

CHARACTERISTICS OF FEEDING AND GROWTH OF PIKE PERCH AND PIKE IN THE PROTECTED PART OF RIVER BEGEJ

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Abstract. Material was collected through 1990 up to October 1991 in the regional park "Stari Begej" of river Begej. Altogether 80 specimens of pike perch and 94 specimens of pike were investigated.

The aim of the study was the analysis of relationship between predators and prey concerning their growth and length.

The age of pike was between 2⁺ and 6⁺, and that of pike perch between 2⁺ and 5⁺. Age class 3⁺ was dominant in the case of both species. The values of body length increase are in the limits reported by Maletin and Budakov (1984), and Budakov (1989) as shown for both predators in Vojvodina rivers.

Pike and pike perch have limited variation concerning feeding. Fish predominated their food, 4 and 6 fish species, respectively. The highest proportion is linked with *Carassius auratus gibelio*. Both species are on the list of Serbian "Red book".

Key words: pike, pike perch, Stari Begej, feeding, growth.

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Introduction

The Regional Park "Stari Begej" is situated in alluvial flat land of rivers Begej and Tisza.

Today's aspect of Stari Begej is the result of digging and its artificial separation on the fifteenth kilometer. In the length of about ten kilometers, river Begej is today in the limit of protected area separated from the rest of rivers Begej and Tisza. Separated part of river Begej is cut from Tisza by water gate. Natural and seasonal variation of water level is regulated by the water gate system on the northern and southern parts.

It represents last and modest remnants of marsh area in the low stream of rivers Begej and Tisza.

Stari Begej is occupied by 24 fish species from 7 families: Esocidae, Cyprinidae, Cobitidae, Siluridae, Ictaluridae, Centrarchidae and Percidae. The greatest is Cyprinidae family with 16 species (Budakov, 1989).

Ichthyofauna of Stari Begej has been investigated in the last few years. Predators (*Silurus glanis*, *Stizostedion lucioperca*, *Esox lucius*, *Perca fluviatilis*) are abundant and consequently their in-

fluence on the other species is important.

Material and Methods

Studied material was collected in Stari Begej within the limits of protected area - Regional Park Stari Begej. Catching of pike and pike perch was done through 1990 up to October 1991 by electrofishing.

Material - 94 pike and 80 pike perch individuals - were investigated in fresh condition. Age and reconstruction of body length were determined on the basis of scales. Body weight was estimated from body length. Annual cycle of food composition was established from the stomach content, depending on season, age and sex.

Results

In the studied sample, age classes of pike were labeled 2⁺ - 4⁺ in 1990 and 2⁺ - 6⁺ in 1991. Within the period of both years, the age class 3⁺ was dominant.

Averages of body length (without caudal fin) were 369.75 and 438.33 mm, respectively (Table 1). According to the calculated values, length was duplicated after the second year, showing an intensive increase in the first years of life. It increased with age and became larger in individuals from 1991. Annual increase of body length gradually depressed, but after age 5⁺ it increased prominently. Growth rate and growth constant are the highest in age 2⁺ (C=0.03; K=4.07 or 3.57). Decrease of growth constant was noticed from 3⁺ (K=2.07 or 1.74) related to approaching maturity.

Table 2. shows average values of body length (without caudal fin) for pike perch ranging from 337.86 to 342.69 mm. Estimated values of growth of body length are the same during the first year. This parameter increased gradually with age but the

values are slightly larger in individuals from 1990. In the ages 1⁺ and 2⁺, annual increase of length growth and growth rate were very similar for both years, then gradually decreased but from age 4⁺ they abruptly increased.

Growth of weight of pike and pike perch is shown in Fig. 1. These values prominently increased for pike after fifth and for pike perch after fourth year.

