THE INFLUENCE OF STOKING DENSITY OF PIKEPERCH FRY REARED UNTIL 40 DAYS POST-HATCH IN CONTROLLED CONDITIONS ON THEIR GROWTH AND SURVIVABILITY

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Abstract

There are just few reports available related with the effect of stocking densities on the rearing of the pikeperch larvae and fry in the controlled conditions. The aim of this study is to identify the effect of stocking density on the growth performances of the pikeperch fry raised in recirculated aquaculture system (RAS) in the first 40 days post-hatch (DPH). Two variants of stocking densities were tested: 12 individuals l^{-1} and 9 individuals l^{-1}. Growth dynamic of the pikeperch fry was monitorised by somatic measurements of randomly sampled individuals at each 7 days, until the age of 40 days post-hatch. Even at final the difference between total lengths of the individuals from the two variants was insignificant ($p>0.05$), very significand differences ($p<0.001$) were observed at their survivability. Therefore, a higher density (12 individuals l^{-1}) don't negatively influence the growth dynamic, but have a significant effect on survivability of pikeperch fry.

Key words: pikeperch, fry, RAS, density

INTRODUCTION

Pikeperch (*Sander lucioperca*) are generally bred in Europe in ponds, in extensive and semi-intensive systems based on polyculture with common carp (Molnar et al., 2004). In the last few years favorable conditions for breeding of this species appeared, even in intensive or highly-intensive systems. The possibility of juvenile pikeperch weaning to formulated feed has been proven (Ljunggren et al., 2004; Kestermont et al., 2007), this fact leading to the increasing of the interest in intensive breeding of this species. The intensive system is based on breading technologies that are corresponding with the biological needs of interest species, even at highly stocking densities. Regarding highly-intensive systems and especially recirculated aquaculture systems (RAS), high stocking densities for fish rearing are needs to have economical rentability but taking care not to have detrimental influence in fish growing process.

In the literature are generally few informations regarding pikeperch breeding in RAS, therefore studies regarding the effect of specific technological factors on growth performances are need. Also information relating intensive rearing methods for pikeperch larvae and fry in RAS are limited, and just few are related with the impact of stoking density on the rearing of the larvae of this species (Zakes, 1997; Molnar et al., 2004; Sykudlarek and Zakes, 2007).

The aim of this study was to investigate the influence of stoking density on growth and survivability of pikeperch fry, reared until 40 days post-hatch in RAS.

MATERIAL AND METHODS

A total number of 3.360 pikeperch larvae obtained in Aquaculture Research Laboratory from Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara were used in our study, in 2009. Breeders were stoked in earthen ponds (0.40 ha) at Aquaculture Facility from the

university, and in March 23 were sampled and introduced in 8 m^3 fiberglass tank, indoor, at 11°C. In this tank the breeders were fed ad-libidum with roach for 2 weeks, and after hormonal stimulation with hCG (Chorulon, Intervet) 400 UI/kg, intraperitoneal in one dose, were moved in Aquaculture Research Laboratory into 1 m^3 tank. Breeders were maintained 72 hours at 17°C and then were moved into 500 l tanks in pair, for spawning on artificial nest. They spawned in the next 12 hours, and the female was removed. The male was maintained in the tank in the next 4 days, until larvae were hatched.

The larvae were maintained in the hatching tank 4 days and than were moved into recirculating aquaculture system (RAS) special designed for pikeperch rearing. Total volume of RAS was 8 m^3, having 7 tanks, drum filter, bio-filter, UV sterilization unit, aerators, pumps and spraying unit. Into the tank (1 m^3 capacity), dedicated to our study, a cage with 4 compartments was introduced, each compartment having 80 liters net capacity. Each cage compartment was connected to spraying unit which provided a flow rate in each compartment of 0.6 L min^{-1}.

Ten of the most important physical and chemical parameters were continuously monitored, using SC 1000 controller (Hach Lange) with 7 different sensors, and all interventions related with water quality management were made, based on these data. Mean values during the study for some important parameters were as follow: water temperature 20.5±0,5°C, turbidity 0.6647±0.05 NTU, pH 8.33±0.1, dissolved oxygen 9.3±0.1 mg L^{-1} , nitrates 27.2±0.7. Total ammonia and nitrites were maintained below 0.02 mg L^{-1} and 0.2 mg L^{-1}, respectively. Pikeperch juvenile were maintained to a constant photoperiod (LD 16 h:8h), and the intensity of the light at the water surface had a mean value of 14.75 lx.

Two groups of larvae (V_1 and V_2), each in two repetitions (R_1 and R_2) were introduced at 4 days post-hatch into 4 compartments: 960 and 720 individuals per 80 liters in V_1 and V_2, respectively. From the fifth day post-hatching larvae were fed with newly-hatched Artemia nauplii (Coppens International). The weaning starts 23 days post-hatch using the dry feed Steco Crumble HE 200-300 µm (Coppens International) that replace 20% of Artemia naupli daily. Pikeperch fry were fed manually at 1 h interval from 8.00 a.m. to 11.00 p.m. with Steco Crumble HE 200-300 µm, and after 35 days post-hatch with dry feed Noblesse (300 µm and 500 µm) until 40 days post-hatch (2 gr. $compartment^{-1}$ day^{-1}). Dead fish, faeces and unconsumed food were daily removed by siphoning the bottom of the cage-compartment. Dead fish were counted daily.

