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# THE DIET OF ADULT PERCH, *PERCA FLUVIATILIS* L., IN THE VISTULA DAM RESERVOIR IN WŁOCŁAWEK

# ODŻYWIANIE SIĘ DOROSŁEGO OKONIA, *PERCA FLUVIATILIS* L. WE WŁOCŁAWSKIM ZBIORNIKU ZAPOROWYM NA WIŚLE

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Stomachs were collected in July and August 1981 from April to October from 553 perch, the body length (l.c.) of which ranged from 12.1 to 29.7 cm. The perch were caught in the mid-part of the reservoir, near Nowa Wieś (653rd km of the Vistula). Stomach content analyses showed a high level of plasticity as concerns the diet of perch. The fishes fed on organisms which were currently most abundantly available.

## INTRODUCTION

The perch is an interesting species of fish due to its high level of plasticity in feeding. Irrespective of size it feeds both on invertebrates as well as on fish, thereby allowing for a relatively rapid reaction to qualitative and quantitative changes in the food resources. It feeds on organisms which currently are most numerous and are most easily caught.

The present work constitutes a part of the studies on the diet of fish in Włocławek Reservoir, conducted by the Institute of Ecology of the Polish Academy of Sciences in Dziekanów Leśny and is aimed at determining what fish and invertebrates constitute the basic diet of perch.

## MATERIAL AND METHOD

The material consisted of stomachs taken from perch caught in July and August 1981 and over the period from April to October 1984 in the vicinity of Nowa Wieś (midway between Płock and Włocławek). The number of stomachs collected in 1981 was 127 and 426 in 1984. A characteristic of the material is given in Table 1.

Catches were carried out with a seine having a 30 mm mesh, wing length of 150 m and wing height at the bag of 2.5 m. Catches in 1984 were carried out night and day.

In determining the size of the fish, body length (*longitudo corporis, l.c.*) was measured at an accuracy of up to 1 mm, and the fishes were weighed with an accuracy of up to 5 g. Age was determined from scales taken at the height of the pectoral fin. The scales were legibile.

Stomach fill was determined by weighing their content with an accuracy of up to 2 mg. Organisms found in the stomachs were classified as near as possible to their lowest taxonomic units. Weight of consumed organisms was reconstructed from their length (l) according to the following formulae: *Chironomidae larvae* $W = 3.5\ L^3$ (Morduchaj-Boltowskoj 1954), *Chironomidae pupae* $W = 1.0855 \times 10^{-2}\ L^{2.5836}$ (own data), *Trichoptera larvae* $W = 3.1986 \times 10^{-2}\ L^{2.6392}$ (own data), *Anisoptera larvae* $W = 0.2363\ L^{1.8296}$ (own data), American crayfish $W = 1.7170\ L^{1.9353}$ (own data), *Leptodora kindtii* $W = 9.2144 \times 10^{-4}\ L^{4.0265}$ (own data), perch-pike $W = 1.8417 \times 10^{-5}\ L^{2.9285}$ (Wierzbicka 1983), ruffe $W = 1.9925 \times 10^{-5} \times L^{3.0237}$ (Boroń 1984), gudgeon $W = 7.6102 \times \times 10^{-6}\ L^{3.1533}$ (Boroń 1984), roach $W = 1.4120 \times 10^{-2}\ L^{3.1994}$ (Wierzbicka 1983). Stomach contents were determined with respect to number of organisms occurring, as also weight and frequency with which such food organisms occurred. Determinations were likewise made of relative importance indices (the sum of percentages defining the share of a given component in total numbers and weight of the food content multiplied by frequency of occurrence) and of filling indices. It was decided to divide the prey with respect to numbers and share in the food content into the following groups: eudominant (50.1–100% of the total), dominant (10.1–50.0%), subdominant (5.1–10.0%), recedental (1.1–5.0%), subrecedental (less than 1.0%).

## RESULTS

### Food structure

The most important component of the diet of perch 12.1 to 25.0 cm in body length consisted of fish in summer months of 1981 (Table 2). Fish were not always predominant as concerns numbers, but in the total weight of food they were decidedly eudominant, with a share ranging from 60 to 90% (Fig. 1). Fish were consumed by the major number of perch, both small and large ones (Tab. 3), with ruffe being the basic component. Next

Table 1

Characterization of collected material

| Date | Range of body sizes of perch | | Age of modal group (number of annual rings) | Number of collected stomachs | Empty stomachs % | Full stomachs % |
|---|---|---|---|---|---|---|
| | Body length (l.c.) in cm | Body weight in g | | | | |
| 28 VII 1981 | 12.1–25.0 | 35–315 | – | 64 | 42.2 | 57.8 |
| 20 VIII 1981 | 12.1–27.0 | 35–390 | – | 63 | 42.9 | 57.1 |
| 9–10 IV 1984 | 14.2–24.0 | 55–315 | 2+ | 26 | 30.8 | 69.2 |
| 15–16 V 1984 | 15.0–24.7 | 60–280 | 2+, 3+ | 76 | 22.4 | 77.6 |
| 11–12 VI 1984 | 14.2–24.0 | 55–240 | 3+ | 44 | 40.9 | 59.1 |
| 2–3 VII 1984 | 14.5–21.8 | 60–210 | 3+ | 28 | 14.8 | 85.2 |
| 7–8 VIII 1984 | 15.6–29.7 | 65–490 | 2+, 3+ | 78 | 69.2 | 30.8 |
| 17–18 IX 1984 | 16.2–25.5 | 85–320 | 3+ | 49 | 34.7 | 65.3 |
| 9–10 X 1984 | 13.8–26.2 | 60–445 | 2+, 3+ | 126 | 6.4 | 93.6 |

