EXPERIENCE WITH EUROPEAN PERCH (*PERCA FLUVIATILIS* L.) LARVAL REARING IN CONTROLLED CONDITIONS

Mareš J.[1], Hillermann J.[1], Kouřil J.[2], Kopp R.[1] and Kalová M.[1]

[1] Mendel University of Agriculture and Forestry Brno, Department of Fisheries and Hydrobiology, Zemědělská 1, CZ-613 00 Brno, Czech Republic
[2] University of South Bohemia in České Budějovice, Research Institute of Fish Culture and Hydrobiology, Zátiší 728/II, CZ-389 25 Vodňany, Czech Republic

Introduction

European perch have been reared for centuries, but only in extensive culture, where it represents about 2-5% of production in polyculture cyprinid ponds (KESTEMONT et al., 1996). The potential market for perch is estimated at 5 000 to 10 000 tons per year in Europe (MÉLARD et al., 1995). With regard to recent development in research aimed at intensifying production of the different stages of perch, it appears that the production cost of fingerlings is one of major bottlenecks for the intensification of commercial culture of this species. The small size and fragility of the larvae and their dependence on live food are usually cited as limiting factors. Cannibalism has also been evidenced as a major factor reducing the survival rate during larval and post-larval stages of European perch (KESTEMONT et al., 1996). In order to meet the optimal rearing conditions of this critical developmental stage, it is necessary to better understand the ontogeny of digestive system, the nutritional requirements and the effects of different biochemical parameters on survival and growth of perch larvae.

In most fish larvae, organogenesis is not completely achieved by the time of hatching and continues during larval development. In particular, the anatomy of the digestive system of the larvae is quite different from that of older fish (CUVIER-PERÉS and KESTEMONT, 2000) and the activity of digestive enzymes is generally low, but increases with age. Larvae can be divided into three groups according to alimentary tract morphology and the enzymes secreted into the gut (DABROWSKI and CULVER, 1991). Salmonids appear to have a functional stomach before changing from endogenous to exogenous feeding. The second group of fish are those that at the larval stage have no functional stomach or gastric glands but whose digestive organs differentiate during a complex metamorphosis. Percid fish are an example of this group. The third group of fish (e.g. cyprinid fish) remains stomachless throughout life.

Perch larvae are relatively small after hatching (total length about 5mm, body weight about 0,6mg) in comparison to other freshwater fish and mouth size after hatching (about 0,35mm) constitutes a limiting factor for uptake of initial food.In addition, the perch is a visual predator and perch larvae of less than 10mm in length have poor vision (GUMA`A, 1982). Therefore, prey movements seems to be an important factor in food perception. Considering the above-mentioned problems, the choice of a suitable starting food for newly-hatched perch larvae is very complicated.

The aim of the present experiment was to compare growth a survival rate in newly-hatched perch larvae (0.58±0.23 mg) fed with live food (Artemia nauplii), mixed diet (Artemia nauplii and a salmonid starter feed), decapsulated Artemia cysts and artificial food (two commercial salmonid starter feeds). Decapsulated Artemia cysts and dry food were used to evaluate the suitability of non-moving prey and formulated feeds, respectively.

Materials and Methods

Perch larvae were obtained from an artificial propagation. 5 days after hatching larvae were randomly allotted to 15 tanks of 9 l volume operating in recirculating system. Water temperature was maintained at 23±1°C, dissolved oxygen level ranged from 80% to 90%. Photoperiod was constant – 16h light/8 h dark. Larvae were fed with the following diets:

Variant A- live food – Artemia nauplii (Sanders Premium)

B- mixed diet – after initial five-day feeding with live food (Artemia nauplii) transfer to mixed diet (Artemia nauplii and a salmonid starter feed 50:50)

C- decapsulated Artemia cysts

D- salmonid starter feed (50% protein and 12% lipid) with particle size <0.1mm

E- salmonid starter feed (55% protein and 15% lipid) with particle size <0.1mm

Each of the experimental diets was randomly assigned to three tanks. Tanks were stocked with 675 larvae.tank^{-1} (75 fish.l^{-1}). The initial body weight of the settled larvae was 0.58±0.23mg. The experiment was conducted for 30 days. All fish at the variants A, B, C were fed five times daily, fish at the variants D, E seven times daily. The initial daily food rations were 150% of biomass weight in live food and 30% in dry food. The total feeding amount was gradually decreased in dependence on growth intensity and survival rate. Thirty fish from each variant were randomly sampled every five days and preserved for later examination in 4% formalin. The observed parameters were: survival rate, body weight, total length and growth intensity (SGR). The data were statistically evaluated. For the assessment of the significance of differences, ANOVA with subsequent testing by Scheffe´s method was utilized. The results are presented as mean and standard deviation.

