GROWTH PERFORMANCE OF MONO-SEX AND MIXED SEX POPULATION OF *Oreochromis niloticus* FED SIMILAR DIET

SULE, Oricha Dirisu
National Institute for Freshwater Fisheries Research, Zonal Office, C/O Lake Chad Research Institute, P.M.B. 1293, Maiduguri, Borno State, Nigeria

ABSTRACT

The growth performance of all-male, all-female and mixed sex population of Oreochromis niloticus fed similar diet was carried out. The fingerlings used in the study were of relatively similar weight ranges (24.8 g – 26.6 g) with initial mean weight of 25.7±1.3 g and initial mean total length of 3.8 ± 1.5 cm. The mean increase in weight for the all-male Oreochromis was significantly higher than the values for the all-female Oreochromis and the control (P < 0.05). The food conversion ratio (FCR) was best in the all-male Oreochromis, while that of all-female was better than that of the mixed population. There was no significant difference between the food conversion ratio of all-male Oreochromis and those of all-female and mixed population (P > 0.05). The percentage survival of all-male O. niloticus was 94 % and that of all-female was 88 %, while that of the mixed population was 74 %. All-male O. niloticus grew better than the all-female under the same experimental conditions. It is therefore recommended that the culture of all-male O. niloticus species by fish farmers should be encouraged for increased fish production in Nigeria.

Keywords: Mono-sex culture, All-male, All-female, *Oreochromis niloticus*

INTRODUCTION

Nile Tilapia, *Oreochromis niloticus* is an important culturable species and it is highly accepted by the consumers in Nigeria. The species have a disadvantage of prolific reproduction under mixed sex culture in ponds. They attain sexual maturity in 2 -3 months from fry stage. They can breed as often as once a month under favourable conditions. This characteristic results in the production of large numbers of stunted fish which cause overcrowding in the pond and does not appeal to consumers when harvested for sale (Sule *et al.,* 1996). It therefore becomes imperative to curb or eliminate completely this unwanted reproduction and its resultant consumers non preference.

The existing methods in use to salvage this problem include: Cage culture (Coche, 1976), irradiation (Nelson *et al.,* 1976), combined stocking with piscivorous fish (Shell, 1967), hybridization (Allison et al., 1976, sex reversal (Guerrero, 1975) and monosex culture (Bardach et al., 1972). Kirk, (1972) discussed *Tilapia* with special reference to those aspects of their physiology and breeding behaviour which were relevant to their culture in fresh and brackish water. Details on husbandry techniques of *Tilapia* have been described in Bardach *et al.,* (1972). Their Biology and culture with particular reference to Africa have also been reported by Balarin (1979).

Improved growth capacity and high fish production are the major economic aims of fish farmers. Comparative studies on growth and survival of fingerlings of hybrids of *Tilapia* species have been carried out by different workers in Nigeria, notably, Eyo, (1996), Madu *et al.* (1996), and Omoniyi and Fagade (2003). Comparative growth studies on mono-culture and mixed population of *O. niloticus* has not been extensively studied in Nigeria. This study was therefore carried out to investigate the growth responses of all-male, all-female and mixed population of *Oreochromis niloticus* using 25% crude protein fish feed.

MATERIALS AND METHODS

Differentiation of Sexes: The distinctive feature of the genitalia of male and female *Tilapia* as described by Maar *et al.,* (1966), was used in separating the males from the females. The fingerlings used for this experiment were obtained from the Institute's production pond.

Stocking of Fish Fingerlings: One hundred (100) fingerlings each of all-male, all-female and randomly selected mixed population with initial mean weight of 28.6 ± 1.30 g were stocked in 30 m^2 earthen ponds located at Dadin Kowa,

Gombe State, after pond preparation. The ponds were marked $A_1 - A_3$, $B_1 - B_3$ and $C_1 - C_3$ respectively for all male, all females and mixed sex populations.

Feeds and Feeding: Feeding of fish fingerlings started immediately after stocking at established feeding spots. The fish were fed with 25 % crude protein feed at 5 % body weight twice daily; 900 and 1600 hours. The feed was formulated from local feed ingredients as described by Eyo (1989). The proximate composition of the diet is presented in Table 1. Length and weight measurements of the experimental fish were taken fortnightly and the feed adjusted to the new body weight. The experiment was monitored for 42 weeks.

