



## Short Communication

# The Culture Performance of Mono-sex and Mixed-sex Tilapia in Fertilized Ponds

MUHAMMAD HAFEEZ-UR-REHMAN<sup>1</sup>, IFTIKHAR AHMED<sup>†</sup>, MUHAMMAD ASHRAF<sup>‡</sup>, NOOR KHAN AND FAYYAZ RASOOL

*Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore, Pakistan*

*†Department of Zoology and Fisheries, University of Agriculture, Faisalabad, Pakistan*

*‡Fish Seed Hatchery, Satiana Road, Faisalabad, Pakistan*

<sup>1</sup>Corresponding author's e-mail: mhafeezurehman@hotmail.com

## ABSTRACT

The experiment was conducted to evaluate the culture performance of mono-sex and mixed-sex tilapia (*Oreochromis niloticus*) in semi-intensive integrated pond system. The experiment was conducted in three earthen ponds for a period of 320 days. In pond-1 (P<sub>1</sub>), 100 males and in pond-2 (P<sub>2</sub>), 100 female, while in pond-3 (P<sub>3</sub>), 50 male and 50 female tilapias were stocked. Fertilization of all the ponds were done with cowdung at the rate of 0.2 g N 100 g<sup>-1</sup> wet fish body weight daily. The net fish production was calculated as 1148.0, 994.0 and 842.1 kg ha<sup>-1</sup> year<sup>-1</sup> in P1, P2 and P3 pond, respectively. Males (♂) tilapia caused a significant (P<0.05) increase in fish production in three ponds.

**Key Words:** Mono-sex; Mixed-sex; Tilapia; Growth

## INTRODUCTION

Tilapia is an important food fish in many tropical and sub-tropical countries. It provides one of the most important sources of animal protein and income through out the world (Sosa *et al.*, 2005). They are considered suitable for culture because of their high tolerance to adverse environmental conditions, relatively fast growth and the ease with which they can be bred. Pakistan has vast areas of salt waters which can be best utilized for culturing tilapia, as this fish is very hardy, more tolerant than most commonly farmed freshwater fish to high salinity, high water temperature, low dissolved oxygen and high ammonia concentration. Tilapia fish has become one of the more commercially important groups (Coward & Bromage, 2000).

The culture of tilapia is still beset with problems of their prolific breeding habit and stunted growth. Tilapia starts breeding even when three months old at a size of about 8 cm onwards. Within a few months of culture, the pond gets full with small fishes and later due to overpopulation, the growth of fish is slow and the fish farmer gets very little or no profit. In order to control breeding of tilapia and increase its body size, monosex culture is practiced. Monosex culture therefore gives faster growth and eliminates reproduction (Guerrero, 1982). Tilapia male has better growth than female for two reasons. One is the genetic capability of male, another is female keep fertilized eggs and spawns in their mouth to produce young,

thus preventing themselves from feeding. Manual separation of male and female tilapias is one of the easiest alternatives that are to perform for single sex culture of tilapia.

Keeping in view the importance of monosex culture, this project has been planned to study the culture performance of monosex and mixed-sex tilapia in fertilized ponds.

## MATERIALS AND METHODS

For this study, experiment was conducted in three earthen ponds, each with dimensions 25 m x 8 m x 1.5 m located at Fisheries Research Farms, University of Agriculture, Faisalabad, Pakistan. The experiment was expanded over a period of 320 days from February 1, to December 16, 2005. To disinfect these ponds and to stabilize pH of water, liming with calcium oxide (CaO) was done at the rate of 8.5 kg pond<sup>-1</sup> (Hora & Pillay, 1962). The inlet of water, ponds was properly screened with guaze of fine mesh to avoid the entry of any intruder into or exit of fish from the ponds. All the ponds were watered up to the level of 1.0 m. This water level was maintained through out the experimental period. After the preliminary preparation, the pond-1 was stocked with 100 males, pond-2 was stocked with 100 females, while in pond-3, 100 mixed-sex (50 males & 50 females) tilapia were stocked. The identification of male and females of tilapia was done manually on the basis of number of openings of genital papilla. All the ponds

were manured by cowdung at the rate of 0.2 g N 100 g<sup>-1</sup> wet fish body weight daily. The amount of manure was adjusted on the basis of the data obtained after every fortnight. At fortnightly intervals, a sample of 10 fishes was captured randomly, their body weight was recorded and average was calculated. After obtaining the data, the fish were released back into their respective ponds. The data thus obtained were subjected to Analysis of Variance to find out statistically significant relationships among various parameters under study (Steel *et al.*, 1996).

## RESULTS

After 320 days of rearing, all fish species were harvested from all the ponds. Survival rate for all the fish species was found to be 100% through out the experimental period.

