

# Observations on the effects of water exchange rate on the growth rate of *Oreochromis mossambicus* (Peters) Part 1: Production fish over a period of 200 days

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## Abstract

An acceptable growth rate was obtained for *Oreochromis mossambicus* from a mean mass of 19.2 g at the time of stocking to 360.7 g at harvest over a period of 200 d in a pond where the water exchange rate of 0.71 l min<sup>-1</sup> kg<sup>-1</sup> at stocking density of 90 fish·m<sup>-3</sup> was sufficient to remove the growth limiting substances from the system.

A significant positive correlation level of  $r=0.96$  ( $p < 0.001$ ) between water exchange rate and growth rate of *O. mossambicus* was obtained at all levels of intensive and super-intensive production.

A similar significant positive correlation ( $r=0.93$ ) was recorded between stocking density and required water exchange rate. With an increase in stocking density progressively more water is required to produce 1 kg of fish over the same period of time. The demand for water per kg of fish produced increased drastically over the last quarter of the production period.

## Introduction

*Oreochromis mossambicus* is indigenous to Zululand and can play an important role in the protein requirements of the fast-growing local communities. It is a palatable fish and it was therefore considered important to explore its culture potential.

*Oreochromis mossambicus* has been described as a slow-growing (Mires, 1983) and a poor culture fish (Torrans, undated; Hephher and Pruginin, 1981; Henderson-Arzapalo et al., 1980). Preliminary experimental production trials were undertaken to identify the requirements for an acceptable growth rate at different stocking densities.

During the 1986 to 1989 production trials Visser (1991) had found a positive correlation between water exchange rate and growth rate at production levels of up to 2.5 kg·m<sup>-3</sup> of water. This paper reports on further studies to evaluate the water requirements at a wider range of stocking densities.

Little is known about the effect of the water exchange rate on the growth rate (production) of Tilapia. This information is of special importance in a country with limited water resources such as South Africa.

## Material and methods

The present series of experiments were carried out over a period of 3 production seasons of 200 d each (Ponds V7 to V13, Table 1). The results of Visser (1991) (ponds VI to V4, Table 1) are included for comparison.

The experimental programme was severely restricted by the lack of natural impounded water on the university campus. Chlorinated tap water had to be dechlorinated in 2 reservoirs with a total capacity of 244 m<sup>3</sup> and matured before use in the fish ponds. Replication of the treatments was therefore not possible

but significant tendencies were nevertheless observed which should further be investigated.

The construction and management of the 15.9 m<sup>3</sup> circular vinyl ponds (4.5 m dia. by 1 m deep), as well as their effectiveness as production ponds has been described by Visser et al. (1989) and Visser (1991). No provision for continuous water flow-through was, however, made in these earlier trials but water was exchanged daily for cleaning purposes and for maintaining turbidity levels of about 25 NTU (Ponds VI to V4, Table 1).

In the 1990/91 trials Pond V7 was stocked with sex reversed (all male) fish at 29.2 fish·m<sup>-3</sup>. It was managed as in the previous trials but more water was used per fish·d<sup>-1</sup> for cleaning purposes (Table 1).

In the 1991/92 trials one outdoor vinyl pond (V8) with a capacity of 15.9 m<sup>3</sup> was stocked with all male fish at 40 fish·m<sup>-3</sup> but, in contrast to the previous trials, a continuous water exchange of 0.22 l min<sup>-1</sup> kg<sup>-1</sup> was maintained (Table 1).

At the end of the 1991/92 season it became clear that density and water exchange play an important role in the growth rate of *O. mossambicus*. The 1992/93 experiments were therefore planned to accommodate this relationship. Smaller ponds were used in the present experiments because of the large volumes of water required at high stocking densities. Four circular fibreglass ponds (Ponds V10 to V13) with a 2 m dia., 0.5 m deep and with a 1.5 m<sup>3</sup> capacity, were installed inside a hothouse. In addition to these small ponds, one large 15.9 m<sup>3</sup> capacity outdoor vinyl pond (V9) was also used. The correct water depth was maintained in each pond by means of a vertical central overflow pipe. A screen prevented fish from escaping. Shade cloth (80%), placed over the ponds provided some shelter to the fish. The floors of the ponds were cleaned daily by means of a siphon. Details of the sex reversed (all male) fish stocked are summarised in Table 1 (Ponds V9 to V13). Outdoor pond V9 was stocked at the same density·m<sup>3</sup> as the small indoor pond V10.

Commercial trout pellets (35% protein) were fed at regular intervals during the day. The equation  $y = 271 + 13.3x$  [where  $y$  is the food required (mg·d<sup>-1</sup>) and  $x$  is the wet mass of the fish (g)]

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