Table 2

Indicator of relative significance of primary components in the perch feed, in 1981. A – standard length (l.c.) from 12.1 to 15.0 cm; B – standard length from 15.1 to 25.0 cm

| Date | Body length classes | Viviparus sp. | Leptodora kindtii | Cambarus affinis | Gobio gobio | Stizostedion lucioperca | Gymnocephalus cernuus | Cyprinidae | Pisces – total |
|---|---|---|---|---|---|---|---|---|---|
| 28 July | A | 8 | 1668 | | | | 4726 | | 9284 |
| | B | 1040 | | 1020 | 144 | 95 | 7410 | 8 | 9623 |
| 20 August | A | 17 | 1945 | 424 | 104 | | 2068 | 17 | 5810 |
| | B | 300 | 1815 | 517 | | | 1563 | 93 | 3792 |

Table 3

Occurence frequency of more important components in perch feed, in 1981, in %. A – standard length (l.c.) from 12.1 to 15.0 cm, B – standard length from 15.1 to 25.0 cm

| Date | Body length classes | Viviparus sp. | Leptodora kindtii | Cambarus affinis | Gobio gobio | Stizostedion lucioperca | Gymnocephalus cernuus | Cyprinidae | Pisces n. det. | Pisces – total |
|---|---|---|---|---|---|---|---|---|---|---|
| 28 July | A | 6 | 19 | | | | 56 | | 31 | 88 |
| | B | 50 | | 30 | 15 | 10 | 60 | 5 | 10 | 70 |
| 20 August | A | 6 | 22 | 22 | 6 | | 35 | 6 | 26 | 70 |
| | B | 20 | 25 | 20 | 25 | | 30 | 15 | | 50 |

Table 4

Indicator of relative significance of primary components in the perch feed, in 1984, a – indicator uncalculated

| Date | Oligochaeta | Leptodora kindtii | Cambarus affinis | Anisoptera l. | Chironomidae l. | Chironomidae p. | Spawn | Rutilus rutilus | Gymnocephalus cernuus |
|---|---|---|---|---|---|---|---|---|---|
| 9–10 April | a | | 44 | | 8930 | | | | |
| 15–16 May | 846 | | 2 | 70 | 35 | 307 | 2157 | | 395 |
| 11–12 June | | | 345 | 1349 | 5369 | 3589 | | | |
| 2–3 July | | 10295 | 218 | | 52 | 912 | | | |
| 7–8 August | | | 1250 | 14 | 428 | 3669 | | 77 | |
| 17–18 September | | | 44 | | 4710 | 6418 | | | |
| 9–10 October | | | 1 | | 18649 | 321 | | | |