The initial average body weight of male tilapia was 25.5±4.69 g while the final was 421.6±17.77 g in pond-1. There was net gain of 396.1 g. The maximum increase (34.8 g) in average body weight was observed in the 7<sup>th</sup> fortnight (16-05-2005). The gross fish production was found to be 2411.13 kg ha<sup>-1</sup> year<sup>-1</sup>, while the net production was 2265.65 kg ha<sup>-1</sup> year<sup>-1</sup> in pond-1 (Table I).

The fish having average weights of 25.4 g was stocked initially; however at final harvest female (♀) tilapia had an average body weight was recorded as 369.7 g in pond-2. The net gain in average body weight was 344.3 g. The maximum increase (28.6 g) in average body weight was observed in the 9<sup>th</sup> fortnight. The gross fish production was calculated to be 2114.69 kg ha<sup>-1</sup> year<sup>-1</sup>, while the net

production was found to be 1969.20 kg<sup>-1</sup> ha<sup>-1</sup> year<sup>-1</sup> in pond-2 (Table I).

The initial average body weight of mixed-sex tilapia was 26.2 g, while the final average body weight was recorded as 318.0 g in pond-3. There was net gain of 291.8 g. The maximum increase (22.3 g) in average body weight was observed in the 3<sup>rd</sup> (16-03-2005) and 13<sup>th</sup> (16-08-2005) fortnights. The gross fish production was calculated to be 1818.73 kg<sup>-1</sup> ha<sup>-1</sup> year<sup>-1</sup>, while the net production was 1668.75 kg<sup>-1</sup> ha<sup>-1</sup> year<sup>-1</sup> in pond-3 (Table I). Analysis of variance shows that there was a highly significant ( $P<0.05$ ) difference in the increase in body weight of fishes among the fortnights as well as among the ponds.

Comparison of means of increase in average body weight of all the three ponds and fortnights showed that means sharing the same letter differ non-significantly, while those having different letters, differ significantly (Table II).

## DISCUSSION

The results of present research revealed that in monosex culture of tilapia, male tilapia grew faster (1.12 times) than female and (1.32 times) mixed-sex culture. The females grew lesser than males but faster (1.17 times) than mixed-sex culture. Middendorp (1995) carried out a study in which Nile tilapia was given combination of cotton seed cake and brewery waste. Culture of male tilapia resulted in significantly higher net pond production than in mixed-sex culture. Schreiber *et al.* (1998) reported that male tilapia appear to grow faster than females, which may be caused either by a sex-specific physiological growth capacity,

**Table I. Comparison for increase in body weight (g) of Tilapia in pond-1, pond-2, pond-3**

Sr. No.	Fortnights	Pond-1 (Male Tilapia)		Pond-2 (Female Tilapia)		Pond-3 (Mixed-sex Tilapia)	
		Average Weight (± SD)	Increased Weight	Average Weight (± SD)	Increased Weight	Average Weight (± SD)	Increased Weight
Stock. Date	01-02-2005	25.5±4.69	-	25.4±3.15	-	26.2±4.37	-
1	16-02-2005	31.5±5.64	6.0	30.6±2.18	5.2	30.6±3.93	4.4
2	01-03-2005	42.8±5.96	17.3	39.5±3.29	8.9	40.5±5.91	9.9
3	16-03-2005	62.6±6.79	19.8	60.3±5.44	20.8	62.8±5.64	22.3
4	01-04-2005	88.9±7.81	26.3	78.5±6.75	18.2	77.6±6.71	14.8
5	16-04-2005	108.6±6.65	19.7	90.5±7.54	12.0	85.9±7.81	8.3
6	01-05-2005	120.8±7.29	12.2	105.6±6.99	15.1	98.8±7.69	12.9
7	16-05-2005	155.6±10.85	34.8	130.8±7.81	25.2	120.9±8.74	22.1
8	01-06-2005	189.9±9.19	34.3	149.9±8.79	19.1	131.8±8.61	10.9
9	16-06-2005	210.8±12.39	20.9	178.5±7.98	28.6	150.6±10.50	18.8
10	01-07-2005	222.6±11.34	11.8	190.8±8.18	12.3	162.9±11.67	12.3
11	16-07-2005	241.4±10.42	18.8	205.4±9.83	14.6	176.4±17.81	13.5
12	01-08-2005	263.6±9.63	22.2	220.8±8.99	15.4	194.5±14.34	18.1
13	16-08-2005	287.1±8.91	23.5	237.3±12.64	16.5	216.8±12.52	22.3
14	01-09-2005	312.4±19.13	25.3	254.9±11.96	17.6	237.3±13.35	20.5
15	16-09-2005	340.9±12.35	28.5	277.0±10.61	22.1	259.5±13.49	22.2
16	01-10-2005	367.4±11.63	26.5	302.2±9.59	25.2	277.8±16.71	18.3
17	16-10-2005	392.6±9.95	25.2	325.7±8.49	23.5	290.4±21.61	12.6
18	01-11-2005	405.1±10.65	12.5	346.0±22.64	20.3	300.8±6.99	10.4
19	16-11-2005	413.4±21.19	8.3	358.3±19.19	12.3	309.6±7.89	8.8
20	01-12-2005	418.6±18.65	5.2	366.5±17.22	8.2	314.9±19.31	5.3
21	16-12-2005	421.6±17.77	3.0	369.7±18.71	3.2	318.0±10.11	3.1
Gain in average weight (g)		396.1		344.3		291.8	
Gross fish production (kg ha <sup>-1</sup> year <sup>-1</sup> )		2411.13		2114.69		1818.73	
Net fish production (kg ha <sup>-1</sup> year <sup>-1</sup> )		2265.65		1969.20		1668.75	