Table 1: Ingredients and proximate composition of experimental diet

Ingredients (g/100g dry matter)	Weight (g)
Guinea corn	54.4
Groundnut cake	20.0
Blood meal	11.8
Fish meal	8.3
Bone meal	0.5
Vitamin premix	2.0
Starch	1.5
Vegetable oil	1.0
Common salt	0.5
Total	100
Calculated crude protein level (%)	25
Analyzed nutrient content (% dry matter)	
Protein level (%)	24.9±0.4
Moisture	6.8±0.7
Ash	8.3±0.5
Crude fibre	4.9±0.3
Crude lipid	4.5±0.3
Energy content (KJg^{-1})	19.0

Mean Growth Rate: The mean growth rate (MGR) was computed using the method of Wayne and Davis (1977) as: MGR = W2 - W1/0.5(W_1-W_2)t x 100/1. Where: W_2 = Final weight, W_1 = Initial weight, T = Culture period in days, O.5 = Constant

Food Conversation Ratio: Food conversation ratio (FCR) was computed as: FCR = Dry weight of feed fed / Gain in fish weight.

Percentage Survival: Percentage survival was calculated as: % survival = Number of fish survival / Number of fish stocked x 100/1.

Physico-Chemical Parameters: The dissolved oxygen, temperature and pH of pond water were monitored fortnightly. Dissolved oxygen was determined by Winkler's method, water temperature by glass thermometer and the pH by Lovibond comparator.

Statistical Analysis: Growth data were tested using the Analysis of Variance (ANOVA). Means were analysed for significant difference using the multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The growth performance of all-male, all-female and mixed population of *Oreochromis niloticus* fed similar diet is shown in Table 2. At the end of the experiment, the mean total weight increase for the all-male *Oreochromis niloticus* was 206.0 ± 1.3 g and that of the female was 170 ± 1.0 g while that of the control (Mixed population) was 132.0 ± 0.8 g respectively. The mean increase in length for the all-male and all-female *Oreochromis* niloticus were 2.6 ± 0.3 cm and 1.8 ± 0.1 cm respectively. The mean increase in weight for the all-male *Oreochromis* were significantly higher than the values of the female Oreochromis and the control ($P < 0.05$). This result is supported by an earlier observation of Abella, *et al.,* (1990) in which higher growth rate was reported for male *(Oreochromis aureus)*.

The food conversion ratios (FRC) were 0.45 in the all-male *O. niloticus* and 0.44 in all-female, and were better than those of the mixed population (0.33). There was no significant difference between the food conversion ratio of the all-male and those of the all-female and the mixed sex population ($P > 0.05$). This agrees with the report of Guerrero (1985) where no difference was observed in the food conversion of all-male *Sarotherodon galillaeus* and that of the all-female and mixed sexes. The percentage survival of all male *O. niloticus* was 94 % and that of the female was 88 % while that of the mixed population was 74 %. The comparison between the all-male and all-female *O. niloticus* in this experiment shows that growth and survival of all-male was better than those of the all-female and the control. This result is in line with Chervinski (1982) who reported that male *Tilapia* grows better with higher survival rate than the all-female when the sexes are cultured separately.

Table 2: Growth performance of all-male, all-female and mixed population of *Oroechromis niloticus* fed similar diet

Treatments	Initial mean weight (g)	Final mean weight (g)	Mean weight gain (g)	mean growth rate g/day	mean initial length (cm)	Mean final length	mean length increase	feed conversion ratio	% survival
Males	24.0	230.0	206	0.57	3.6	6.2	2.6	0.45	94
Mixed (control)	25.5	157.0	132.0	0.36	3.8	4.6	0.8	0.33	74
Females	28.6	198.6	170.0	0.47	4.0	5.8	1.8	0.44	88

The result of water quality parameters show that laboratory water temperature ranged from 27.5 - 32.5 ^{o}C with a mean of 29.95 $\pm$ 1.95 ^{o}C during the period of the experiment. The dissolved oxygen ranged between 5.2 mgl^{-1} – 5.7 mg^{-1} with a mean of 5.65 $\pm$ 0.39 mgl^{-1}. The pH has a range of 6.0 - 7.5 with a mean of 7.0 $\pm$ 0.53. These parameters has no negative effect on fish growth, since they fall within the range reported by Boyd (1976). It has been clearly shown from this experiment that all-male *O. niloticus* grew better than the all-female under the same experimental conditions. It is therefore recommended that for the purposes of table size *Oreochromis* production, the culture of all-male *Oreochromis* species by fish farmers should be encouraged for increased fish production from aquaculture in Nigeria.

