THE INFLUENCE OF STOCKING DENSITY ON SURVIVAL AND GROWTH OF DACE *LEUCISCUS LEUCISCUS (L.)* LARVAE REARED UNDER LABORATORY CONDITIONS

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INTRODUCTION

Dace *Leuciscus leuciscus* (L.) is characteristic ichthyofaunal cyprinid species of the rivers across Europe. With other cyprinids included in the group of rheophilic fish, they are one of the most sensitive to changes in the environment that stem primarily from constructions on rivers and pollution. In case of intensive rearing of larvae and production of stocking material, density is one of the key factors influencing effectiveness of rearing, particularly in case when water recirculation systems are used. This study aimed at determining the effect of the stocking density on the growth rate and survival of dace during initial rearing under controlled conditions.

MATERIALS AND METHODS

Experimental larval dace were obtained from artificial reproduction conducted at the hatchery of the Department of Lake and River Fisheries, University of Warmia and Mazury in Olsztyn (Kujawa 2004). The rearing of the larvae was carried out at eight densities of 50; 100; 150; 200, 250; 300; 350 and 400 individuals per l l in a customized recirculation system consisting of one large glass 50-l tank functioning as the water bath with 16 smaller 1-l tanks each submerged in it (Fig. 1).

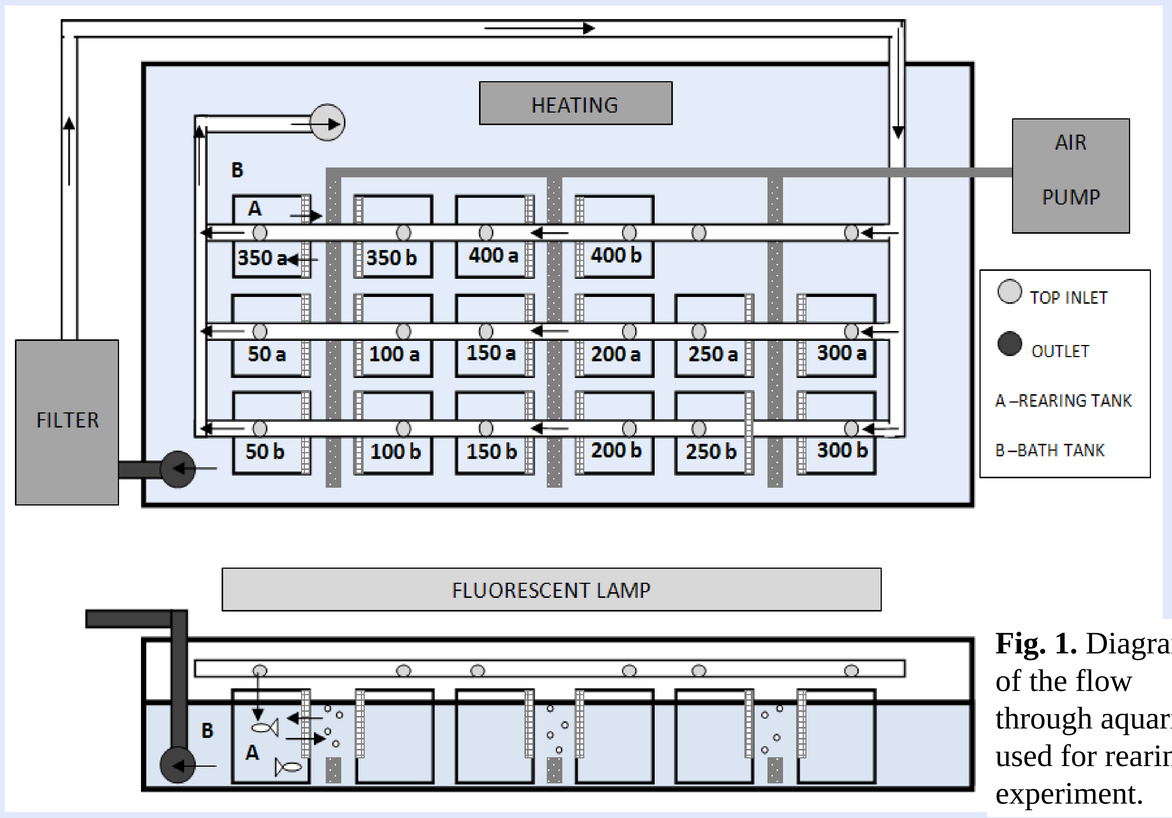

Fig. 1. Diagram of the flow through aquaria used for rearing experiment.

The experiment started when the fish had resorbed 2/3 of the yolk sac and started intake of exogenous food and it ended after 21 days of rearing. Water temperature during rearing was constant at 25.0°C. The photoperiod during the entire rearing period was constant (12L:12D). The larvae were fed 3 times a day (8.00; 12.00 and 16.00) *ad libitum* with live *Artemia* nauplii. Statistical differences between groups in length and weight of larvae were analyzed by applying the variance analysis (ANOVA) and Tukey's post hoc test (α=0.05). Survival rate of the larvae observed on the last day of the rearing was established by two-proportion test.

RESULTS AND DISCUSSION

Significant differences between groups in the average total length of the fishes were observed after the first week of rearing, when individuals in group L50 until the end of the experiment were characterized by a significantly larger total length than those from the other experimental groups (Fig. 2). The same correlation was observed frequently during rearing of numerous other species (Żarski et al. 2009). The average final weight of fishes in that group was 79.26 mg, with the average length of 23.27mm (Table I). During the experiment the larvae survival rate was very high and similar in all the experimental groups ranging from 88.3 to 93.6%. The highest larvae mortality was recorded during the two initial weeks of rearing (Fig. 3).

