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AGRICULTURAL SCIENCE AND TECHNOLOGY

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Prey size selectivity of pikeperch (*Sander Lucioperca* L.) fed with topmouth gudgeon (*Pseudorasbora parva* Temminck & Schlegel)

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(Manuscript received 29 May 2017; accepted for publication 29 July 2017)

**Abstract.** The aim of this study is to examine the size selectivity of the pikeperch fed with one of the most widespread weed fish in fish farms, such as topmouth gudgeon (*Pseudorasbora parva* Temminck & Schlegel). Topmouth gudgeon (*Pseudorasbora parva* Temminck & Schlegel), separated in two size groups: large - group 1 (body weight of the specimens 8.63 ± 2.68 g, total length 9.58 ± 0.92 cm, and height of the body 2.06 ± 0.33 cm) and small - group 2 (body weight of the specimens 1.10 ± 0.36 g, average total body length of 5 ± 0.62 cm, and height of 0.85 ± 0.13 cm), were used as prey. The experiment was carried out under controlled laboratory conditions, in the course of 40 days, in 7 tanks. One pikeperch and 10 topmouth gudgeons from both size groups, in total 20 preys were placed in each tank. During the experimental period it was observed that pikeperch preferred to feed on smaller individuals, the difference in the number of consumed small and large fish is approximately 2 times (70 to 34, respectively).

**Keywords:** pikeperch (*Sander lucioperca* L.), prey, topmouth gudgeon (*Pseudorasbora parva* Temminck & Schlegel), size, selectivity, food

**Introduction**

Predation as a form of relationship between different species is essential for the formation of fish populations. Predators can affect not only species composition, but also the size structure (Bronmark et al., 1995). The presence of predatory fish in water bodies affects significantly the entire ecosystem and can change the feeding behavior or habitat preference of other species (Magnenhagen, 2006; Persson et al., 1996). The direct effect of their presence is expressed in reduction in the number of preys, important in this respect being the selectivity of eating, which is defined as total quality for predators (Beyerle and Williams, 1968; Ivlev, 1977; Hart and Hamrin, 1988; Einfalt and Wahl, 1997).

The interaction between predator and prey in aquatic ecosystems is highly dependent on their size (Paine, 1976; Olson, 1996). According to Nilsson and Bromark (1999), pike (*Esox lucius*) prefers to eat smaller prey when there is such choice presented. It is believed that this is determined by the lower risk of failure to catch them. Those who are larger swim vigorously and cause real danger of kleptoparasitism (Nilsson and Brommark, 1999; 2000; Turesson et al., 2006). The opposite conclusion is reached by Hubenova et al. (2013), who found that pike prefers to feed on larger specimens.

The maximum size of prey that predator may eat depends on the morphological constraints of the oral apparatus (Werner, 1974; Nilsson and Brommark, 2000). In this connection, from entirely anatomical viewpoint the pikeperch has significantly less capacity compared to European pike and Wels catfish.

Essential for the choice of prey, except for size, is the shape and height of the body, swimming speed, accessibility, level of satiation of predators, the existence of competition, etc. According to Petrova et al. (1993; 1993a) the food spectrum of pikeperch is a reflection of the species composition, abundance, biological and ecological status of the ichthyofauna in the environment. In practice, this choice is determined by a complex set of factors that occur in specific conditions.

The issue of selectivity of pikeperch (*Sander lucioperca* L.) with respect to consumed fish species, including in terms of their size, is important not only for the natural reservoirs, but also for the fish farms. In aquaculture pikeperch is cultivated in pond and dam farms as an additional species. It plays the role of a biomeliorator to combat weed species that have negative effect on the yield and economic efficiency of aquaproduction.

In recent years one of the most common and numerous weed species in fish farms is topmouth gudgeon (*Pseudorasbora parva* Temminck & Schlegel), a small-sized fish with a fusiform body, which reaches about 6-8 g weight and 8-10 cm length. It is an invasive species found for the first time in Bulgaria in fish farm "Bear" - Ruse region (Marinov, 1979). It later spread throughout the country, mainly in ponds with standing water - lakes and fishponds. Usually its numbers are large because it spawns and reproduces several times over the summer months.

The aim of this study is to examine the size selectivity of pikeperch fed with one of the most widespread weed fish in fish farms, such as topmouth gudgeon (*Pseudorasbora parva* Temminck & Schlegel).

**Material and methods**

For the purpose of the experiment one-summer-old pikeperch were used, produced and raised in conditions of polyculture in earth pond. The trial was conducted under controlled laboratory conditions: topmouth gudgeon (*Pseudorasbora parva* Temminck & Schlegel) were used as prey (from two size groups: large - group 1 and small - group 2). The conducting of the experiment under controlled conditions allows ignoring some factors that can directly or indirectly influence the results such as accessibility and number of prey, the availability of other food, competition, etc.

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The experiment was performed in seven tanks with volume of 50 l/tank at a water layer depth of 40 cm and continuous water flow at seven-fold repetition. In each tank one pikeperch was placed with body weight ranging from 167.2 to 261.8 g and 10 specimens from both size groups of tompmouth gudgeon, 20 preys in total. During the experimental period the temperature of the water (°C), the amount of dissolved oxygen (mg l⁻¹), dissolved oxygen (%), electrical conductivity (µS cm⁻¹) and pH were monitored. Before setting the experiment, a representative sample of both prey fish groups was measured for weight (BW, g), maximum length (SL, cm) and height (H, cm).