On the basis of the seasonal analysis of feeding of pike from 93 stomachs (Table 3.), the highest mass was noticed in Spring and the smallest in Summer. Seven fish species were determined in stomach content, as well as young fish were separated. The largest proportion belonged to *Carassius auratus gibelio*, followed by *Rutilus rutilus*. Pikes of ages 2⁺ to 4⁺ feed with *Perca fluviatilis* and

Table 1. Longitudinal growth of *Esox lucius* in Stari Begej, on the basis of samples from 1990 and 1991. Data are given in mm.

| age class | generation | N | length mm | L1 | L2 | L3 | L4 |
|-----------------|------------|----|-----------|--------|--------|--------|--------|
| 2 ⁺ | 1990 | 11 | 327.64 | 154.86 | 258.07 | | |
| 3 ⁺ | 1989 | 42 | 352.02 | 135.29 | 233.70 | 307.22 | |
| 4 ⁺ | 1988 | 19 | 433.32 | 134.69 | 235.67 | 323.40 | 386.84 |
| average | | | 369.75 | 138.12 | 237.97 | 312.26 | 386.84 |
| annual increase | | | | 138.12 | 99.84 | 74.3 | 74.58 |

| age class | generation | N | length mm | L1 | L2 | L3 | L4 | L5 | L6 |
|-----------------|------------|----|-----------|--------|--------|--------|--------|--------|--------|
| 2 ⁺ | 1991 | 1 | 377.00 | 150.80 | 282.75 | | | | |
| 3 ⁺ | 1990 | 14 | 421.71 | 159.47 | 278.90 | 370.23 | | | |
| 4 ⁺ | 1989 | 4 | 464.00 | 143.73 | 262.85 | 359.41 | 420.70 | | |
| 5 ⁺ | 1988 | 1 | 448.00 | 135.76 | 203.64 | 271.51 | 339.39 | 407.27 | |
| 6 ⁺ | 1987 | 1 | 620.00 | 155.00 | 258.33 | 344.44 | 413.33 | 482.22 | 551.11 |
| average | | | 438.33 | 154.72 | 271.46 | 361.84 | 405.92 | 444.75 | 551.11 |
| annual increase | | | | 154.72 | 116.74 | 90.38 | 44.08 | 38.83 | 106.36 |

Table 2. Longitudinal growth of *Stizostedion lucioperca* in Stari Begej, on the basis of samples from 1990 and 1991. Data are given in mm.

| age class | generation | N | length mm | L1 | L2 | L3 | L4 | L5 |
|-----------------|------------|----|-----------|--------|--------|--------|--------|--------|
| 2 ⁺ | 1990 | 9 | 283.11 | 115.82 | 217.36 | | | |
| 3 ⁺ | 1989 | 18 | 335.44 | 119.74 | 215.40 | 284.75 | | |
| 4 ⁺ | 1988 | 9 | 399.78 | 116.32 | 207.47 | 285.38 | 347.85 | |
| 5 ⁺ | 1987 | 2 | 530.00 | 147.86 | 259.29 | 345.71 | 422.14 | 478.57 |
| average | | | 337.86 | 119.6 | 216.3 | 289.16 | 361.36 | 478.57 |
| annual increase | | | | 119.6 | 96.81 | 72.86 | 72.21 | 117.21 |

| age class | generation | N | length mm | L1 | L2 | L3 | L4 | L5 |
|-----------------|------------|----|-----------|--------|--------|--------|--------|--------|
| 2 ⁺ | 1991 | 9 | 333.78 | 143.49 | 255.48 | | | |
| 3 ⁺ | 1990 | 22 | 339.41 | 118.61 | 216.09 | 287.79 | | |
| 4 ⁺ | 1989 | 8 | 339.25 | 99.14 | 175.71 | 242.05 | 296.74 | |
| 5 ⁺ | 1988 | 3 | 402.67 | 96.04 | 180.12 | 260.20 | 320.50 | 363.36 |
| average | | | 342.69 | 118.6 | 214.3 | 274.2 | 303.2 | 363.4 |
| annual increase | | | | 118.6 | 95.7 | 59.9 | 29.2 | 60.1 |

Rutilus rutilus. Young fish is eaten in the largest amount by age class 2+. From age class 2+ to 4+ range of food is very wide and includes five species. *Carassius auratus gibelio* was prey of pike of age 4+.

