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Short communications

THE FEEDING SELECTIVITY OF WELS (*SILURUS GLANIS* L.) IN LAKE GÓRECKIE

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ABSTRACT. In 1997, 375 cultivated wels specimens were released into Lake Góreckie, which is located in the Wielkopolski National Park. The average mass per specimen was 1,350 g. Control catches were made in 1998 and 1999, and the diet consumed by the wels was investigated. The striped crayfish *Orconectes limosus* Raf. was detected in 51% of the fish caught. The contribution of striped crayfish to the wels diet fell to 4% after two years. This was probably correlated with changes in the feeding grounds of the older wels.

Key words: WELS (*SILURUS GLANIS*), STRIPED CRAYFISH (*ORCONECTES LIMOSUS*), FOOD SOURCE

Wels, *Silurus glanis* L. is a predacious fish with a very wide diet spectrum. Its natural food includes various fish species, other vertebrates such as frogs, rodents and water foul and invertebrates including crayfish. In many waters an essential element of the trophic chain is crayfish, and in some periods it may become the main element in the diet of fish such as eel *Anguilla anguilla* (L.) or perch *Perca fluviatilis* L. The striped crayfish currently dominates Polish waters, and its range of occurrence is increasing. Unfortunately, the striped crayfish is forcing the noble *Astacus astacus* L. and marsh crayfish *Astacus leptodactylus* Esch. out of their habitats. It also may be a carrier of the plague. However, its role in aquatic ecosystems a similar to that of other species which it replaces, and it may occur in locations where less resistant species have no chance of survival. This explains why it inhabits existing, free niches. Populations of striped crayfish can become abundant in some habitats, thus providing a potential food source for many fish species including wels.

A review of the literature indicated that the majority of research is devoted to the occurrence of crayfish, its numbers, biology and dietary composition (Kossakowski 1956, Leńkowa 1962, Sakowicz and Kompowski 1962, Orzechowski 1984, Świerczyński and Śmietana 1994, Krzywosz et al. 1995, Białokoz et al. 1996,

Strużyński and Śmietana 1999). Czarnecki et al. (2000) examined the possibilities of restituting the wels population in the Wielkopolska region using cultivated stocking material. Draganik (1962) investigated the diet of eel inhabiting Masurian lakes and reported crayfish to be an essential component of it. Rudnicki et al. (1971) found that wels consume crayfish sporadically. Napora and Kleszcz (2001) reported that crayfish, comprising 1% of the wels diet, were the fourth most common dietary component of this species following fish, amphibians and mammals. Brylińska (2000) indicated that crayfish was found frequently, particularly in the stomachs of large perch. Although crayfish occur rather frequently in the diet of wels, to date there are no documented data which refer to this subject.

The aim of the present study was to determine the importance of striped crayfish (*Orconectes limosus* Raf.) in the diet of wels.

This study on the contribution of striped crayfish to the wels diet utilized fish material obtained from Lake Góreckie, which is located in Wielkopolski National Park. The lake is in the early stages of eutrophication, and from the point of view of fisheries, it is classified as a bream lake. Its area of 99.4 ha has a maximum depth of 15.5 m and a mean depth of 6.5 m (Jańczak 1996). A portion of the lake, approximately 50 ha, is designated as a nature sanctuary. The noble crayfish inhabited Lake Góreckie in the 1970s, and currently there is an abundant population of striped crayfish (Mastyński 1970).

Three-hundred and seventy-five wels specimens of an average weight of 1,350 g were released into Lake Góreckie in June 1997. The fish had been cultivated at the State Treasury Fish Farm in Gosławice. Control catches of wels were conducted in spring, summer and fall for two years (1998 and 1999) using various gear - lake seines, splash nets, ropes. The diet consumed was identified and the quantity of the various components was determined (Szypuła 1979). The material for further investigations was obtained from the fish by one of the following four methods: exerting manual pressure on the abdomen; regurgitation; suctioning the stomach contents; dissection.