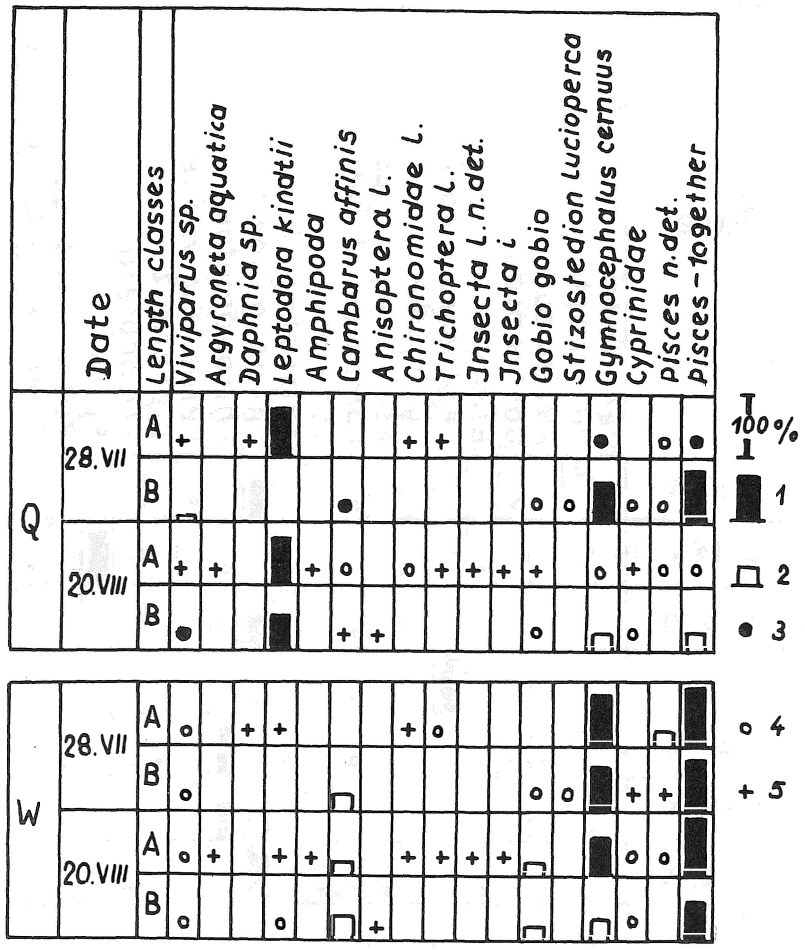


Fig. 1. Composition of the perch feed in 1981. Q – share in numbers, W – share in weight, A – standard length class (l.c.) from 12.1 to 15.0 cm, B – standard length class from 15.1 to 25.0 cm; 1 – eudominant (50.1 – 100.0%), 2 – dominant (10.1 – 50.0%), 3 – subdominant (5.1 – 10.0%), 4 – recedent (1.1 – 5.0%), 5 – subrecedent (below 1.0%).

to ruffe, gudgeon was likewise consumed, but in noticeably smaller numbers, as also pike-perch and cyprinid fry. Invertebrates constituted a less important component. From amongst the latter *Leptodora kindtii* was of some importance, being consumed by 1/5 to 1/4 of the perch population investigated, in which case although low in weight, having been classified in the recedental or subrecendtal groups. It was quite numerous and in this respect constituted the main component of the diet (18–40%, dominant).

The food composition in 1984 was totally different and mainly made up of *Chironomidae* larvae and pupae (Tab. 4). *Chironomus sp.* were the dominating larvae, and *Cryptochironomus defectus* also occurred in the diet. As a rule, Chironomidae

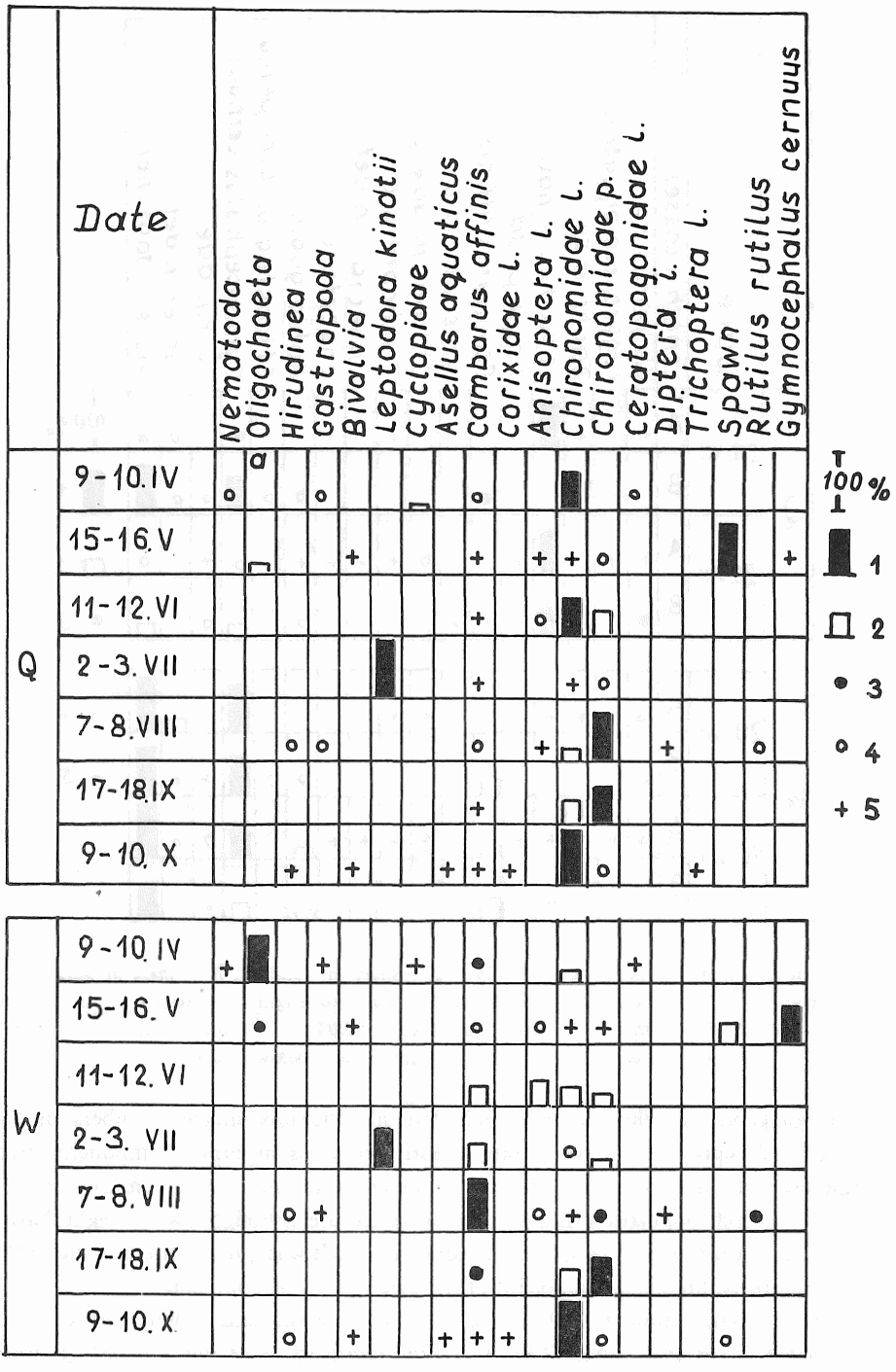


Fig. 2. Composition of the perch feed in 1984. a – not taken into consideration when counting the share in numbers. Other description as on Fig. 1