In Spring, after pike's spawning, female are more active in searching food, but the proportion of individuals with not empty stomach is almost the same for male and female.

From 78 studied stomachs of pike perch, 56 had one component - fish and young fish. The determination of the latter was not possible. Increasing number of species were noticed from Spring to Autumn, but *Carassius auratus gibelio*, *Rutilus rutilus* and *Lepomis gibbosus* were present during all seasons. *Carassius auratus gibelio* and *Rutilus rutilus* are main components of food of pike perch in age classes 2+ to 5+. Males and females have practically the same demands for food after spawning.

Discussion

Data related to the growth of length are contribution to the knowledge of ecology of pike and pike perch which are very important in economy as well as in sport fishing.

Age and growth of pike in Vojvodina waters were investigated by Ristic (1968), Jankovic (1973), Budakov and Maletin (1982a, 1982b, 1984), Maletin and Budakov (1983) and Budakov (1989), and those of pike perch by Maletin and Budakov (1984).

Table 3. Composition of prey species in the food of studied predators.

| <i>Esox lucius</i> | season | | | growth | | | | | Spring sex | |
|------------------------------------|--------|--------|--------|--------|-------|-------|--------|--------|------------|-------|
| | Spring | Summer | Autumn | 2+ | 3+ | 4+ | 5+ | 6+ | female | male |
| number of estimated stomachs | 58 | 14 | 21 | 12 | 54 | 21 | 1 | 1 | 43 | 14 |
| Number of full stomachs | 30 | 3 | 17 | 4 | 28 | 16 | 1 | 1 | 23 | 7 |
| <i>Rutilus rutilus</i> | 24.39 | - | 20.00 | 42.86 | 25.96 | 9.09 | - | 100.00 | 22.58 | 30.00 |
| <i>Scardinius erythrophthalmus</i> | 2.44 | - | 10.00 | - | - | 18.18 | - | - | 3.23 | - |
| <i>Abramis ballerus</i> | - | 50.00 | - | - | 3.70 | - | - | - | - | - |
| <i>Carassius auratus gibelio</i> | 46.30 | - | 40.00 | - | - | 54.55 | - | - | 45.16 | 50.00 |
| <i>Misgurnus fossilis</i> | 4.88 | - | - | - | 7.41 | - | - | - | 6.54 | - |
| <i>Lepomis gibbosus</i> | 7.32 | 50.00 | 10.00 | - | 14.81 | - | 100.00 | - | 6.45 | 10.00 |
| <i>Perca fluviatilis</i> | 2.44 | - | 10.00 | 14.29 | 44.44 | 9.09 | - | - | 3.23 | - |
| Young fish | 12.19 | - | 10.00 | 42.86 | 7.41 | 9.09 | - | - | 12.90 | 10.00 |

| <i>Stizostedion lucioperca</i> | season | | | growth | | | | Summer sex | |
|----------------------------------|--------|--------|--------|--------|-------|-------|-------|------------|-------|
| | Spring | Summer | Autumn | 2+ | 3+ | 4+ | 5+ | female | male |
| number of estimated stomachs | 16 | 37 | 25 | 17 | 40 | 16 | 5 | 23 | 14 |
| Number of full stomachs | 10 | 24 | 22 | 10 | 28 | 14 | 4 | 13 | 11 |
| <i>Rutilus rutilus</i> | 41.67 | 42.42 | 13.79 | 30.77 | 31.15 | 28.57 | 16.67 | 43.75 | 41.18 |
| <i>Alburnus alburnus</i> | - | 3.03 | - | - | - | 7.14 | - | 6.25 | - |
| <i>Carassius auratus gibelio</i> | 50.00 | 33.33 | 41.38 | 69.23 | 26.83 | 42.86 | 50.00 | 31.25 | 35.29 |
| <i>Misgurnus fossilis</i> | - | 3.03 | 3.45 | - | 2.44 | - | 16.67 | - | 5.88 |
| <i>Lepomis gibbosus</i> | 8.33 | 9.09 | 10.34 | - | 12.20 | 14.29 | - | 18.75 | - |
| <i>Perca fluviatilis</i> | - | - | 6.90 | - | 4.88 | - | - | - | - |
| Young fish | - | 9.09 | 24.14 | - | 19.51 | 7.14 | 16.67 | - | 17.65 |

