Farming of All-Male Java Tilapia (*Oreochromis mossambicus*) at Two Stocking Densities in Cages in a Brackishwater Pond

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Abstract

A study was conducted to determine the growth, survival, and yield of all-male *Oreochromis mossambicus* in cages at two stocking densities: 50 fish/m^2 (Treatment I) and 100 fish/m^2 (Treatment II) in a brackishwater pond. The artificial diet contained 70% fine rice bran and 30% Peruvian fish meal. The 25% crude protein diet was fed in pellet form at 5% of fish biomass per day for the first two months and in mashed, moist form at 3% of fish biomass per day for the last month of culture. Results showed that fish in Treatment I gave higher mean weight gain (59.75 g) than in Treatment II (45.10 g). Similarly, higher daily growth rate was observed in Treatment I (0.56g/day) than in Treatment II (0.42 g/day). Feed conversion ratios of 2.42 and 2.85 were obtained for Treatment I and Treatment II, respectively. Fish in treatment I had higher percent survival (87.3%) than those in Treatment II(72.0%). Moreover, higher net income per cage was obtained in Treatment I than in Treatment II. Statistical analysis, however, showed no significant differences between the two treatments.

Introduction

Cage culture of tilapias has become a major industry in the Philippines (Guerrero 1987; Pante and Macaranas 1989; Coche and Edwards 1989) because of the bright economic potentials it offers (Bayani 1989) and a number of advantages it has over other rearing systems. Cages are comparatively inexpensive to construct and cage culture makes use of existing water bodies, thus allowing non land-owning sectors of the community access to fish farming and providing a free supply of planktonic food for the caged fish (Guerrero 1987; Coche and Edwards 1989; Pagan-Font 1975).

Among the four tilapia species introduced in the country, the giant Nile tilapia (*Oreochromis niloticus*) is the most extensively cultured in freshwater ponds, lakes and reservoirs, while Mozambique tilapia (*O. mossambicus*) is mainly limited to brackishwater ponds (Guerrero 1989).

O. mossambicus was once considered pest in brackishwater ponds and a competitor of the commercially important milkfish. Its culture was started in 1950 but it did not last long due to excessive breeding which caused overcrowding in ponds resulting to the production of small fish (Pullin 1989; Fortes 1989). Guerrero (1981) cited poor technology and management as the cause of the unsuccessful culture of such species.

The development of new technologies in tilapia such as manual sexing and sex-reversal have made scientists, researchers, and aquaculturists take a second look at *O. mossambicus* as a potential aquaculture species for brackishwater. It was found that culture of all-male *O. mossambicus* in brackishwater ponds produced yield comparable to that of milkfish monoculture (Alejar 1991). The present study was conducted to determine the effect of two stocking densities (50 fish/m^2 and 100 fish/m^2) on growth, survival, and yield of all-male *O. mossambicus* in cages in a brackishwater pond.

Materials and Methods

Wild all-male *O. mossambicus* fingerlings (about 18-19 g each) collected from milkfish ponds by seining were randomly stocked in 6 net cages measuring 2m x 2m x 1.5m at 50 fish/m^2 (Treatment I) and 100 fish/m^2 (Treatment II). The cages were installed in a 2,000-m^2 brackishwater pond about 2 meters away from the main dike. The cages were arranged in single file one meter apart. The pond used in the study is located beside San Isidro Norte River; thus, there was a regular exchange of water in the pond during high tides. Moreover, it was stocked with milkfish grown to marketable size using the *lumot* method of culture.

Prior to stocking, fish were acclimatized in holding cages for three days and were given fine rice bran at 5% of fish biomass. The artificial diet used in feeding the fish in cages contained 70% fine rice bran and 30% Peruvian fish meal which were mixed and prepared in pellet form. The 25% crude protein diet was fed at 5% of fish biomass per day for the first two months of culture and in mashed, moist form at 3% of fish biomass for the last month of culture. Feeding was done twice a day for 106 days.

