LARVI '91 - FISH & CRUSTACEAN LARVICULTURE SYMPOSIUM
P. Lavens, P. Sorgeloos, E. Jaspers, and F. Ollevier (Eds)
European Aquaculture Society, Special Publication No.15, Gent, Belgium. 1991.

A RECIRCULATION SYSTEM FOR THE EXPERIMENTAL HATCHERY-REARING OF TURBOT (*SCOPHTHALMUS MAXIMUS*) LARVAE

P. Dhert, P. Lavens, and P. Sorgeloos

Laboratory of Aquaculture and Artemia Reference Center, University of Ghent, Rozier 44, B-9000 Gent, Belgium

Introduction

A new pilot hatchery was constructed with the aim to develop an operational system for larval nutrition studies with various fish species. Special attention was paid to develop independent rearing units, including a separate biofilter section, similar to the setups used for crustacean larviculture (Ferraz de Queiroz, 1989). The idea was to create optimal and reproducible rearing conditions on a laboratory scale, providing the possibility to test various nutritional treatments simultaneously.

Materials and methods

Since the rearing requirements largely fluctuate among cultured species and vary along larval development, physical parameters, *e.g.* illumination conditions and temperature have to be adjusted from 0 to 2000lux and 10 to 30°C respectively. The photoperiod can be regulated by a timer. The larval rearing tanks have a cylindro-conical shape and a capacity of 100 l and are made of untransparent grey polyethylene (Fig. 1).

The water in each of the rearing tanks (1) is circulated over a biofilter (2) and is returned to the bottom of the conical part of the tank. The fish are retained in the tank by a removable filter (3) with a mesh size of 150, 250, or 500µm, depending on the application. The effluent water is pumped into the biofilter at an adjustable flow rate (4) (bypass regulation preventing overheating of the suction pump at low flow rates). In the biofilter the water is aerated and mixed by two air-water lifts. After nitrification the water is drained from the bottom of the biofilter into a separate aeration chamber (5). Oxygen-saturated water is drained to the bottom of the rearing tank where it creates an upflow of oxygenated water.

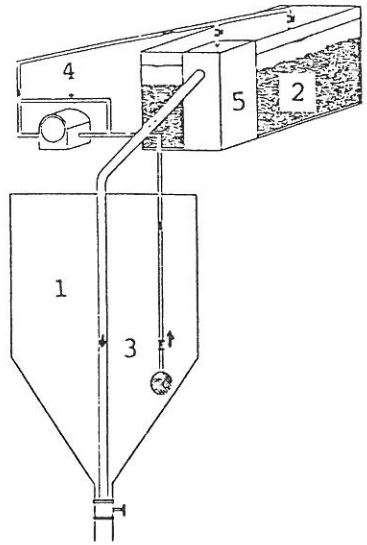

Fig. 1. Schematic drawing of the larval rearing unit. (1) Conical rearing tank (100 l); (2) submerged rock biofilter (15 l); (3) removable filter; (4) suction pump; (5) aeration chamber.

Results and discussion

In a first set of experiments, the loading capacity of the submerged rock biofilters was tested. The large size of the pebbles (± 10mm diameter) allowed the unharmed passage of *Artemia* through the biofilter system. This solved the problem of clogging of the strainer (2) when a smaller mesh size had to be used to keep the brine shrimp nauplii in the rearing tank. Rotifers, on the other hand clumped, together after passing through the pump and the biofilter and consequently were unsuitable for uptake. However, since *Artemia* can already be ingested by turbot larvae after only 5 days of culture, a short batch-rearing period was applied during the period of rotifer-feeding.

The biofilters were inoculated with 10% (volume %) pebbles taken from an operational filter. The activity of the nitrifying microbiota was activated by adding 10ppm ammonium chloride after inoculation of the filters. The ammonia was converted to nitrite and finally transformed to nitrate. Once the nitrite disappeared, 10ppm ammonium chloride was again added.

Once the nitrite was completely converted, the culture tanks were ready to be used. The turbot larvae were stocked at an initial stocking density of 100 ind./l in a volume of 60 l. During the first week of larval rearing, the fish larvae were held in a batch system to which an extra 5% of filtered seawater was added daily until a volume of approximately 80 l was reached. At that time the turbot larvae were actively swimming and could avoid

the suction area around the strainer. During the first period of batch culture a mild aeration was used in order to avoid stress to the animals and allow them to feed on the rotifers. Starting from day 5 *Artemia* could be fed for the first time. The effect of the biofilter on the water quality in the rearing tank is illustrated in Fig. 2.

