973, Hartman 1974, Craig 1978), and no data exists on the feeding of the individual sexes.

The study presented here represents an attempt to describe the feeding of perch males and females in the autumn-winter period.

Lake Kortowskie, a typical eutrophic reservoir (53°06′ N and 21°27′ S), is located in the Olsztyn Lake District in the basin of the Łyna River. The surface area of the lake is 89.7 ha and the maximal depth is 17.2 m (mean depth – 5.9 m). The experimental material was

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collected from October 2001 to March 2002 with a set of nets with different mesh bar lengths (from 18 to 55 mm), and a fishing rod set with ice spoon. Net fishing was also carried out under the ice. A total of 81 perch specimens of both sexes were caught; 20.2% were males and 69.1% were females. It was impossible to determine the sex of seven specimens, although their body size indicated that they should have been sexually mature. Immediately after capture, the fish were weighed (± 0.1g) and measured (± 0.1cm). Following these measurements, the gastrointestinal tracts were collected, and the sex of the fish was determined based on the gonads. The length classes of the fish caught ranged from 7.1 to 29.1 cm (Lc) and the body weights ranged from 9.5 to 594 g.

The authors tried to determine the dietary components to the lowest possible taxonomic units (Horoszewicz 1960, Brylińska 2000). Due to the substantially high differences in amounts, the results obtained were only analyzed with the frequency of occurrence method (Hyslop 1980). Statistical analysis of the population number distribution was performed with the Kruskal-Wallis ANOVA test of ranks, whereas diet composition was analyzed with boundary and partial model analysis and Cochran's test.

The mean lengths and body weights of fish of both sexes are presented in Table 1.

TABLE 1

Body length (Lc) and weight of perch in Lake Kortowskie

Sex	Body length (cm)			Body weight (g)		
	Mean	SD	Range	Mean	SD	Range
Male	12.2	2.84	8.5 – 18.8	41.5	33.3	10.5 – 139.7
Female	14.4	4.76	7.1 – 29.1	99.1	145.94	9.5 – 654.6
Unidentified	14.5	6.24	10.5 – 28.3	98.6	168.3	20.6 – 479.3

Of the males, none had body lengths exceeding 19.0 cm. This indicates that the perch males in Lake Kortowskie attain smaller body sizes than do females. However, the differences were not statistically significant (ANOVA test of ranks, $P > 0.05$). This was most likely due to the low number of males caught. Similar observations were also reported by Le Cren (1958), El-Zarka (1959), and Muncy (1962) for yellow perch *Perca flavescens* Mitchill. Of the 81 specimens caught for this study, 28% had empty alimentary tracts. The distribution factors of males and females with empty alimentary tracts were not statistically different.

The composition of the perch diet was highly diversified (Table 2) and consisted of zooplankton, insect larvae, and fish – roach, *Rutilius rutilus* L., perch, white bream, *Abramis bjoerkna* (L.), gudgeon, *Gobio gobio* (L.), bream, *Abramis brama* (L.), and bleak, *Alburnus alburnus* (L.). The Chironomidae larvae were the most frequent component

(27.6%), whereas perch was the most frequently consumed fish (42.9%).

TABLE 2

Food composition of perch from Lake Kortowskie (% of frequency of occurrence)

Prey	Month			
	October	December	February	March
Cladocera	7.7	-	-	-
Copepoda	46.2	-	-	-
Heteroptera	7.7	-	-	-
Rotatoria	15.4	-	-	-
Chaoborus sp.	7.7	16.0	40.0	-
Chironomidae	15.2	28.0	40.0	20.0
Zygoptera	-	40.0	-	-
Sialis sp.	-	16.0	-	-
Trichoptera	-	-	13.3	80.0
Other invertebrate	15.2	16.0	6.7	-
Fish	38.5	28.0	46.7	-

