

# Observations on the effects of water exchange rate on the growth rate of *Oreochromis mossambicus* (Peters) Part 2: Juvenile fish over the first 60 days after hatching

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## Abstract

Larvae were stocked at different densities in fibreglass tanks with 1 500 l capacity for a period of 60 d after hatching. Different water flow rates were used to establish the relationship between water used and growth (production) and the effect of different stocking densities on growth. A flow-through system to waste was used to prevent an accumulation of growth-limiting substances in the water.

A significant positive correlation of  $r=0.95$  ( $p<0.001$ ) between water exchange rate and growth rate was obtained with juvenile *Oreochromis mossambicus*. A positive correlation of  $r=0.82$  ( $p=0.001$ ) was also obtained between total water used per fish and the mean mass of the fingerlings at the end of the 60 d period.

An insignificant correlation of  $r=0.59$  ( $p>0.05$ ) was obtained between stocking density and water exchange rate.

## Introduction

When the production studies were commenced in 1986 great difficulties were experienced to produce fair sized fingerlings over the first 60 d after hatching, which could be used in the production ponds. It was then noticed that a faster flow-through of water to waste enhanced growth. The aim was to produce fingerlings of about 20 g each over that period. The experiments were then designed to study this relationship between growth and water exchange and whether different stocking densities have any influence on this relationship. The only other information available on the growth of juvenile *O. mossambicus* was that of Henderson-Arzapola and Stickney (1983). They used a constant flow of  $1.9 \text{ l}\cdot\text{min}^{-1}$  through tanks with 60 l capacity and stocked at different densities.

## Materials and methods

The experimental programme, carried out over a period of 4 years, was severely restricted by the lack of natural impounded water on the university campus and chlorinated tap water had to be dechlorinated in two reservoirs with a total capacity of  $244 \text{ m}^3$  before use in the fish tanks. Replication of the treatments was therefore not always possible.

Circular fibreglass tanks of 2 m dia., 0.5 m depth and 1 500 l capacity were installed inside a hothouse, converted into a hatchery. The required water depth was maintained by means of a vertical central overflow pipe. A screen prevented fish from escaping. Shade cloth (80%) placed over the tanks gave some shelter to the fish. The bottoms of the tanks were cleaned with a siphon twice daily. Details of the water flow rate ( $\text{l}\cdot\text{min}^{-1}\cdot\text{kg}^{-1}$ ), depth, and stocking densities are summarised in Table 3. In the 1993 experiment Tanks J9 to J11 were stocked at different densities and the flow rate was calculated from the regression equation  $y=0.0058x + 0.126$  where  $y$  = flow rate ( $\text{l}\cdot\text{m}^{-1}\cdot\text{kg}^{-1}$ ) and  $x$  = density ( $\text{fish}\cdot\text{m}^{-3}$ ) as recommended by Visser and losifov (1995) for production fish.

The flow rate in Tank J12 was reduced to half of that of Tank J11 but the stocking densities in both tanks were the same (Table 3). The water was not recirculated to prevent an accumulation of unknown quantities of growth-limiting substances in the water. The tanks were artificially aerated by means of a blower to ensure an  $\text{O}_2$  concentration above  $5 \text{ mg}\cdot\text{l}^{-1}$ . Thermostat controlled heaters were placed inside the tanks which kept the water temperature above the air temperature and reduced the temperature fluctuation to narrow limits (Table 2).

Fertilised eggs were removed from the female's mouth and incubated in 8 l capacity glass funnels (1.3 m long) in which the water flow could be regulated. After hatching the larvae swam out through the upper outlet of the funnel into a 50 l collecting tank with a very fine screen attached to its side-wall, preventing the larvae from escaping. From here they were transferred to a number of 60 l tanks where they were kept for 5 to 7 d and feeding commenced about 4 d after hatching. The stronger larvae were then counted and transferred to the experimental tanks. Monosex male progeny were obtained by means of the sex reversal technique described by Guerrero (1975) and Hopher and Pruginin (1981). Commercial trout pellets (35% protein) were ground to a fine powder with an ordinary coffee-bean grinder. This grinder was very suitable as it prevented overheating of the powder and consequent destruction of the protein and vitamin contents of the feed. The maximum feed particle size fed to the larvae varied according to the size of the larvae and sieves with different mesh

TABLE 1  
MAXIMUM FEED PARTICLE SIZE FED TO  
FISH AT DIFFERENT STAGES OF  
GROWTH

Fish mass (g)	Maximum particle size (mm)
Up to 0.7	0.5
0.8 - 2.9	1
3 - 8	2
above 8	3

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