constituted the eudominant group, their share reaching 61 to 95% (Fig. 2). *Chironomidae* larvae were consumed by all of the perch in April and October only. During the remaining months, frequency of their occurrence in the stomach content differed (Tab. 5). Chironomidae pupae were always consumed by more or less one half of the perch investigated. From among other food components found during specific months the following were also of considerable importance: *Leptodora kindtii*, fish spawn, Oligochaeta, American crayfish and *Anisaptera* larvae (Tab. 4). *Leptodora kindtii* was the most important food component in July, reaching 97 and 61% with respect to weight and numbers respectively, and was found in over 50% of perch stomachs. Fish spawn was consumed in great amounts in May and occupied an eudominant (78%) position with respect to numbers, although covering only 28% as concerns weight. Fish spawn was found in 20% of the perch, in amounts of from 43 to 814 eggs per stomach. Oligochaeta were of some significance in April, as also in May, and were consumed by 1/3 of the perch population investigated. From among the *Oligocheta, Limnodrilus hoffmeisteri* and *Limnodrilus claperedeianus* were found. American crayfish was consumed by only a small number of the fishes, but next to *Chironomidae* was the only component occurring each and every months. With respect to weight, it at times constituteda fairly considerable part of the food and next to *Chironomidae* larvae and pupae made up an important component of perch diet.

Characteristic of fish preyed upon.

In 1981, when perch also red on fish, stomachs of this predator at body lengths of from 12.1 to 15 cm as a rule contained one fish each. The number of fishes consumed by perch 15.1 to 25.0 cm long ranged from 2 to 6. The largest number of fishes, i.e. 12, was found in the stomach of an 18.5 cm perch.

Body length (l.c.) of consumed fishes ranged from 3 to 6 cm and had no connection with the size of perch feeding on them. Both in July as well as August the smallest perch, which consumed fishes, measured 12.1 cm, and at the same time these were the smallest perch caught.

From amongst the perch of body length 12.1 to 15.0 cm, 80% in July and 35% in August consumed only fishes, 6 and 20% for the respective months consumed both fishes and invertebrates, and 14 and 45% – only invertebrates. As concerns stomach contents of perch of body length more than 15.1 cm, the respective percentages were as follows: 64 and 40% – fish only, 23 and 27% – fish and invertebrates, 13 and 33% – invertebrates only.

Intensity of feeding.

Intensity of feeding differed between the two sexes. Females very frequently showed higher level of stomach filling than males (Tab. 6). In the samples collected, which in reality represented only one half of a 24 hour period, highest values indicating stomach

Table 5

Occurence frequency of more important components in the perch feed in 1984, in %

| Date | Oligochaeta | Leptodora kindtii | Cambarus affinis | Anisoptera l. | Chironomidae l. | Chironomidae p. | Trichoptera l. | Spawn | Rutilus rutilus | Gymnocephalus cernuus |
|---|---|---|---|---|---|---|---|---|---|---|
| 9–10 April | 33 | | 6 | | 94 | | | | | |
| 15–16 May | 37 | | 2 | 14 | 24 | 63 | | 20 | | 7 |
| 11–12 June | | | 12 | 31 | 65 | 73 | | | | |
| 2–3 July | | 65 | 9 | | 17 | 65 | | | | |
| 7–8 August | | | 15 | 4 | 31 | 46 | | | 8 | |
| 17–18 September | | | 2 | | 66 | 56 | | | | |
| 9–10 October | | | 1 | | 99 | 44 | 31 | | | |

Table 6

The perch males and females stomachs filling to the total body weight (W) and to body weight without intestines ($W_o$) ratio, in %

| Date | Age (number) of annual rings) | Hour | Sex | Stomach fullness | |
|---|---|---|---|---|---|
| | | | | W | $W_o$ |
| 15–16 May | 2+(3°) | $22^{30}$ | females | 64 | 75 |
| | | | males | 68 | 79 |
| | | $5^{00}$ | females | 177 | 195 |
| | | | males | 166 | 191 |
| | 3+(4°) | $20^{30}$ | females | 105 | 121 |
| | | | males | 183 | 191 |
| | | $5^{00}$ | females | 144 | 161 |
| | | | males | 155 | 168 |
| 11–12 June | 3° | $22^{30}$ | females | 96 | 107 |
| | | | males | 58 | 66 |
| 2–3 July | 3+ | $20^{00}$ | females | 246 | 281 |
| | | | males | 170 | 197 |
| 17–18 September | 3+ | $5^{00}$ | females | 9 | 10 |
| | | | males | 10 | 11 |
| 9–10 October | 2+ | $19^{00}$ | females | 99 | 122 |
| | | | males | 41 | 61 |
| | | $23^{00}$ | females | 63 | 71 |
| | | | males | 31 | 37 |
| | | $3^{30}$ | females | 23 | 25 |
| | | | males | 20 | 24 |

