

PREY SELECTIVITY IN ONE-SUMMER-OLD WELS (*SILURUS GLANIS* L) FED WITH CARP (*CYPRINUS CARPIO*) AND TOPMOUTH GUDGEON (*PSEUDORASBORA PARVA*)

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Abstract

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The aim of this study was to determine the selectivity index in one-summer-old wels (*S. glanis*). The experiment was carried out under controlled laboratory conditions, in the course of 36 days, in 10 tanks. One wels (*S. glanis*), 5 carps (*C. carpio*), and 5 topmouth gudgeons (*P. parva*) were placed in each tank. As a result of the experiment, positive values of the selectivity index were established, as regards *P. parva* (+0.2575) and a negative value as regards *C. carpio* (-0.1163). Data shows that when the wels is fed with carp and topmouth gudgeon it demonstrates greater affinity towards the second species.

Key words: wels, prey, selectivity index

Introduction

The prey selectivity of the predatory fish species depends on many factors (Mauck and Coble, 1971; Ivlev, 1977; Nilsson, 2001). Among these the size of the prey is of considerable significance (Nilsson, 2000; Turesson et al., 2002; Turesson et al., 2005; Dörner, 2007), as well as its morphological characteristics, which are determined mainly by their species affiliations. Besides morphological characteristics (body height, hard rays in the fins, etc.), prey accessibility and its location, population density, and agility of the prey, etc. (Ivlev, 1977) have an effect upon the prey selectivity of the predator.

The wels (*Silurus glanis* L.) is among the most commonly cultivated predatory fish in warm-water

pond fishery. It is used as a bio-meliorator in ponds, designed for breeding of different fish species with the main purpose of regulating the quantity of weed species. Its nutrition spectrum includes a wide range of water organisms such as crustacean, mussels, fish, etc. (Orlova and Popova, 1987; Czarnecki et al., 2003; Dogan and Gul, 2004). In this relation, its preferences towards consuming one prey or another, a problem which has an important practical significance, is of considerable interest.

Prey selectivity of wels was studied by Adamek et al. (1999), their experiments were carried out in controlled conditions, using 8 fish species as preys – chub (*Leuciscus cephalus*), Prussian carp (*Carasius auratus gibelio*), roach (*Rutilus rutilus*), topmouth gudgeon (*Pseudorasbora parva*), asp (*Aspius*

aspius), sunbleak (*Lepomis delineates*), rudd (*Scardinius erythrophthalmus*) and bitterling (*Rhodeus sericeus*). According to the same study, body shape does not have a decisive significance for prey selectivity.

In the fish farms, the wels feed on all fish accessible. Its nutrition spectrum includes economically valuable species, which are an object of cultivation, as well as weed species. The carp is one of the main species for warm-water aquaculture in Bulgaria, while one of the most common and widely spread weed fish is the topmouth gudgeon (*Pseudorasbora parva*) (Bojadjev and Basamakov, 1988). In Bulgaria, this species was discovered by Marinov (1979) and at present it represents a considerable problem for carp breeding, because the quantity of carp, inhabiting water ponds is very big. Their presence has a significant negative effect upon breeding of economically valuable species.

The aim of this study is to determine the selectivity of wels when fed with carp and topmouth gudgeon. Carrying it out under laboratory conditions allows to reduce to minimum the influence of some side factors of the environment (accessibility and number of preys, greater availability of one species or another, availability of the other types of food, fluctuations of the hydrochemical parameters, etc.), which can have an influence upon the final result.

Materials and Methods

The experiments for determining prey selectivity of wels fed with carp and topmouth gudgeon were carried out in the aquarium of the Institute of Fisheries and Aquaculture, Plovdiv. For this purpose, 10 tanks with a volume of 20 l were used and the water in them was aerated by micro-compressors. During the experimental period, the water temperature and the quantity of dissolved oxygen in it were monitored.

One wels, 5 carps and 5 topmouth gudgeons were placed in each tank. In total, the experiments were carried out by using 10 one-summer-old wels, 50 carps and 50 topmouth gudgeons, i.e., at 10-times repetition of the experiments.

Before setting the experiment, the body length and body weight of the predator, as well as the body weight, body height and body length of the preys were individually measured. The size of the prey is in accordance with the size of the predator, the bigger preys were placed in the tanks with a bigger wels. The number of swallowed preys in each tank was reported at every 24 h. The end result was reported when all the fish from one or the other species offered as preys were eaten.

The wels used for the experiment were grown in an earthen pond. They were fed with fish including carp and topmouth gudgeon so they have the experience as predators.

In order to determine the prey selectivity of wels, in regard to the two species proposed as food, Ivlev's formula was used (1977) $E = (r-p)/(r+p)$, where r - is preys' share, swallowed by the predator (%), and p - is the share of the remaining preys, which have not been swallowed yet (%). The positive values of E mean that the prey is preferred, while the negative ones mean that it is avoided as food by the predator. Values around zero show that the preys are accepted depending on their density.