Results and Discussion

The average size of the settled fish was 0.58±0.23mg body weight and 5.48±0.64mm total length. From the beginning of the experiment all tested feeds were taken up very well. At the 5th day of experiment the survival rates ranged from 80 to 56% in dependence on the feeding variant, when the highest survival rate was at the variant with live food (Fig. 1 and Table I). With regard to fish size at the variants A and B at the day 15 we decided to reduce stocking density at these variants to 275 fish.tank^{-1} (30 fish.l^{-1}). After 20 days the survival rate dropped below 5% at both variants with starter feeds and after 25 days also at the variant with decapsulated Artemia cysts. The survival rate and growth intensity of perch larvae during the experiment are shown in Fig. 1 and Table I. In our experiment the survival rate was not as we had planned at the beginning of the trial (>50% up to an age of 30 days from the onset of their exogenous feeding). However, the variants with live food (Artemia nauplii and mixed diet) showed the best survival and growth rate at the end of experiment (Fig. 1 and Table I) – survival was 37 and 43%, body weight 195 and 85mg, total length 26 and 20mm, respectively. The other variants showed very low survival and growth. At the variants with salmonid feeds survival was less than 5% at the age of 25 days (body weight reached 2.6 and 3.5mg). At the variant with decapsulated Artemia cysts survival was less than 5% at the age of 30 days (body weight reached 28.5mg). As under the latter variants, survival rate and body weight was very low, we decided to terminate the experiment.

Table I: Growth and survival of perch larvae fed with Artemia nauplii (A), mixed diet (B), decapsulated Artemia cysts (C) and artificial food (D, E)

TIME (DAYS)	PARAMETERS	A	B	C	D	E
5	body weight (mg)	$1,99\pm1,01^{B}$	$2,21\pm0,84^{B}$	$0,66\pm0,26^{A}$	$0,82\pm0,38^{A}$	$0,70\pm0,34^{A}$
	total length (mm)	$7,10\pm0,90^{B}$	$7,38\pm0,78^{B}$	$5,88\pm0,52^{A}$	$5,90\pm0,88^{A}$	$5,78\pm0,57^{A}$
	SGR (%.day^{-1})	31,65	27,85	24,45	6,24	11,38
	survival (%)	78,07	80,59	62,72	72,54	55,85
10	body weight (mg)	$7,87\pm3,40^{B}$	$7,55\pm2,35^{B}$	$1,97\pm1,52^{A}$	$1,11\pm0,61^{A}$	$1,20\pm0,76^{A}$
	total length (mm)	$10,20\pm1,36^{B}$	$10,42\pm0,83^{B}$	$7,18\pm1,20^{A}$	$6,40\pm0,83^{A}$	$6,62\pm0,94^{A}$
	SGR (%.day^{-1})	20,83	8,05	22,48	14,14	15,44
	survival (%)	69,22	65,81	22,77	27,38	12,56
15	body weight (mg)	$20,27\pm6,31^{C}$	$11,12\pm7,09^{B}$	$5,43\pm2,71^{A}$	$2,15\pm1,05^{A}$	$2,46\pm1,47^{A}$
	total length (mm)	$13,72\pm1,38^{D}$	$11,38\pm1,62^{C}$	$9,27\pm1,02^{B}$	$7,17\pm0,89^{A}$	$7,50\pm1,17^{A}$
	SGR (%.day^{-1})	15,83	19,81	15,83	3,63	7,00
	survival (%)	61,55	59,58	12,53	12,12	4,85
20	body weight (mg)	$42,26\pm12,35^{D}$	$27,45\pm10,10^{BC}$	$11,32\pm6,06^{AB}$	$2,57\pm1,37^{A}$	$3,45\pm1,18^{A}$
	total length (mm)	$16,75\pm1,45^{D}$	$14,53\pm1,84^{C}$	$10,90\pm1,39^{B}$	$7,65\pm1,63^{A}$	$8,73\pm0,82^{AB}$
	SGR (%.day^{-1})	23,92	21,27	16,02	7,73	9,33
	survival (%)	51,60	52,89	9,35	4,44	3,88
25	body weight (mg)	$106,16\pm40,02^{C}$	$45,51\pm12,68^{B}$	$28,45\pm10,71^{AB}$	-	-
	total length (mm)	$21,31\pm2,03^{C}$	$16,77\pm1,41^{B}$	$13,63\pm1,74^{A}$	-	-
	SGR (%.day^{-1})	23,17	19,07	16,85	-	-
	survival (%)	42,32	48,06	4,04	-	-
30	body weight (mg)	$194,82\pm50,57^{B}$	$84,92\pm31,68^{A}$	-	-	-
	total length (mm)	$25,85\pm2,24^{B}$	$20,02\pm2,40^{A}$	-	-	-
	SGR (%.day^{-1})	21,40	18,08	-	-	-
	survival (%)	37,06	43,22	-	-	-

Values of the same line with the same superscript are not significantly different (P<0.01)