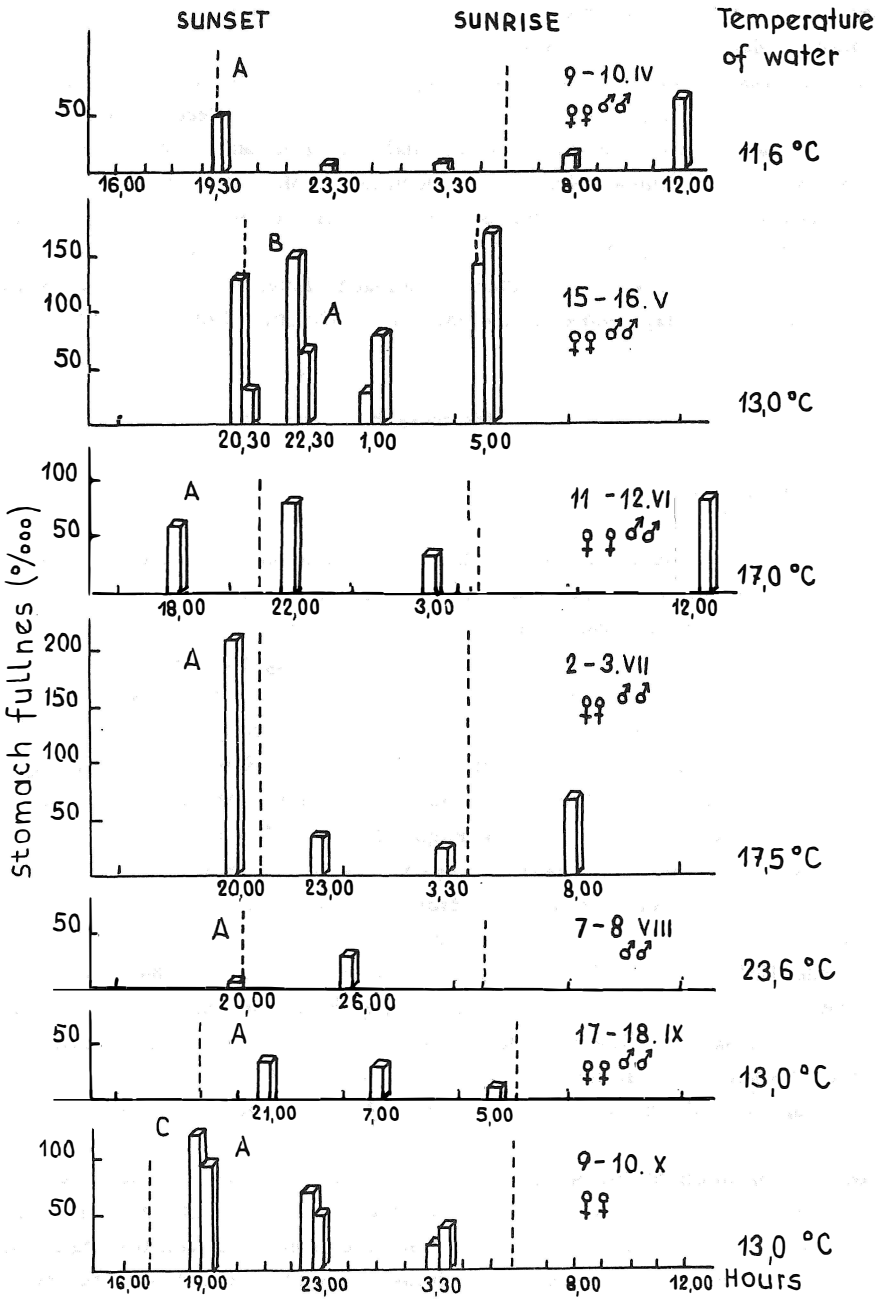


Fig. 3. Perch stomachs feeling expressed by the feeling indicator. A – age from 2+ on April to 3+ on October (age of fours), B – age from 3+ on May (age of fifth), C – age from 2+ on October (age of third)

filling were noted at dusk. Perch did not feed at night, while at daybreak – with the exception of May, this index was low (Fig. 3).

On the basis of the material under study, it was difficult to give any conclusion concerning growth of the index of stomach filling (intensity of feeding) with increasing water temperature. It can be said, however, that two or actually three peaks connected with precise dates of sample collection can be noted. In May, at daybreak, average filling of stomachs for both males and females taken together was 145 and 170‰, in July at dusk – 210‰, and in October 122 and 95‰ (Fig. 3). Low numbers of empty stomachs were coupled with high indices of stomach filling, these numbers constituting 22.4% of the total in May, 14.8% in July, and 6.4% in October (Tab. 1).