The choice of the carp and the topmouth gudgeon as preys was motivated by the fact that the carp is the most commonly grown species in the aquaculture in Bulgaria. Many of the fish farms have turned to three-summer interval of rearing, and as a result from the uncontrolled breeding of the three-summer-old brood fish, unwanted generation will be produced. The topmouth gudgeon, on other side, is one of the most widely spread species of weed fish in the aquafarms in our country.

Results and Discussion

During the experiment the quantity of dissolved oxygen in water was within the optimum limits of 5.8 – 6.7 mg.l⁻¹, and the temperature was below the optimum limits for the wels with small variations within 18 – 20°C.

The average values for body weight (BW, g), height (H, cm), and total length (TL, cm) of the specimens

used as preys are shown in Table 1. Data shows that no significant differences in terms of these parameters exist among preys belonging to the same species in the different tanks.

Figure 1 indicates the body weight of wels used for the purposes of the experiment. The values vary within 37.2–42.7 g, i.e., the difference between the

biggest and the smallest specimen is 5.5 g. The same graphic shows also the body length of the predators, which varies within very narrow limits 19.0–20.2 cm.

The body weight (Figure 2) was used as the main parameter for prey selection, so there is no significant difference in the value of this parameter for the individuals from the two species used as a prey (*C. carpio*

Table 1
Average value of body weight (g), total length (cm) and height (cm) of the used preys

Tank N	Parameter	<i>Ciprinus carpio</i>			<i>Pseudorasbora parva</i>		
		BW, g	TL, cm	H, cm	BW, g	TL, cm	H, cm
1	x	4.3	6.78	1.68	4.28	7.96	1.4
	SD	0.31	0.25	0.05	0.37	0.29	0.03
	Cv%	7.35	3.81	2.97	8.65	3.62	2.02
2	x	4.16	6.64	1.73	3.96	7.8	1.36
	SD	0.32	0.11	0.05	0.23	0.23	0.05
	Cv%	7.71	1.71	2.64	5.81	3.01	3.79
3	x	4.58	6.84	1.82	4.56	7.98	1.43
	SD	0.29	0.15	0.03	0.68	0.53	0.09
	Cv%	6.44	2.21	1.63	14.92	6.6	5.93
4	x	4.52	6.78	1.79	4.36	8.06	1.39
	SD	0.37	0.16	0.05	0.51	0.29	0.08
	Cv%	8.18	2.42	3.01	11.65	3.57	5.71
5	x	4.4	6.76	1.75	4.68	8	1.44
	SD	0.27	0.11	0.04	0.71	0.48	0.08
	Cv%	6.22	1.68	2.36	15.21	5.99	5.36
6	x	4.44	6.66	1.74	4.38	8.02	1.39
	SD	0.32	0.15	0.07	0.57	0.35	0.08
	Cv%	7.22	2.27	3.72	12.96	4.36	5.71
7	x	4.26	6.72	1.77	4.38	7.96	1.44
	SD	0.35	0.22	0.07	0.51	0.15	0.06
	Cv%	8.23	3.39	4.07	11.57	1.90	4.02
8	x	4.22	6.6	1.74	4.04	7.74	1.37
	SD	0.22	0.10	0.04	0.27	0.18	0.07
	Cv%	5.40	1.51	2.09	6.69	2.16	5.14
9	x	4.46	6.88	1.77	4.38	7.96	1.4
	SD	0.41	0.18	0.05	0.68	0.42	0.10
	Cv%	9.32	2.60	2.60	15.43	5.30	7.37
10	x	4.42	6.72	1.73	4.24	7.88	1.38
	SD	0.30	0.18	0.04	0.51	0.23	0.04
	Cv%	6.86	2.66	2.40	11.98	2.89	2.82

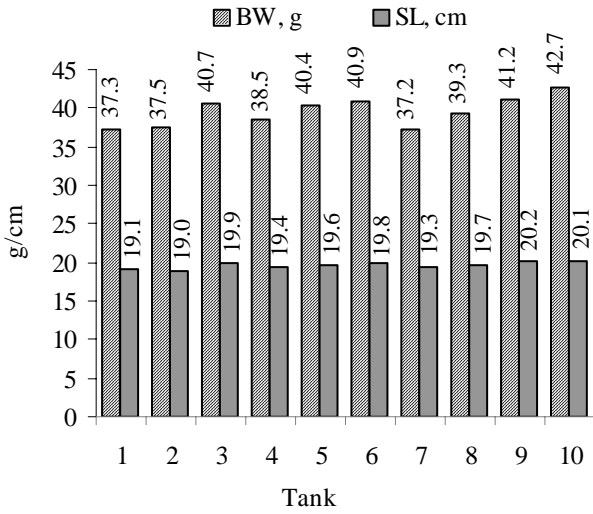


Fig. 1. Values of body weight and body length of the wels used as predators

and *P. parva*). The average value of this parameter for the carp is 4.38 ± 0.14 g (n=50). In the different tanks this variation is within 4.58-4.16 g. For the topmouth gudgeon, the average body weight of the preys was 4.33 ± 0.22 g (n=50), with variation within 3.96-4.68 g.