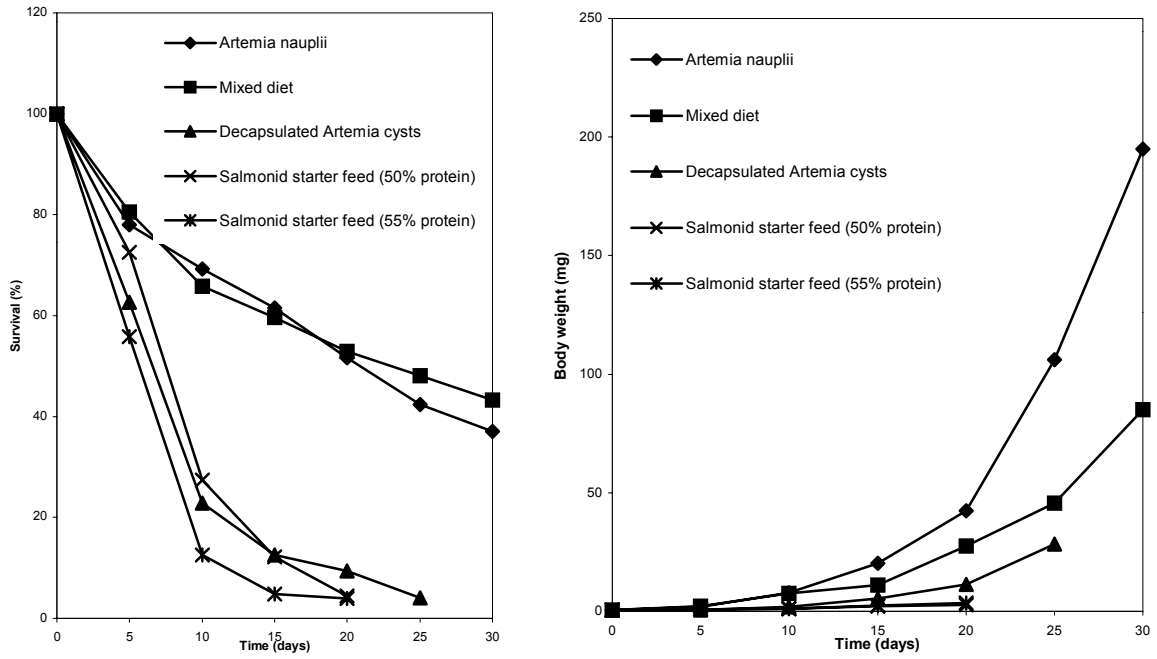

Fig.1: Survival and growth of perch larvae fed with different diets

Our results correspond to MÉLARD and KESTEMONT (1994, in KESTEMONT et al., 1996). These authors compared the growth and survival of perch larvae (initial body weight 0.8mg) fed with live food (group 1-100% Artemia nauplii) and mixed diet (group 2-Artemia nauplii : dry food 75 : 25, group 3-Artemia nauplii : dry food 50 : 50) up to an age of 44 days from the hatching. The highest survival (33%) was in the group fed with 100% Artemia nauplii. In the groups fed with mixed diets survival reached 20.2% and 19.8%, respectively. Growth was similar in all treatments, average body weight ranged from 292 to 329mg, specific growth rate from 13.4 to 13.7% . day^{-1}.

Although some attempts at feeding of perch larvae with dry diet as unique food from the time of hatching have been done they had variable results (DREYER, 1987, AWAÏSS et al., 1992). TAMAZOUZT et al. (1998) investigated the effects of the size of food particles on the uptake of an artificial diet by perch larvae, reared in tanks for 15 days following hatching. Average survival rates ranged from 11 to 25% and body weight from 2.2 to 2.6mg. Considering the poor growth rates and low survival rates obtained by offering the fish dry food from hatching onwards, it appears more appropriate to feed newly-hatched larvae with live food or mixed diet (live + dry food) up to a developmental stage allowing successful weaning of the larvae with dry food.

References

Awaïss A., P. Kestemont, and J.C. Micha. 1992. Nutritional suitability of the rotifer *Brachionus calyciflorus* for rearing freshwater fish larvae. J. Appl. Ichthyol. 8: 263-270.

Cuvier-Péres A., and P. Kestemont. 2000. Development of pepsin and three pancreatic enzymes in *Perca fluviatilis* larvae. p. 165. In: Responsible aquaculture in the new millennium. EAS Spec. Publ. No. 28, Oostende, Belgium. 834 p.

Dabrowski K., and D. Culver. 1991. The physiology of larval fish, digestive tract and formulation of starter diets. Aquaculture Magazine, March/April: 49-61.

Dreyer S. 1987. Der europäische flussbarsch *(Perca fluviatilis)* als objekt der aquakultur. PhD thesis, University of Hohenheim, Germany. 118pp.

Kestemont P., C. Mélard, E. Fiogbé, R. Vlavonou, and G. Masson. 1996. Nutritional and animal husbandry aspects of rearing early life stages of Eurasian perch *Perca fluviatilis*. J. Appl. Ichthyol. 12: 157-165.

Mélard C., P. Kestemont, and E. Baras. 1995. First results of European perch *(Perca fluviatilis)* intensive rearing in tank: effect of temperature and size grading on growth. Bull. Fr. Pêche Piscic. 336: 19-27.

Tamazouzt L., C. Leray, A.M. Escaffre, and D. Terver. 1998. Effects of food particle size on *Perca fluviatilis* larval growth. Aquatic Sciences 60: 89-98.