

## Growth and Survival of Goldfish (*Carassius Auratus*) Larvae Reared at Different Densities

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**Abstract:** A growth trial was performed to evaluate to what extent density of fish affect growth and survival of goldfish larvae (*Carassius auratus*). A total of 5100 larvae (mean initial weight: 0.9 mg) were randomly distributed in a recirculating water system constituting 15 groups of 200, 250, 300, 350 and 400 individuals each in 5 L tanks. All treatments were carried out in triplicate and a fasted group was used as control. The trial lasted 21 days and a microparticulate diet was delivered by automatic feed dispenser. At the end of the trial high survival and growth rates were observed in all treatments. There were no significant differences in total length and total weight among treatments. Considering the high survival rate of goldfish larvae obtained this study it can be concluded that growth of goldfish larvae is independent of the stock density when varying between 40 and 80 larvae L<sup>-1</sup>.

**Key words:** Goldfish, *Carassius auratus*, Larvae, Density

### Introduction

The ornamental fish industry was developed in the last 10 years. One of the main goals to attain in the ornamental fish industry is the use of small rearing production units well controlled in terms of the physical-chemical parameters for the production of high densities of healthy larvae without any significant larval losses (Dhert *et al.*, 1997 and Calado *et al.*, 2003). This work was aimed at evaluating to what extent density of fish affect growth and survival of goldfish larvae and to confirm the feasibility of mass-rearing *C. auratus* larvae for commercial proposes.

### Materials and Methods

Spawning of breeders was induced following intraperitoneal injections of a crude extract of carp hypophyse. Eggs were incubated at 20°C and larvae (mean initial weight and length: 0.9 mg; 5,4 mm) were randomly distributed in a recirculating water system (Charlon et Bergot, 1984) constituting 12 groups of 200, 250, 300, 350 and 400 individuals each in 5 L tanks. The trial lasted 21 days following first exogenous feeding (3 days after hatching). Rearing water temperature was raised from 20° C (day 0) to 24° C (day 5) and kept constant at 24° C thereafter. A microdiet (52% protein; 7.6% lipid) was prepared Bergot *et al.*, 1986) and delivered by automatic feed dispenser (Charlon et Bergot, 1984) during light period (12 hours). All treatments were carried out in triplicate and a fasted group in triplicate was used as control (40 larvae L<sup>-1</sup>). Food particle size was 100-200 µm during the 1st week, 200-400 µm during the 2nd week and 400-630 µm during the 3rd week. Tanks were daily cleaned and dead animals removed and registered. At days 7th, 14th and 21st, samples of 10 larvae were taken from each tank, anaesthetised and the total length and weight were measured. At the end of the trial the survivors from each tank were fasted for 1 day, counted and total biomass was weighted. Data on survival (after angular transformation), total length (untransformed) and weight (after logarithmic transformation) were compared by the Newman-Keuls test, using a Statgraphics version 7.0 software package at the 0.05 significant level.

### Results

At the end of the trial high survival and growth rates were observed in all treatments (Table 1) with the exception of the unfed control group with a total mortality recorded at day 16th. There were no significant differences in total

Table 1: Mean values of survival (%), total length (mm) and weight (mg) of larvae at the end of the trial.

Larvae L <sup>-1</sup>	40	50	60	70	80
Survival	92	91	90	90	90
Mean Final Length	18,7 ± 0.1	17,3 ± 0.1	17,6 ± 0.1	17,2 ± 0.2	17,2 ± 0.1
Mean Final Weight	105 ± 0.5	95,4 ± 0.5	95,2 ± 0.1	94,7 ± 0.4	94,3 ± 0.4
W x S	96,6 <sup>a</sup>	87,3 <sup>b</sup>	85,6 <sup>b</sup>	85,2 <sup>b</sup>	84,9 <sup>b</sup>

Values with different superscript letters in the same row are significantly different ( $P < 0.05$ ).

length and total weight among treatments, although, a slight decrease in both parameters were noticed with increasing larval densities. The product weight plus survival (WxS) was calculated as entire criteria, which allows the comparison of the final biomass of the different larvae groups. The best value was recorded in the group with the lowest density (40 larvae L) which was significantly higher ( $P < 0.05$ ) than those of the other groups.

### **Discussion**

Survival and growth rates observed in larvae are comparable to those obtained in other works (Hecht and Iljoen, 1982; Bergot *et al.*, 1986 and Alami-Durante *et al.*, 1991) which could indicate that the basic nutritional requirements were met by the diet. Considering the high survival rate of goldfish larvae obtained this study the experimental conditions seemed to be effective for the rearing of small fish larvae and it can be concluded that growth of goldfish larvae is independent of the stock density when varying between 40 and 80 larvae L<sup>-1</sup>.

### **References**

- Alami-Durante, H., N. Charlon, A. M. Escaffre and P. Bergot, 1991. Supplementation of artificial diets for common carp (*Cyprinus carpio* L.) larvae. *Aquaculture*, 93: 167-175.
- Bergot, P., N. Charlon and H. Alami-Durante, 1986. The effect of compound diets feeding on growth and survival of coregonid larvae. *Arch. Hydrobiol. Beih. Ergebn. Limnol*, 22: 265-272.
- Calado, R., L. Narciso, S. Morais, L. Rhyne and J. Lin, 2003. A rearing system for the culture of ornamental decapod crustacean larvae. *Aquaculture*, 218: 329-339.
- Charlon, N. and P. Bergot, 1984. A rearing system for feeding fish larvae on dry diets. Trial with carp (*Cyprinus carpio* L.) larvae. *Aquaculture*, 41: 1-9.
- Charlon, N. and P. Bergot, 1986. An improved automatic dry food dispenser for fish larvae. *The Progressive Fish-Culturist*, 48: 156-158.
- Dhert, P., L. C. Lim, P. Candreva, H. Van Duffel and P. Sorgeloos, 1997. Possible applications of modern fish larviculture technology to ornamental fish production. *Aquarium Sciences and Conservation*, 1: 119-128.
- Hecht, T. and J. H. Iljoen, 1982. Observations on the suitability of various dry feeds for the commercial rearing of carp, *Cyprinus carpio* larvae in South Africa. *Water S.*, 8: 58-65.