In October, the most frequent perch prey were copepods and fish, constituting 46.2 and 38.5% of the diet, respectively. In December, Zygoptera larvae were the most common (40.0%), followed by Chironomidae larvae (28.0%), and fish (28.0%). In February, the perch diet was dominated by fish (46.7%), *Chaoborus* sp. larvae (40.0%), and Chironomidae larvae (40.0%), whereas in March it consisted of Trichoptera (80.0%) and Chironomidae (20.0%) larvae only (Table 2). Changes in the feeding of perch in the winter season were also observed by Skóra (1964), Bączkowska (1965), Scott and Crossman (1973), Hartman (1974), and Craig (1978). They observed that in the warmer seasons, zooplankton was of considerable significance in the perch diet, while in winter the dominant components of the diet appeared to be bottom fauna (Hartman 1974, Craig 1978) or fish (Skóra 1964, Bączkowska 1965).

Significant differences in diet were observed between the length classes of the specimens caught, especially between the largest fish and the remaining classes. The diet of the largest perch was composed exclusively of fish ($Q = 10.889$, $P < 0.01$). On the other hand, fish were not found in the diets of the smallest male or female perch (Table 3). This indicates that, in Lake Kortowskie, when perch reach body lengths over 10 cm they become raptorial feeders, whereas those with body lengths over 20 cm become obligatory predators. A lack of fish in the diets of the smallest perch confirms the observations of other authors (Antosiak 1963, Bączkowska 1965, Craig 1978)

who noted that perch begin to eat fish when they reach body lengths over 10 cm.

TABLE 3

Diet composition of perch in relation to body length (Lc) and sex in Lake Kortowskie (% of frequency of occurrence)

	Male smaller than 10 cm	Female smaller than 10 cm	Male 10-15 cm	Female 10-15 cm	Unidenti-fied 10-15 cm	Female 15-20 cm	Male 15-20 cm	Female larger then 20 cm	Unident ified larger than 20 cm
Cladocera	-	-	-	-	-	16.7	-	-	-
Copepoda	-	57.1	4.6	-	-	16.7	33.3	-	-
Heteroptera	-	-	-	20.0	-	-	-	-	-
Rotatoria	-	28.6	-	-	-	-	-	-	-
Chaoborus sp	16,7	28.6	27.7	20.0	-	16.7	-	-	-
Chironomidae	50.0	-	50.0	-	33.3	-	33.3	-	-
Zygoptera	66.7	42.9	4.6	20.0	33.3	-	-	-	-
Sialis sp.	16.7	14.3	4.6	20.0	-	-	-	-	-
Trichoptera	-	-	18.2	20.0	-	-	33.3	-	-
Other invertebrates	-	-	-	13.6	-	-	-	-	-
Fish	-	-	27.3	-	-	83.3	-	100	100

The dietary composition of the two sexes differed in length classes, and the χ^2 values obtained were consistently higher than the boundary values (the analysis of boundary and partial models) (Table 3). A lack of fish in the diet of males indicates that their energy needs are low in comparison to those of the females. This probably stems from the smaller amount of energy males expend on the production of gametes.

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STRESZCZENIE

ODŻYWIANIE SIĘ DOJRZAŁEGO PŁCIOWO OKONIA (*PERCA FLUVIATILIS* L.) W JEZIORZE KORTOWSKIM W OKRESIE JESIENNO-ZIMOWYM

Przeprowadzono badania dotyczące odżywiania się dojrzałego płciowo okonia (*Perca fluviatilis* L.) w okresie jesienno-zimowym (październik – marzec) w Jeziorze Kortowskim. Ogółem odłowiono 81 sztuk ryb, z czego samce stanowiły 20,2%, a samice 69,1%; u siedmiu osobników płci nie udało się ustalić (tab. 1).

Skład pokarmu okonia był bardzo zróżnicowany. Występował w nim: zooplankton, larwy owadów i ryby. Największy udział zooplanktonu zanotowano późną jesienią (54,9% częstości występowania), natomiast ryby i larwy owadów dominowały zimą (tab. 2). Stwierdzono występowanie różnic w odżywianiu się zarówno w odniesieniu do płci (brak ryb w diecie samców), jak też klas długości (osobniki powyżej 20 cm były obligatoryjnymi drapieżnikami) (tab. 3).