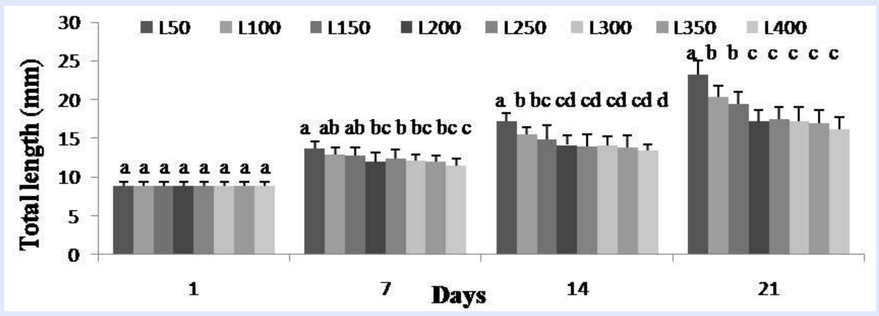

Fig. 2. Mean (± SE) length of larval dace during rearing. Data with the same letter index do not differ significantly (P>0.05).

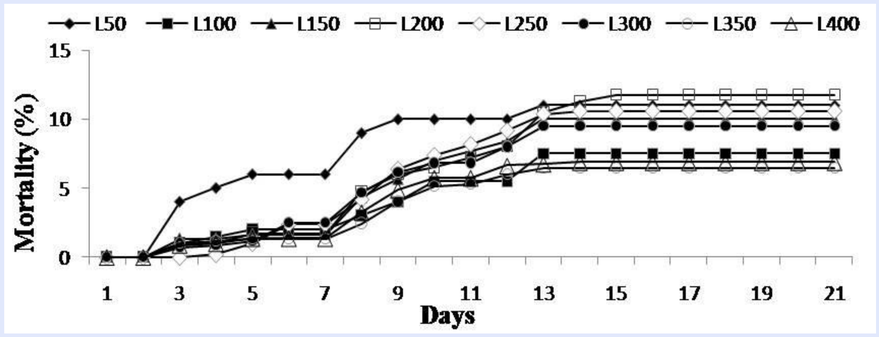

Fig. 3. Cumulative mortality of larval dace during rearing under controlled conditions.

Table I. Initial and final characteristics of the rearing of dace (mean±□SD)

Parameter	Stocking density (indiv. dm^{-3})							
	50	100	150	200	250	300	350	400
Mean initial weight (mg)*	1.85 ± 0.38 ^{a}	1.85 ± 0.38 ^{a}	1.85 ± 0.38 ^{a}	1.85 ± 0.38 ^{a}	1.85 ± 0.38 ^{a}	1.85 ± 0.38 ^{a}	1.85 ± 0.38 ^{a}	1.85 ± 0.38 ^{a}
Mean final weight (mg)*	79.26 ± 17.66 ^{a}	52.60 ± 13.44 ^{b}	44.43 ± 12.26 ^{bc}	33.23 ± 9.70 ^{cd}	31.77 ± 10.91 ^{d}	33.53 ± 13.99 ^{cd}	29.78 ± 9.60 ^{d}	23.76 ± 8.70 ^{cd}
Mean initial length (mm)*	8.83 ± 0.56 ^{a}	8.83 ± 0.56 ^{a}	8.83 ± 0.56 ^{a}	8.83 ± 0.56 ^{a}	8.83 ± 0.56 ^{a}	8.83 ± 0.56 ^{a}	8.83 ± 0.56 ^{a}	8.83 ± 0.56 ^{a}
Mean final length (mm)*	23.27 ± 1.71 ^{a}	20.33 ± 1.40 ^{b}	19.42 ± 1.61 ^{b}	17.17 ± 1.53 ^{c}	17.43 ± 1.62 ^{c}	17.18 ± 1.89 ^{c}	16.95 ± 1.67 ^{c}	16.18 ± 1.61 ^{c}
Survival (%)*	89,0 ± 1,0 ^{ab}	92,5 ± 1,5 ^{ab}	90,0 ± 2,0 ^{ab}	88,3 ± 1,8 ^{b}	89,4 ± 1,4 ^{ab}	90,5 ± 1,2 ^{ab}	93,6 ± 0,1 ^{a}	93,1 ± 0,9 ^{ab}
Index of incremental total length (ITL) (mm d^{-1})	0,69 ± 0.01	0,55 ± 0,00	0,50 ± 0,00	0,40 ± 0,00	0,41 ± 0.01	0,40 ± 0.01	0,39 ± 0,00	0,35 ± 0,00
Relative growth rate in weight (RGR_W) (% d^{-1})	19,58 ± 0,09	17,26 ± 0,23	16,32 ± 0,30	14,73 ± 0,19	14,49 ± 0,03	14,78 ± 0,04	14,13 ± 0,08	12,91 ± 0,11
Biomass (g dm^{-3})	3.53 ± 0.10	4.86 ± 0.12	6.01 ± 0.46	5.86 ± 0.08	7.10 ± 0.15	9.10 ± 0.19	9.75 ± 0.12	8.85 ± 0.27

*Data in the same row with different superscripts are significantly different (P<0.05)

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