## DISCUSSION

Foodcomposition.

It is the general opinion that fishes constitute the basic food of perch, especially perch and roach fry in addition to such small fish as stickleback, ruffe and smelt. Smaller perch likewise feed on fish. Antosiak (1963) found that perch from lakes in the vicinity of Węgorzewo began a predatory mode of life upon reaching body length of from 13 to 15 cm, and fed consistently upon fish after exceeding 15 cm. Makarowa (1973) found fish in perch stomachs from the Iwanski Dam Reservoir at body length of 9 cm. Fishes were consumed by half of the perch from the Rybinski Dam Reservoir at body lengths of more than 10 cm (Leszczewa 1967), while Bączkowska in her analyses on perch stomachs found fish in these predators with body length of 11 cm. More than 70% of the perch in Włocławek Reservoir of body length 12.1 to 15.0 cm fed on fishes.

As a species the perch is not, however, a total predator. At times its energy requirements are almost exclusively covered by feeding on invertebrates. This is very well exemplified by the population analysed in this study, which in 1984 actually did not consume fish. Similarly as in Włocławek Dam Reservoir, basic diet of perch in Ust-Kamieniogorski Dam Reservoir (Bogdanowa 1959) consisted of *Chironomidae* larvae, whereas the share of fish in the diet reached only 10%. Perch of less than 20 cm from the Vistula Lagoon fed in general on available *Neomysis vulgaris* (Filuk and Żmudziński 1965).

Food composition in the same reservoir can vary from year to year. As regards Włocławek Reservoir, fishes were the basic food component of perch in July and August 1981. In 1984 fishes were not preyed upon, Chironomidae constituting the major food, although perch, ruffe, gudgeon and bleak fry were in abundance, species which could have been the prey. In 1981 the biomass of *Oligochaeta and Chironomidae* larvae living at the bottom was low, while reaching 1.75 and 0.54 g/m$^2$ respectively in the non-mainstream zone (Giziński at. al. 1985). Their biomass in 1984 increased 29-fold (Tab. 7). Initially *Chironomidae* at this station were not an attractive food and not until

Table 7

The Oligochaeta and Chironomidae larvas biomass in 1981 to 1984, in g/m$^2$ (Gizińska, 1985)

| | Zona | Year | | | |
|---|---|---|---|---|---|
| | | 1981 | 1982 | 1983 | 1984 |
| Chironomidae l. | Littoral | 0.73 | 2.72 | 11.16 | – |
| | Stream | 0.54 | 0.83 | 1.33 | 11.24 |
| Oligochaeta | Littoral | 1.38 | 5.92 | 6.50 | – |
| | Stream | 1.75 | 7.78 | 12.44 | 21.0 |

Table 8

Average parameters of the perch body in age of four, in 1984, a – age determined by the number of annual rings

| Date | 9–10 IV | 15–16 V | 12–12 VI | 2–3 VII | 7–8 VIII | 17–18 IX | 9–10 X |
|---|---|---|---|---|---|---|---|
| Age[a] | 2+(3°) | 2+(3°) | 3° | 3+ | 3+ | 3+ | 3+ |
| Body length (l.c.), cm | 16.0 | 16.2 | 15.8 | 16.3 | 18.3 | 19.6 | 20.6 |
| Body weight, g | 76 | 69 | 76 | 88 | 112 | 164 | 205 |

later, upon increasing their numbers, were they easier to attain than fish, the catching of which was possibly connected with greater energy requirements. It appears that growth of perch on this diet was good, having reached a body length of 20.6 cm by the end of the first ten days of October in 1984 in their fourth year of life (3+). Increment since the last ten days of April was 4.6 cm (Tab. 8). Four year old perch in lakes of the vicinity of Węgorzewo reached a body length of 18.3 cm (Żuromska 1961).

Pressure on other fishes.

The relation of adult perch to other fish comminities constituting potential prey can be looked upon as predator attacking young fishes and as a consumer of spawn from the spawning grounds.

As regards Włocławek Dam Reservoir, populations of juvenile ruffe constituted the main source of food in 1981. Young gudgeon was consumed to a much lesser degree, as also cyprinid and pike-perch fry. Thus, as concerns fish as food, energetic requirements of perch were covered on species constituting the most numerous population from amongst the small fishes inhabiting the reservoir. It can be assumed that perch did not limit the numbers of roach, bream and pike-perch fry communities, the main species taken advantage of by commercial fishery.

Mass perch populations reeding on spawn can have a highly damaging effect. Around 1/5 of the perch population in Włocławek Dam Reservoir fed on spawn (probably cyprinid), in which case spawn, as a rule, constituted the only food found in perch stomachs. As many as 800 eggs were found in one of the stomachs of this predator, thereby proving its voraciousness. Spawn also constituted the diet of 21% of the perch from Kozłowa Góra Reservoir on the Brnica River, with up to 75 eggs found in one stomach (Skóra 1964). Perch fed on vendace spawn in Harsz and Legińskie lakes with up to 150 eggs found in the stomachs (Pliszka 1953, Bączkowska 1965).