The first method consisted of applying manual pressure to the abdomen to determine if the stomach was full. In some cases, this manipulation prompted the fish to regurgitate, which allowed for a better examination of the stomach contents. Some of the fish regurgitated ingested food when they were placed into water-filled containers after being caught. Stomach suction was performed with the Woynarovich system (1958), which consists of a syringe and a hose 10 mm in diameter. The hose was passed through the mouth and into the stomach of the fish, then the contents were

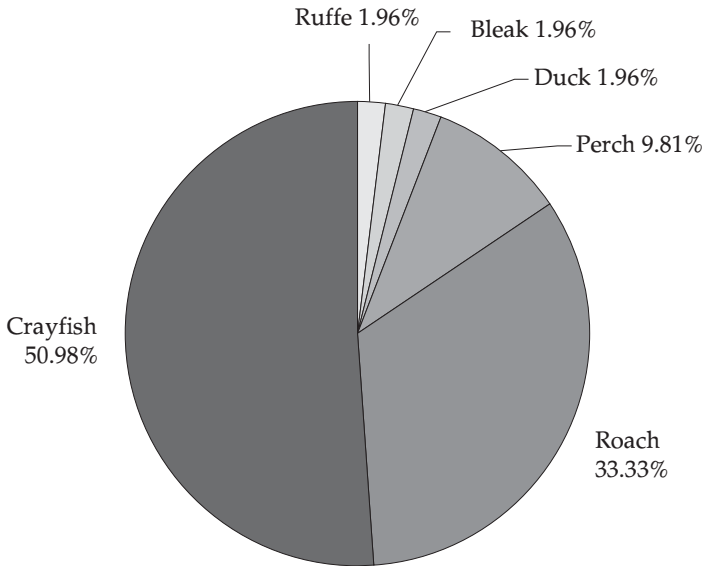

Fig. 1. Diet composition (%) of wels in the Góreckie Lake (mean values in the years 1998-1999).

suctioned into the syringe. These *in vivo* methods for obtaining and examining the ingested dietary contents of the wels specimens were applied particularly at the beginning of the studies so that the fish could be released back into the lake. Later in the study the stomach contents were obtained through dissection. The abdominal muscles were sectioned and the stomach was resected in order to remove the contents. The material obtained by the methods described above was either identified immediately after the fish had been caught, or it was preserved in 4% formalin and examined in the laboratory. The prey were identified based on morphological features, scales or pharyngeal teeth. Measurements were carried out with a slide caliper and a WE 2000 laboratory scale to the nearest 0.1 g.

Over two years, 13 control catches were carried out in Lake Góreckie during which 133 wels were obtained. The diet ingested by 23 wels was comprised of a total of 26 specimens of crayfish (51% of all the prey consumed), 17 specimens of roach *Rutilus rutilus* (L.), 5 specimens of perch, 1 specimen of ruff *Gymnocephalus cernua* (L.) and 1 specimen of bleak *Alburnus alburnus* (L.) and 1 duck *Anas platyrhynchos* L. (Fig. 1).

There was an especially high contribution of striped crayfish in their diet during the first year of the study. Striped crayfish were found in the wels diet between May and October with a higher prevalence of them in July and August. In the following

year the crayfish contribution decreased significantly and the amount of fish consumed increased (Table 1). Crayfish were also found in the stomachs of two perch consumed by wels.

TABLE 1

The percentage of dietary components of wels caught in Lake Góreckie in 1998 and 1999

Prey	1998		1999	
	Specimens	%	Specimens	%
Crayfish	22	81.5	4	16.6
Roach	1	3.7	16	66.7
Perch	3	11.1	2	8.3
Ruffe	-	-	1	4.2
Bleak	-	-	1	4.2
Duck	1	3.7	-	-
Total	27	100.0	24	100.0

Furthermore, the intestinal content of 21 wels specimens whose stomachs contained no crayfish revealed that this prey had been ingested earlier. The size of the crayfish consumed by the wels indicates that they prefer large individuals (6.5-10.2 cm). Table 2 presents the length and body weight of the consumed crayfish which could be measured. The results indicate that these parameters were highly diverse and that they oscillated in rather significant ranges.