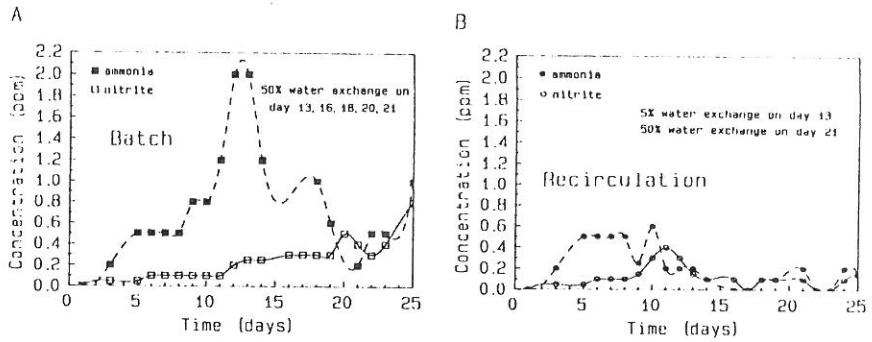

Fig. 2. Changes in ammonia and nitrite concentration under batch (A) and recirculation (B) conditions.

It is clear that ammonia was effectively removed after day 10 in the treatments with recirculation. At that time the ammonia in the batch cultures started to accumulate and the problem could only be solved by frequent water renewal. Nonetheless, stress tests, performed on day 15 did not confirm the better condition of the larvae in the recirculation system (Table I).

Table I. Difference in stress sensitivity and growth of turbot larvae reared under batch and recirculation conditions

Age of the fish	Batch treatment		Recirculation system	
	Stress sensitivity	Total length (mm)	Stress sensitivity	Total length (mm)
Day 15	126*	7.2 ± 0.8	143*	6.3 ± 0.5
Day 22	57**	10.6 ± 0.9	37**	12.7 ± 0.4
Day 27	73**	17.1 ± 2.1	64**	17.6 ± 0.5

* Salinity stress test at 55ppt.
** Salinity stress test at 70ppt.

This might be explained by the abrupt raise in the nitrite level which occurred shortly after operating the recirculation. It was probably due to the fast oxidation of the ammonia to nitrite, and the insufficient colonization of *Nitrobacter* which sustains further oxidation of nitrite to nitrate. After day 15, however, the conversion of nitrite was optimal and

acceptable nitrite levels were reached. This resulted in a far better condition of the fish which was reflected in the results of the stress tests on day 22 and 27.

In conclusion it can be stated that the recirculation system is working efficiently but the filtering capacity of the biofilter could be enhanced by a better conditioning. This could be achieved by twice adding 10ppm of sodium nitrite after the ammonium chloride treatment. The higher affinity of the filter for nitrite oxidation is illustrated in Fig. 3.

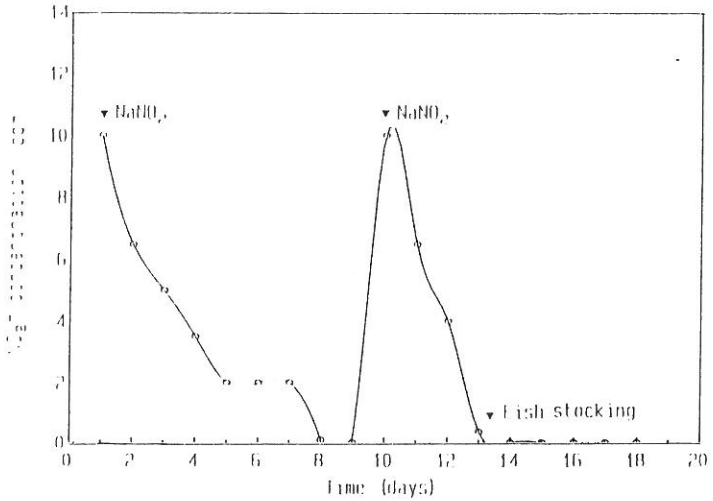

Fig. 3. Changes in nitrite concentration after adding $NaNo_2$ and stocking the fish.

After the total oxidation of nitrite, 30-day-old turbot larvae were stocked in the recirculation system and nitrite accumulation did no longer take place. Preliminary culture trials yielded about 5% survival from hatching to day 40. Reproducibility of the system will now be evaluated under various feeding regimes.

Acknowledgements

This study has been supported by the Belgian Administration for Development Cooperation (ABOS) and the Belgian National Science Foundation (NFWO-FKFO).

References

Ferraz de Queiroz J. 1989. The effect of *Artemia* diets on the reproductive activity and offspring quality in the marine crustacean *Mysidopsis bahia* (M.), in function of shrimp farming. Thesis, Univ. Ghent, Belgium. 257p.