Canibalism is characteristic for perch (Antosiak 1963), although this was not met with in Włocławek Reservoir. It was noted that fish larvae and fry of this species could make up the only component of the diet (Thorpe 1977, Craig 1978).

Intensity of feeding.

It would appear that intensity of feeding should increase with increasing water temperature. It was found that this was by no means true. High stomach filling indices were noted both during months of low as also high (May, July, October) temperature (Fig. 3). At the same time various values were noted for months of similar temperature (May, September, October). Water temperature creates conditions leading to more or less intensive feeding through slower or more rapid rate of digestion. The volume of food intake is, however, connected with potential density of prey, their mobility, and energy requirements of the fish.

High indices of stomach filling noted in mid-May were probably connected with high energy requirements for spawning, this being facilitated by the availability of the spawn of other fish species. It may be assumed that energy requirements for reproduction were already covered by mid-June and hence the organisms consumed (*Chironomidae* larvae and pupae, Anisoptera larvae) had a chance, at least theoretically, of escaping. Thus, intensity of feeding decreased notwithstanding higher water temperature. Despite similar water temperature at the begining of July, higher food consumption index was noted, this being due to the feeding on a cladoceran *Leptodora kindtii* which – as observed by the author – occurred abundantly in the reservoir and constituted economic prey. Fairly high index of filling noted in October was probably due to higher energy requirements of females compared to males (samples from this months were represented by females only).

Index of stomach filling used in this study is not a good measure of the feeding intensity. An estimation of this intensity over a 24-hour diurnal period gives a better picture. Jobling (1981) in his study on the currently applied methods stated that in order to calculate 24-hour diurnal consumption one must know the rate of evacuation and collect data concerning the amount of food in stomachs at 2–3 hour intervals over the full 24-hour diurnal period. This is, however, quite difficult to carry out. It furthermore appears that such materials should be collected from sufficient number of individuals, so as to render possible distinction between sexes and age groups. These conditions were not totally fulfilled with respect to perch population analysed in Włocławek Reservoir, and for this reason 24-hour diurnal food consumption was not estimated. There was a possibility of reconstructing the 24-hour diurnal cycle of stomach filling, but this would necessitate a speculative assumption that there was one more peak of food consumption around noon.

## SUMMARY

The perch living in Włocławek Dam Reservoir showed high level of plasticity with respect to the food consumed. Food consumption was connected with such organisms which through their considerable density in the environment constituted an attractive and readily available prey.

Populations of small fishes, from among which ruffe in the first place, constituted main source of food in July and August 1981. Fishes were consumed by perch of 12 as also 25 cm in body length. The cladoceran *Leptodora kindtii* was also of considerable importance. American crayfish and viviparous were also consumed. Chironomidae occurred from time to time, but these were rare in the reservoir.

The basic food in 1984 consisted of *Chironomidae* larvae and pupae, although *Oligochaeta* predominated in food composition in April, fish spawn in May, and *Leptodora kindtii* in July. As in 1981, American crayfish was readily consumed. On the other hand, fishes constituted a minimum component in the diet. It appeared, however, that an invertebrate diet had not a negative effect on the growth of perch.

Change in the diet of perch in 1984 to feeding on *Chironomidae* larvae and pupae, and not so much on the fishes, was connected with a considerable increase in the biomass and numbers of the larvae of these insects as compared to 1981.

Index of the stomach filling (feeding intensity) was not directly connected with water temperature. Feeding intensity depended more or less on the density and mobility of the prey, and upon energetic requirements of the fish. It appeared that these requirements were higher during the spawning period (May), and higher in females than in males (at least in autumn).

In view of the assumed difference in the intensity of feeding between perch males and females, diurnal rations should be determined separately for the two sexes.

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## REFERENCES

**Antosiak B.**, 1963: Udział ryb w pokarmie starszych roczników okonia w niektórych jeziorach okolic Węgorzewa. [Fish fraction in the feed of the older age group perch in some lakes of Węgorzewo district]. – Rocz. Nauk Roln. 82, B, 2:273–294.

**Bączkowska M.**, 1965: Pokarm i odżywianie się okonia w jeziorach Legińskim i Pasterzewo. [Feed and nourishment of perch of the Legińskie and Pasterzewo lakes origin]. – Zesz. Nauk. WSR Olszt., 20, 2:233–243.

**Bogdanov G.K.**, 1959: Pitane nekotorych vidov ryb iz Kamenogorskogo Vodochranilisca. – Zb. rob. po ichtiol. i gidrobiol. Izd. AN Kazach. SSR. 2: 234–244. (in Russian)

**Boroń Sł.**, 1984: Odżywianie się i wzrost kiełbia, Gobio gobio (L) w Zbiorniku Włocławskim w 1982 roku. [Nourishment and growth of gudgeon, Gobio gobio (L) in the Włocławski Reservoir, in 1982]. – M.S. ART Olsztyn.

**Boroń Sł.**, 1984: Odżywianie się i wzrost jazgarza, Gymnocephalus cernuus (L) w Zbiorniku Włocławskim w 1982 roku. [Nourishment and growth of Gymnocephalus cernuus (L) in the Włocławski Reservoir in 1982]. – M.S. ART Olsztyn.