Sampling was done initially for length and weight measurements and every 17 days thereafter until harvest. The final weight of fish per cage, survival rate , feed conversion ratio, and total yield were determined at harvest. Physico-chemical parameters (temperature, dissolved oxygen, pH and salinity) were measured weekly between 0700-0800h and between 1500-1600h. A simple cost and return analysis was done to determine the profitability of culturing *O. mossambicus* in cages in brackishwater ponds.

All data were analyzed using analysis of variance (ANOVA) in a completely randomized design followed by Duncan's multiple range test (DMRT). Differences were considered significant at $P < 0.05$.

Results and Discussion

Growth

No significant difference in weight gain of fish was observed between the two stocking densities. Average weight gain at stocking density of 50 fish/m^2 was 59.75 g while that at 100 fish/m^2 was 45.10g (Table 1). Results of Taduan and Abella (1982) showed that mean weights and survival were comparable for red tilapia and Nile tilapia at stocking densities of 100 and 200 fish/m^2 after 120 days of culture in cages under freshwater condition. Pantastico and Baldia (1978) reported that *O. mossambicus* were grown to marketable size in floating cages in Laguna de Bay at a stocking density of 75 fish/m^2. Those given supplemental feeds containing 60% rice bran + 20% ipil-ipil + 20% fish meal showed significantly higher growth than those fed 70% rice bran + 30% chopped snails. Guerrero and Sevilleja (1981) reported that Nile tilapia fingerlings fed a mixture of 25% fish meal and 75% rice bran weighed 20-30 g each after 125 days of culture in Aya Reservoir, Pantabangan Dam. Guerrero and Tolentino (1981) also reported that Nile tilapia fed formulated pellet consisting of 75% rice bran and 25% fish meal had a mean weight gain of 42 g after a 4-month culture period.

Table I. Growth, feed conversion, survival and yield of all-male *O. mossambicus* in cages at two stocking densities.

Parameter	Treatment I	Treatment II
Stocking density	50 fish/m^2	100 fish/m^2
Number of fish/cage (2m x 2m x 1. 5m size)	200	400
Initial mean weight (g)	19.16 ± 0.33	19.07 ± 0.44
Final mean weight (g)	77.91 ± 16.49	64.17 ± 9.51
Mean weight gain (g)	59.75 ± 11.89	45 10 ± 9.41
Daily weight gain (g)	0.56 ± 0.19	0.42 ± 0.25
Feed conversion ratio	2.42 ± 0.15	2.85 ± 0.28
Survival (%)	87.3 ± 6.3	72.0 ± 10.3
Mean yield (kg)	13.6 ± 1.4	18.5 ± 1.0

Means (± SEM) are not significantly different between treatments I and II ($P > 0.05$).

Figure 1. Growth of fish increased markedly beginning at about 30 days of culture.

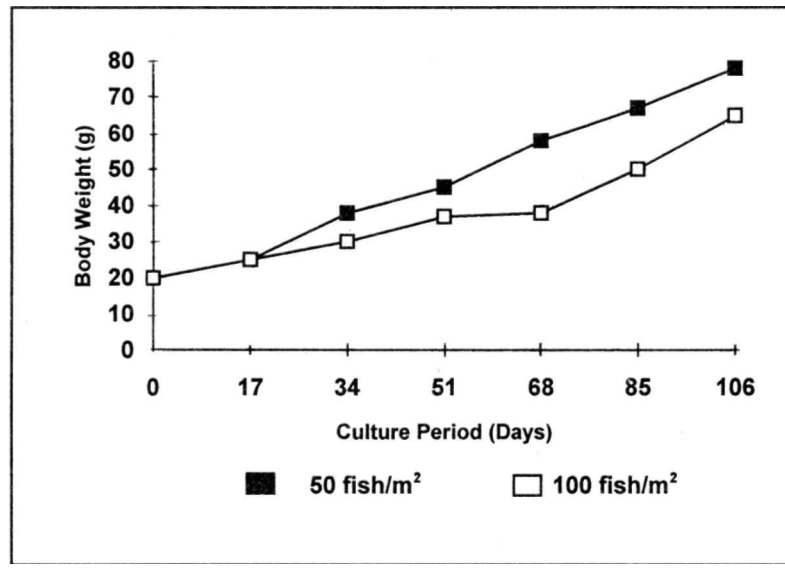

Fig. 1. Growth curves of all-male *O. mossambicus* at two stocking densities in cages in brackishwater.