REFERENCES

ABBELLA, T. A., PALADA, M. S. and NEWKIRK, G. F. (1990). Within family selection for growth rate with rotation marking in *Oreochromis niloticus.* Pages 515 - 518. *In:* Hirano, R. and Hanyu, (Eds). *The Second Asian Fisheries Forum*

ALLISON, R., SMITHERMAN, R. O. and CABRERO, J. (1976). Effects of fish density culture on reproduction and yield of *Tilapia aurea*. *FAO Technical Conference on Aquaculture*, Kyoto, Japan: AQ/Conf/76/E.47 33 pp.

BARDACH, J. E., RYTHER, J. H. and MC LARNEY, W. O. (1972). *Aquaculture: The farming and husbandry of freshwater and marine organisms*. Wiley and Sons Incorporated, Toronto. 512 pp.

BOYD, G. E. (1976). Nitrogen fertilizer effects on production of *Tilapia* in ponds fertilized with phosphorus and potassium. *Aquaculture*, *7(4):* 385 - 390.

BALARIN, J. D. (1979). *Tilapia – A guide to their Biology and culture in Africa*. University of Sterling, 1979. 174 pp.

CHERVINSKI, J. (1982). Environmental physiology of tilapias. Pages 119 – 128. *In:* Pullin, R. S. V. and Lowe, R. H. (eds.). *The biology and culture of Tilapia*, ICLARM Conference Proceedings.

COCHE, A. G. (1976). A general review of cage culture and its application in Africa. *FAO Technical Conference on Aquaculture*, Kyoto, Japan. FIR:AQ/Conf/76/E.72 33 pp.

DUNCAN. D. B. (1955). Multiple ranges and multiple F-test. *Biometrics,* 11: 1 – 42.

EYO, A. A. (1989). The effect of substituting soyabean meal with different levels of fish meal on the growth and food utilization of mud fish (*Clarias anguillaris*) fingerlings. *National Institute for Freshwater Fisheries Research Annual Report, 1989:* 94 – 100.

EYO, A. A. (1996). Growth performance of exotic *Oreochromis niloticus*, exotic *Oreochromis aureus* Hybrid and local *Oreochromis niloticus* fed with pelletted feed *National Institute for Freshwater Fisheries Research Annual Report.*, *1996*: 34 – 42.

GURRERO, R. D. (1975). Sex reversal of Tilapia. *FAO Aquaculture Bulletin*, *7(3-4):* 14 – 17.

GURRERO, R. D. (1985) Control of Tilapia reproduction. Pages 15 – 69. *In:* Pullin, R. S. V. and Lowe, R. H. (eds.). *The Biology and culture of Tilapia. ICLARM Conference Proceedings.*

KIRK, R. G. (1972). A review of recent development in Tilapia culture, with special reference to fish farming in the heated effluents of power stations. *Aquaculture*, *I (I):* 45 – 60.

MAAR, A., MORTIMERS, M. A. E. and VANDERLINGEN, I. (1966). *Fish Culture in Central East Africa. FAO Publication,* 53608-66/E, 158 pp.

MADU, C. T., EMOFURIETA, R., ARINDE, J., ISSAH, X. X. and OKWEGO, C. (1996).

Comparative study on the growth and survival of fingerlings of Tilapia *Oreochromis niloticus, Oreochromis aureus* and their hybrids in outdoor concrete tanks and hapas. *National Institute for Freshwater Fisheries Research Annual Report, 1996*: 95 – 103.

NELSON, S. G., ANDERSON, A. C., MOMENI, M. H. and YEO, R. R. (1976). Attempted sterilization of sexually undifferentiated fry of *Tilapia zilli* by cobalt gamma-ray irradiation *Progressive Fish Culturist, 38(3):* 131 – 134.

OMONIYI, I. T. and FAGADE, S. O. (2003). Effect of different dietary protein levels on the growth performance of hybrid Tilapia. *Nigerian Journal of Fisheries*, *1:* 22 – 32.

SULE, O. D., OKWUNDU, E. C. and OKAEME, A. N. (1996). Utilization of freeflow borehole pond for fish culture in the north-east zone of Nigeria. *National Institute for Freshwater Fisheries Research Annual Report*, *1996*: 160 – 165.

SHELL, F. W (1967). Monosex culture of male *Oreochromis niloticus* (Linnaeus) in ponds stocked at three rates. *FAO Fisheries Report, 44(4):* 253 – 258.

WAYNE, A. N. and DAVIS, C. E. (1977). Effect of fertilization and feeding on fish production. *Journal of Fish Biology,* 11: 87 – 98.