**Craig J.F.**, 1978: A study of the food and feeding of perch, Perca fluviatilis L., in Windermere. – Fresh. Biol. 8: 59–68.

**Filuk J., Żmudziński L.**, 1965: Odżywianie się ichtiofauny Zalewu Wiślanego. [Nourishment of the Vistula Firth ichtiofauna]. – Pr. MIR. A, 13: 43–55.

**Giziński A., Błędzki L.A., Kentzar A., Rejmanowska K., Szempliński K., Wiśniewski R., Żytkowski R.**, 1985: Hydrobiologiczna charakterystyka Zbiornika Włocławskiego (1980–1984). [Hydrobiological characteristic of the Włocławski Reservoir (1980–1984)]. – in press.

**Jobling M.**, 1981: Mathematical models of gastric emptying and the estimation of daily rates of food consumption for fish. – J. Fish. Biol. 19: 245–257.

**Lesceva T.S.**, 1967: Smeny raznernych grup piscevych komponentov v svazi s rostom okuna pribreznij užnoj casti Ribinskogo Vodochranilisca. – Vopr. Ichtiol. 7, 6: 1054–1059.

**Makarova N.P.**, 1973: Sezonnye izmenenia nekotorych fizjologiceskich pokazatelej okuna, Perca fluviatilis, Ivanskogo Vodochranilisca. – Vopr. Ichtiol. 13, 5: 888–900.

**Moruchaj-Boltovskoj F.D.**, 1954: Materialy po srednemu vesu vodnych bezpozvonocnych basena Dona. – Tr. Probl. Soviets. ZIN, 2.

**Pliszka F.**, 1953: Dynamika stosunków pokarmowych ryb z jeziora Harsz. [Dynamics of feeding ratios in fish of Harsz Lake origin]. – Pol. Arch. Hydrobiol. 1: 271–300.

**Skóra S.**, 1964: Wzrost i odżywianie się okonia w zbiorniku zaporowym w Kozłowej Górze. [Growth and nourishment of perch originated from barrier basin in Kozłowa Góra]. Acta Hydrobiol. 6, 4: 373–387.

**Thorpe J.E.**, 1977: Daily ration of adult perch, Perca fluviatilis L., during summer in Loch Leven, Scotland. – J. Fish. Biol. 11: 55–68.

**Wierzbicka D.**, 1983: Wzrost narybku grupy wieku 0+, wybranych gatunków w zbiorniku zaporowym na Wiśle pod Włocławkiem w 1982 roku. [Growth of the chosen fish species fry of the 0+ age group in barrier basin on the Vistula River near Włocławek, in 1982]. – M.S. ART Olsztyn.

**Żuromska H.**, 1961: Wzrost okonia w jeziorach okolic Węgorzewa. [Growth of perch in lakes of the Węgorzewo district]. – Rocz. Nauk. Roln. 77,B, 1:603–639.

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## ODŻYWIANIE SIĘ DOROSŁEGO OKONIA *PERCA FLUVIATILIS* L. WE WŁOCŁAWSKIM ZBIORNIKU ZAPOROWYM NA WIŚLE

### STRESZCZENIE

W lipcu i sierpniu 1981 roku oraz od kwietnia do października 1984 roku zebrano 553 żołądki okonia od długości ciała (l.c.) od 12.1 do 29.7 cm (Tabela 1). Okonie odłowiono w środkowej części zbiornika w okolicach miejscowości Nowa Wieś. W lipcu i w sierpniu 1981 roku zasadniczym pokarmem okonia w Zbiorniku Włocławskim były ryby o długości ciała (l.c.) od 3 do 6 cm, reprezentowane przede wszystkim przez jazgarza (Tabela 2, Rysunek 1). Ryby spożywało 50–80% okoni i nie było to związane z rozmiarami drapieżników (Tabela 3). W skład pokarmu wchodziła również *Leptodora kindtii*, rak amerykański (Cambarus affinis) oraz żyworódka – *Viviparus sp.* W roku 1984 najważniejszym składnikiem pokarmu były larwy i poczwarki *Chironomidae* zjadane przez znaczną część ryb (Tabela 4, 5). Bezkręgowce te pod względem liczbowym stanowiły od 60 do 95% pokarmu (Rysunek 2). Jednakże w kwietniu przeważały nad nimi *Oligochaeta* zjadane przez około 30% badanych okoni (pod względem masy pokarmu stanowiły 50%), w maju ikra ryb (liczbowo stanowiła 78%) a w lipcu *Leptodora kindtii*, która pod względem liczbowym i masy wynosiła odpowiednio 97 i 61% (Tabela 5, Rysunek 2). Przejście okonia, w roku 1984, na odżywianie się larwami i poczwarkami *Chironomidae* oraz rezygnacja z chwytania ryb związane było z przeszło 20-krotnym, w stosunku do roku 1981, zwiększeniem się biomasy larw tych owadów (Tabela 7). Stały się one przez to łatwo dostępnym i atrakcyjnym pokarmem.

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