TABLE 2

The length and body weight of crayfish consumed by wels caught in Lake Góreckie in 1998 and 1999

No	Body length (cm)	Body weight (g)
1	7.0	17.5
2	8.1	20.0
3	6.5	15.5
4	8.3	26.5
5	9.0	27.5
6	10.0	37.0
7	8.5	18.5
8	10.2	35.0
9	8.3	22.5
10	7.6	17.5
11	9.5	30.0
12	8.0	24.5
13	9.0	29.0
14	7.3	22.0
15	8.5	26.0

The results of the study indicate that the striped crayfish was a dominant component of the wels diet in the first year of the study. This is when the greatest number of

fish caught contained crayfish in the stomach or remains of it were found in the intestinal tracts. During this period, crayfish comprised over 81% of wels prey, and the highest percentage of them in the diet was observed in July and August. Similar results were obtained by Orłova and Popova (1987) who found a decisive increase in the share of crayfish in the diet of wels from the Volga (25-100%, depending on the age group) in the same months. However, these authors did not observe a direct dependence between age and the percentage of crayfish in the diet of the examined fish.

The feed selectivity of wels in Lake Góreckie could have been influenced by several factors. The introduced fish originated from a breeding facility, and after they were released into the lake they were confronted with completely different conditions. The wels had been supplied with food until their release, and in the lake they had to learn to find their food by themselves. Hence, in the period after introduction the most attractive and easily obtained food was crayfish. This favorable situation was shaped by the abundant population of striped crayfish in the lake. Additionally, since both crayfish and wels are nocturnal, the fish could easily find and catch crayfish during their peak feeding time. Therefore, it is possible that the accessibility of crayfish has a significant impact on the adaptation of cultivated wels to natural conditions.

As mentioned in the introduction, Lake Góreckie is deep with depths of 8 - 10 m comprising a significant area of the lake. Extensive shallow areas are found only around two islands. The littoral is rich, but narrow (a maximum width of several meters) and drops off sharply to increasing depths. At the boarders of the littoral and on the lake bottom there are numerous branches and even whole trees which provide attractive hiding places for crayfish and wels. Presumably, under these conditions it was much easier for wels to catch crayfish than it was to hunt fish. The presence of crayfish in the diet of the perch which were consumed by wels indicates that perch were caught by wels when they entered the wels feeding grounds (Horoszewicz 1971).

With time, the wels inhabiting the lake improved and diversified their predation methods in all zones of the lake. This is evidenced by the presence in their diet of different types of prey caught in the bottom zone (crayfish), the pelagic and surface zones (bleak, duck) and also in the littoral, particularly during spawning (roach). The fact the wels feed in different zones of the lake is also confirmed by fragments of vegetation and the feather which were noted in the stomach contents. It is presumed that intensive consumption pressure on the crayfish in the first period of the wels life in the lake elicited a periodical decrease in this population and forced the wels to find other sources of food. Data reported by Kiekhäfer (2002) indicate

that wels has a significant impact on the reduction of the striped crayfish population in the Rhine.

CONCLUSIONS

The following conclusions can be drawn from the results of the present study:

- striped crayfish can be an essential component of the wels diet in lakes;
- cultivated wels which are released into natural lakes feed intensively on crayfish in the first years of habitation;
- the release of wels into lakes reduces the number of striped crayfish.

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STRESZCZENIE

WYBIÓRCZOŚĆ POKARMOWA SUMA (*SILURUS GLANIS* L.) W JEZIORZE GÓRECKIM

Do Jeziora Góreckiego położonego na terenie Wielkopolskiego Parku Narodowego wsiedlono w 1997 roku 375 sumów pochodzących z hodowli w akwakulturze. Średnia masa osobnicza wsiedlonych sumów wynosiła 1350 g. Przez dwa lata (1998-1999) przeprowadzono 13-krotnie połowy, w czasie których pozyskano 133 sumy. W pierwszym roku po wsiedleniu zaobserwowano szczególnie liczny udział raków pręgowatych w diecie suma, nawet do 81,5% , natomiast w następnym roku udział raków znacznie zmalał do 16,6% (tab. 1), a wzrósł udział ryb. Długość ciała raków znajdowanych w pokarmie suma wahała się od 6,5 do 10,2 cm, przy ciężarze ciała od 15,5 do 37,0 g (tab. 2). Rak pręgowaty może być więc istotnym składnikiem diety suma w jeziorach. Wsiedlenie suma może być sposobem na ograniczenie liczebności populacji raka pręgowatego.

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