The growth dynamic was established at 10, 17, 24, 31 and 38 days post-hatch. Five individuals from the 2 groups were randomly selected each time, anesthetized with MS_{222} (0.1 g l^{-1}) and measured using micrometer. The dynamics of total body length (T.L.), head height (H.h.), maximum body height (b.H.), were pursued from the 10 days until 38 days post-hatch. When the last measurements were accomplished (at 38 days post-hatch), five other traits were determined: head length (h.l.), snout length (s.l.), minimum body height (b.h.), diameter of eye (d.e.) body weight (b.w.).

At 40 days post-hatch survival rate was established: $S\ \% = 100\ N_f\ N_i^{-1}$ (where N_i and N_f = initial and final number of fish per compartment).

Analyses of the data were performed using Statistica software.

RESULTS AND DISCUSSIONS

The measurements pursued on pikeperch fry from the two stocking densities variants, fed with Artemia and dry feed are presented in the tables 1 and 2.

Data from the two table show that almost all studied traits have very similar dynamics in pikeperch until 38 days post-hatch, and none of them was significant between the two experimental variants ($p>0.05$). Variability coefficient (VC) calculated for each measured trait didn't exceed 20% with a single exception for total length at 17 days post-hatch in group 1 (VC = 32.53%).

Table 1

Growth dynamics of the pikeperch reared in variants with two stocking densities

Days post-hatch	Variant	Mean value (mm) X ± Sx		
		Total body length (T.L.)	Head height (H.h.)	Maximum body height (b.H.)
10	V_1	7.12 ± 0.08	1.05 ± 0.05	1.19 ± 0.05
	V_2	6.95 ± 0.29	0.99 ± 0.05	1.19 ± 0.07
17	V_1	10.58 ± 0.87	1.96 ± 0.07	2.20 ± 0.08
	V_2	11.28 ± 0.37	1.81 ± 0.06	2.21 ± 0.10
24	V_1	19.20 ± 0.11	2.38 ± 0.10	2.78 ± 0.13
	V_2	21.90 ± 0.05	2.65 ± 0.04	2.85 ± 0.04
31	V_1	23.90 ± 0.10	2.94 ± 0.09	4.31 ± 0.12
	V_2	23.90 ± 0.06	2.86 ± 0.03	4.12 ± 0.08
38	V_1	33.10 ± 1.15	3.10 ± 0.11	6.52 ± 0.23
	V_2	34.10 ± 0.69	2.96 ± 0.05	6.42 ± 0.11

where: V_1 = 12 individuals L^{-1}; V_2 = 9 individuals L^{-1}

Table 2

Mean value of some traits of the pikeperch reared in variants with two stocking densities, at 38 days post-hatch

Variant	Mean value (mm; g) X ± Sx				
	Standard length (S.L.)	Head length (h.l.)	Snouth lenth (s.l.)	Diameter of eye (d.e.)	Body weigth (b.w.)
V_1	29.10 ± 1.04	8.50 ± 0.18	2.68 ± 0.09	2.11 ± 0.03	0.42 ± 0.03
V_2	30.00 ± 0.66	7.58 ± 0.15	1.27 ± 0.06	1.59 ± 0.03	0.41 ± 0.02

where: V_1 = 12 individuals L^{-1}; V_2 = 9 individuals L^{-1}

Average body weight at 38 days post-hatch was 0.41 ± 0.03 and 0.42 ± 0.02 g, for group 1 and 2, respectively. Therefore, is better to have in a RAS a stocking density of 12 individuals pikeperch per liter until 38 days. Anyway, we observed that a higher density could be used for this system. A higher density could lead to a better use of Artemia and dry feed, and to a space economy in the RAS, as well. Based on these observations we already rose up the stoking densities in the next experiments including the pikeperch fry produced out-of-season, in January 2010. Szkudlarek and Zakes (2007) concluded their study that is beneficial to have a very high stoking density of 100 individuals L^{-1} until 18 days post-hatch, and after 19 day post-hatch the density should be reduced to 15 individuals L^{-1}. Anyway, in their study the growth rate of the fish was negatively correlated with the initial stoking density, but fish biomass gain was correlated significantly with stoking density.

High mortalities in the first week of exogenous feeding were registered in our experiments, and these observations are quite similar with those of Szkudlarek and Zakes (2007). In the first 40 days post-hatch a continuously decreasing of mortality was registered. Thus, at the final of our experiments, less then 10 % of initial stock remained: S% = 2.5 in V_1 and S% = 8.9 in V_2. Difference between the two variants is very significant ($p<0,001$; test χ^2). This result allows concluding that high density lead to rising of the mortality percent in the first 40 days post hatching in the pikeperch from RAS.

CONCLUSIONS

1. An initial stoking density of 12 or 9 individuals L^{-1} for pikeperch reared in RAS until 40 days post-hatch, lead to growth performance which not significantly differ;

2. The average body weight at 38 days post-hatch was 0.41 ± 0.03 and 0.42 ± 0.02 g, for group 1 and 2, respectively;

3. A higher density could lead to a better use of feed, and to a space economy in the RAS;

4. High mortalities in the first week of exogenous feeding were registered;

5. High density lead to rising of the mortality percent in the first 40 days post hatching in the pikeperch from RAS.

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