As far as the other two parameters (body length and height) are concerned (Figure 3 and Figure 4), there are statistically significant differences between the carp and the topmouth gudgeon, which were in one degree or another dependent on the morphologi-

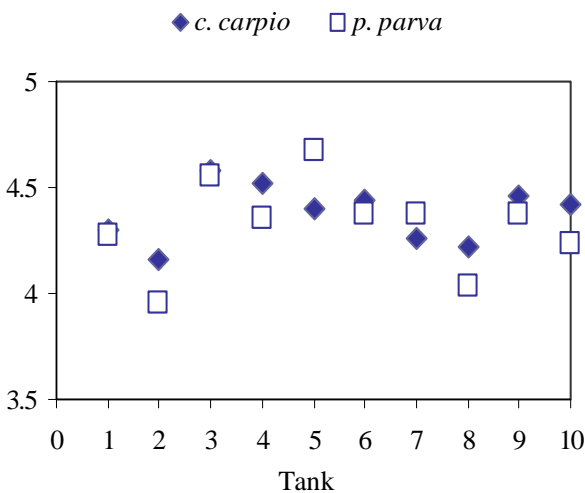


Fig. 2. Body weight (g) of the used preys

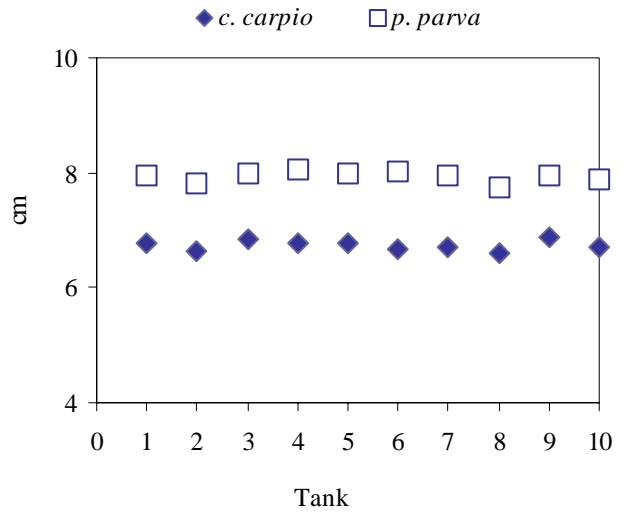


Fig. 3. Body length (cm) of the used preys

cal differences between the two species. At one and the same body weight, the carp has a bigger body height, and the topmouth gudgeon - bigger body length.

Percentage of swallowed preys per species

Figure 5 shows the percent ratio between the offered and swallowed individuals from the two species. For the whole period of the experiment from the 100 preys set in the 10 tanks, 78 (78%) of specimens were eaten in total. A considerably greater is the percent of the eaten topmouth gudgeons – 60.25% or

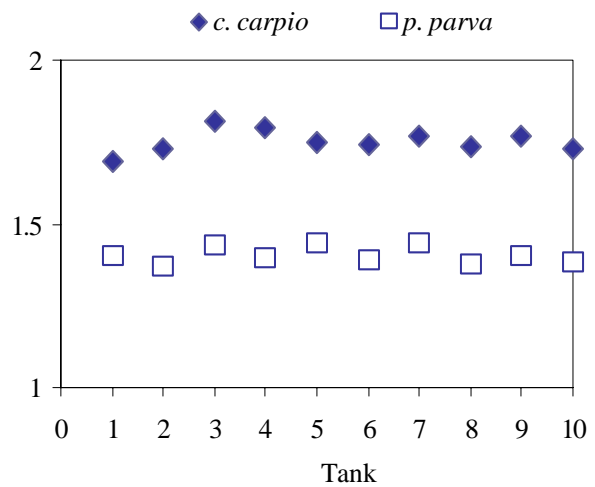


Fig. 4. Body height (cm) of the used preys

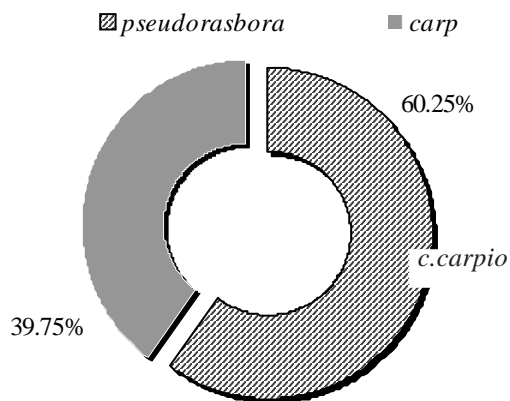


Fig. 5. Percentage of swallowed preys per species

47 in number, while for the carp these values were 39.75% or 31 in number, respectively.