Survival

Higher survival was obtained in Treatment I (87.3%) than in Treatment II (72.0%). However, no significant difference was observed between treatments. Loss of fish in all treatments was due to stress and escape of fish during sampling.

The average percent survival obtained in this study was lower than those obtained by Abella et al (1982) and Taduan and Abella (1982). In their study on cage culture of *O. niloticus,* red tilapia, and different strains of T. *nilotica* at various stocking densities, percent survival ranged from 89 to 99%.

Feed conversion ratio

Although better feed conversion ratio was obtained in Treatment I (2.42) than in Treatment II (2.85), no significant difference was observed. The pellets used to feed the fish for the first two months were hard and were not immediately consumed by the fish. Recruits or small fishes that came in and out of the cages were also observed to compete for feeds. These may explain the low feed conversion ratio obtained.

Physico-chemical parameters

The average water salinity in the culture area fluctuated from 18.7 to 38.2 ppt and water temperature ranged from 24 to 29°C (Table 2). These are within the tolerable limits of the test species. pH (7.0 to 7.8) did not fluctuate much. However, dissolved oxygen (DO) was very low (1.2 to 1.6 ppm) in the morning (Table 2).

Balarin and Hatton (1979) as cited by Trewavas (1982) reported that tilapias are very resistant to low levels of DO. DO as low as 0.1 ppm is tolerated by *Sarotherodon mossambicus* (Maruyama 1958 as cited by Trewavas 1982) and *Sarotherodon niloticus* (Magid and Babiker 1975; Milard and Philippart 1980 as cited by Trewavas 1982).

Table 2. Monthly fluctuations of water quality parameters in a brackishwater pond throughout the culture period.

Month	Temperature		Dissolved Oxygen (ppm)		pH		Salinity (ppt)	
	A.M.	P.M.	AM.	P.M.	AM.	P.M.	AM.	P.M.
November	24.1	28.5	1.4	8.6	7.0	7.8	20.5	18.7
December	23.6	28.2	1.3	7.3	7.3	7.7	33.8	32.3
January	23.6	28.1	1.2	7.2	7.3	7.5	37.7	35.8
February	23.7	28.6	1.6	7.7	7.4	7.4	38.2	36.0

Cost and return analysis

Higher net income of P193.55 was obtained at stocking density of 50 fish/m^2 than at stocking density of 100 fish/m^2 (P145.18). Returns were computed based on the value of the total harvest at P45.00/kg (Table 3) .The cost of fingerlings and feeds were considered.

Growth and survival of all-male *O. mossambicus* cultured in cages were similar at stocking densities of 50 and 100 fish/m^2. Profitability was slightly higher at lower stocking density. Based on the results of the study, all-male *O. mossambicus* has the potential for culture in cages in brackishwater and it can be an additional source of income for farmers.

Table 3. Simple cost and return analysis per cage.

Items	Treatment	
	I	II
Total harvest (kg)	13.6	18.5
Value at 45.00/kg	612.00	832.50
Amount of feeds given(kg)[1]	33.0	50.5
Total feed cost[2]	318.45	487.32
Fingerling cost at 0.50 each[3]	100.00	200.00
Total cost (4+5),	418.45	687.2
Net income (2-6),	193.55	145.18
Benefit cost ratio (BCR)	1.46	1.21

[1]Ration composition: 70% rice bran and 30% fish meal
[2]Based on 3.50/kg of rice bran and 24.00/kg of fishmeal
[3]Based on stocking density of 50 fish/m^2 and 100 fish/m^2

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