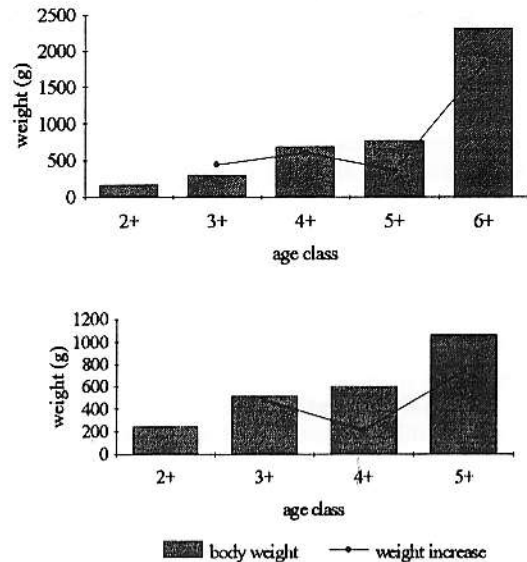


Fig. 1. Estimated growth of weight of *Esox lucius* (upper) and *Stizostedion lucioperca* (lower) in Stari Begej.

The growth of length of pike in Stari Begej is similar to the those in Danube, Sava and Tisza, but larger than those in Obedska bara and Koviljski rit (Budakov, 1989a, 1989b), and opposite to the results of Pankratova (1980).

Maletin and Budakov (1984) reported the largest longitudinal growth of pike perch from Sava and weaker than that from Danube. The values of this parameter were similar for Tisza and Tamis. These

results show that longitudinal growth of pike perch from Stari Begej was better related to that from Danube but smaller concerning pike perch from Sava, Tisza and Tamis.

Food composition of predators in waters of different type depends on the abundance of prey fish species, as well as their availability, dimensions, body shape, behaviour and water regime (Nikoljski, 1974). Feeding characteristics of pike and pike perch change with season and age (Domanevskij, 1958; Rudzjanskene, 1987), as well as related to sex, especially after spawning (Ivanova, 1965).

Spectrum of food of pike and pike perch in Stari Begej is poor, and includes nonvaluable species. Stomach content of pikes from Danube, Sava, Tisza, Koviljski rit consisted of 11 to 17 species. System of feeding is similar to that in Obedska bara (Budakov, 1988, 1990). In the food of pike perch, the primary species are similar to those of pike (Ivanova, 1965). Kirillov et al. (1977) reports that food composition depends on availability of different species as well as on their length and ecological characteristics (Rudzjanskene, 1987).

Spectrum of predator's feeding depending on age is less investigated. Pervazvanskij et al. (1977) reports that predators of age group up to 4⁺ are characterized by different food. On the other hand, individuals labeled from 5⁺ to 9⁺ replace small littoral species with larger ones.

Intensive feeding of pike and pike perch females after spawning (Zajcev, 1956) could not be totally accepted according to our results.

The feeding biology of pike and pike perch are different and because of that there is no interspecific competition between these two fish species. Although *Carassius auratus gibelio* is predominant in their feeding, this resulted from its large abundance in this river. The role of these predators is related to decrease of allochthonous species in the protected area.

Our results show (Budakov, 1989) that pike and pike perch are exposed to enough food, since this factor has no limitation for their longitudinal growth. It is obvious that dependence exists between growth and environmental conditions, but it is very hard to separate any special factor concerning their complex effect.

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