Prey Selectivity

On the first check-up, in 8 of the 10 tanks, the topmouth gudgeon was preferred as food. Only in tank 8 and tank 9 the carp was preferred as a prey. From the very beginning we observed prey selectivity of wells as regards the species affiliations of the preys, and during the whole period of the experiment, the number of the topmouth gudgeons eaten per day remained comparatively constant in the tanks. In the first 10 days, only 2 carps were eaten (1 carp in each one of tanks 8 and 9). During the next days the number of swallowed carps increased, possibly as a result of the decreased number of topmouth gudgeons.

In 9 of the total 10 set variants the experiment ended after all topmouth gudgeons were eaten, and it is only in one variant (9 tank) that all carps offered were eaten.

In the experiment carried out by Adamek et al., (1999) was established that the wells have avoided to consume the topmouth gudgeon and the roach (carp has not been present in the preys offered). This study shows that it preferred the topmouth gudgeon to the carp as food, which has a similar to the roach body shape.

Selectivity Index

The established prey selectivity indices for wells

fed with carp and topmouth gudgeon are, as follows: carp (-0.1163) and topmouth gudgeon (+0.2575). The results obtained and the selectivity indices shows that in conditions of the experiment the wells have demonstrated prey selectivity, by taking as food the carp to a degree higher than that of topmouth gudgeon.

Conclusions

The one-summer-old wells under controlled laboratory conditions prefers the topmouth gudgeon (*Pseudorasbora parva*) compared to the carp (*Cyprinus carpio*), taking into consideration that 60.25% of the preys consumed were topmouth gudgeons and the remaining 39.75% were carps.

The established selectivity index for the topmouth gudgeon is with a positive value (+0.2575) and a negative value (-0.1163) for the carp which confirms the higher affinity of the wells to the first species.

References

- Adamek, Z., K. Fasaic and M. Siddiqui, 1999. Prey selectivity in wells (*Silurus glanis*) and african catfish (*Clarias gariepinus*). *Ribarstvo*, **57**(2): 47-60.
- Bojadjiev, A. and I. Basamakov, 1988. On the distribution of *Pseudorasbora parva* (Schlegel) in Bulgaria. *Annual of Plovdiv Uni, Animalia*, **26**.
- Czarnecki, M., W. Andrzejewski and J. Mastynski, 2003. The feeding selectivity of wells (*Silurus glanis* L.) in lake Goreckie. *Arch. Pol. Fish.* **11**(1): 141-147.
- Dogan, N. and A. Gul, 2004. Feeding biology of *Silurus glanis* L. living in Hirfanli dam lake. *Turk. J. Vet. Anim. Sci.*, **28**: 471-479.
- Dörner, H., S. Hülsmann F. Hölker C. Skov and A. Wagner, 2007. Size-dependent predator-prey relationships between pikeperch and their prey fish. *Ecology of Freshwater Fish*, **16**(3): 307-314.
- Ivlev, V., 1977. Experimental ecology on fish feeding. *Naukova dumka*, Kiev, 272 p. (Ru).
- Marinov, B., 1979. *Pseudorasbora parva* (Shlegel 1842) (Pisces: Cyprinidae) – a new representative of the ichthyofauna of Bulgaria. *Hydrobiologia*, **8**: 75-78.
- Mauck, W. and D. Coble, 1971. Vulnerability of some fishes

to Northern Pike (*Esox lucius* L.) predation. *J. Fish Res. Bd. Canada*, **28**: 957-969.

Nilsson, A., 2001. Predator behavior and prey density: evaluating density-dependent intraspecific interactions on predator functional responses. *Journal of Animal Ecology*, **70**: 14-19.

Orlova, E. and P. Popova, 1987. Age changes in the feeding of catfish *Silurus glanis* and pike *Esox lucius* in the

Volga avantdelna. *Ichthyology*, **27**: 140-148.

Turesson, H., A. Persson and C. Bronmark, 2002. Prey size selection in piscivorous pikeperch (*Stizostedion lucioperca*) includes active prey choice. *Ecology of Freshwater Fish*, **11**(4): 223-233.

Turesson, H., C. Bronmark and A. Wolf, 2006. Satiation effects in piscivore prey size selection. *Ecology of Freshwater Fish*, **15**(1): 307-314.

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