The weight of the pikeperch was measured individually; predators and preys were matched in size, so that ingestion of the prey posed no problem.

The largest pikeperch used for the purposes of the experiment weighed 261.8 g, and the smallest 167.2 g. The death toll was reported every 10 days.

The collected data was processed statistically using Lidanski (1988).

### Results and discussion

The measurements of the dynamics of the main hydro-chemical indicators in the tanks are shown in Table 1. Throughout the experiment the registered fluctuations were in their narrow limits for pikeperch and differences in tanks were insignificant. All parameters were within the limits of the optimum or close to these values, only the water temperature was below the optimum for this species (Hokanson, 1977).

Analysis of the data of the morphological characteristics of the prey fish from the first group showed that the average value of body weight of the individuals was 8.63 ± 2.68 g, total length 9.58 ± 0.92 cm, and height of 0.85 ± 0.13 cm (Table 3).

Statistical processing of the indicators body weight (BW, g), total length (TL, cm) and body height (H, cm) of fish from both size groups showed that the differences are valid: BW: p < 0.001; TL: p < 0.001; H: p < 0.05.

### Table 1. Hydro-chemical indicators in the tanks

<table>
<thead>
<tr>
<th></th>
<th>T, °C</th>
<th>$O_2$, mg.l⁻¹</th>
<th>$O_2$, %</th>
<th>pH</th>
<th>Electric conductivity ($\mu$S.cm⁻¹)</th>
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<tr>
<td>Tank 1</td>
<td>X</td>
<td>15.51</td>
<td>6.19</td>
<td>62.50</td>
<td>7.44</td>
</tr>
<tr>
<td></td>
<td>min</td>
<td>13.80</td>
<td>4.40</td>
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<tr>
<td></td>
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<td>16.00</td>
<td>7.30</td>
<td>74.00</td>
<td>7.73</td>
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<td>Tank 2</td>
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<td>6.00</td>
<td>60.60</td>
<td>7.49</td>
</tr>
<tr>
<td></td>
<td>min</td>
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<td>4.00</td>
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<tr>
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<td>7.20</td>
<td>73.00</td>
<td>7.78</td>
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<tr>
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<td>6.00</td>
<td>60.70</td>
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<td>13.70</td>
<td>3.70</td>
<td>38.00</td>
<td>7.32</td>
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<td></td>
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<td>7.00</td>
<td>71.00</td>
<td>7.85</td>
</tr>
<tr>
<td>Tank 4</td>
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<td>15.48</td>
<td>5.97</td>
<td>60.30</td>
<td>7.52</td>
</tr>
<tr>
<td></td>
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<td>13.70</td>
<td>3.60</td>
<td>35.00</td>
<td>7.30</td>
</tr>
<tr>
<td></td>
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<td>16.00</td>
<td>7.10</td>
<td>72.00</td>
<td>7.90</td>
</tr>
<tr>
<td>Tank 5</td>
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<td>15.42</td>
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<td>64.30</td>
<td>7.55</td>
</tr>
<tr>
<td></td>
<td>min</td>
<td>13.50</td>
<td>3.90</td>
<td>39.00</td>
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<tr>
<td></td>
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<td>7.80</td>
<td>79.00</td>
<td>7.91</td>
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<tr>
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<td>15.80</td>
<td>6.70</td>
<td>68.00</td>
<td>7.89</td>
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</table>
For the three indicators the difference between the groups is reliable with probability 99.9%, allowing differentiating prey fish consumption by pikeperch based on their size-weight differences, while the length and height of the body allows their easier indigestion. This is particularly important given the fact that pikeperch refers to species with relatively limited capacity to feed on larger fish. The maximum length of its prey is about 50% of its own length, (Van Densen 1994; Dörner et al., 2007) while in pike it may exceed 70% of the length of the predator (Zaikov et al., 2006).

At the beginning of the experimental period pikeperch showed some preference to consumption of prey with smaller size (Figure 1). By the 10th day the commonly eaten topmouth gudgeon would be 11 large and 21 small. Most prey from group 1 was eaten in tank 4 - 3 specimens, and from group 2 in tank 1 - 5 specimens.

By the 20th day the total prey fish consumed was 25 large and 47 small fish. In tank 1 and 5 all fish from group 2 were eaten. By the 30th day all the small prey fish from tanks 4, 6 and 7 were indigested, and in tanks 2 and 3 the small fish were eaten by the end of the experimental period.

Upon completion of the experiment it was found that of the 70 large and 70 small topmouth gudgeon from group 1 – 34 specimens were eaten, and from group 2- 70, i.e. the difference was approximately 2 times. The observed in the first ten days tendency of preferred small prey size fish over large remained in all tanks until the completion of the experiment. The results confirm previous research done by Turesson et al. (2002), which found that pikeperch is a selective predator, in terms of size of their prey, by choosing species with smaller sizes.

### Conclusion

Throughout the experimental period of 40 days pikeperch preferred to feed on smaller specimens, the difference in the number of consumed small and large fish is approximately 2 times (70 to 34 fish, respectively). The greater affinity of pikeperch to feed on prey with smaller size can be explained by their easier capturing and swallowing. Due to the morphological constraints of the oral apparatus pikeperch swallows with difficulty preys with larger size. In this connection, from entirely anatomical viewpoint pikeperch has significantly less capacity compared to European pike and Wels catfish.

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