**Table II. Comparison of mean values of increase in body weight (g) of Tilapia in all the three ponds**

PONDS	
	Increase in average body weight
Pond-1	232.9 a
Pond-2	197.5 b
Pond-3	176.6 c
FORTNIGHTS	
	Increase in average body weight
01-02-2005	25.70 o
16-02-2005	30.90 no
01-03-2005	40.93 no
16-03-2005	61.90 mn
01-04-2005	81.67 lm
16-04-2005	95.00 lm
01-05-2005	108.4 lm
16-05-2005	135.8 jk
01-06-2005	157.2 ij
16-06-2005	180.0 hi
01-07-2005	192.1 h
16-07-2005	207.7 gh
01-08-2005	226.3 fg
16-08-2005	247.1 ef
01-09-2005	268.2 de
16-09-2005	292.5 cd
01-10-2005	315.8 bc
16-10-2005	336.2 ab
01-11-2005	350.6 a
16-11-2005	360.4 a
01-12-2005	366.7 a
16-12-2005	369.8 a

Means with similar letters in a column are statistically similar at  $p<0.05$ .

female mouth-brooding or the more aggressive feeding behavior of males. All male culture is desirable in ponds not only to prevent overpopulation and stunting but also because males grow faster. Similar results were obtained by Pandian and Sheela (1995). Males usually grow faster than females. So propagation of all male population is desirable to control reproduction. Green *et al.* (1997) also concluded that all male tilapia population has greater growth potential because no energy was shunted towards reproduction and no competition with younger fish occurred. When females become sexually mature after 4-6 months, they devote more energy and resources into egg production than into growth. In ponds stocked with mixed sex tilapia, uncontrolled reproduction may result in the stunting of the originally-stocked fish. At the time of stocking, the males and females were separated carefully by studying the morphological characters by manual sexing. But at the time of 2<sup>nd</sup> netting the fish fry was found in pond-1 (all males) and pond-2 (all females), which showed that the sexing of tilapia was not done accurately at the time of stocking. So fishes of both the ponds were netted out and the water was drained out.

After examination, it was found that two male fishes were present in the pond-2, (all female) while three females were found in Pond-1, (all male). After drying the ponds, the fishes were re-stocked in their respective ponds through careful examination and manual sexing. According to Mair and Little (1991), it is difficult for even the most skilled workers to achieve greater than 90% accuracy in sexing and so breeding and reproduction is rarely completely controlled.

## CONCLUSION

Results showed that male tilapia grows faster as compared to females and mixed-sex tilapia. Furthermore, for 100% accurate sexing by manual method, a high degree of expertise is required.

## REFERENCES

- Coward, K. and N.R. Bromage, 2000. Reproductive physiology of female tilapia brood stocks. *Rev. Fish Biol. Fisheries*, 40: 1-25
- Green, B.N.W., K.L. Veverica and M.S. Fitzpatrick, 1997. Fry and fingerlings production. In: Egna, H. and C. Boyd (eds.), *Dynamics of Pond Aquaculture*, pp: 215-43. CRC Press, Boca Raton, Florida
- Guerrero, R.D., 1982. *Control of Tilapia Reproduction*, pp: 309-16. Lowe-McConnell
- Hora, S.L. and T.V.R. Pillay, 1962. *Hand book of Fish Culture in the Indo-Pacific Region (F.A.O.)*, p: 204. Fish Biology and Technology
- Mair, G.C. and D.C. Little, 1991. *Population Control in Farmed Tilapia*, pp: 8-13. Naga, the ICLARM Quarterly
- Middendorp, A.J., 1995. Pond farming of Nile tilapia (*Oreochromis niloticus*) in Northern Cameroon. Feeding combination of cottonseed cake and brewery waste in finger ling culture, hand sexed male monosex culture and mix culture with police fish, *Clarias gariepinus*. *Aqua. Res.*, 26: 715-22
- Pandian, T.J. and S.G. Sheela, 1995. Hormonal induction of sex reversal in fish. *Aquaculture*, 138: 1-4
- Schreiber, S., U. Focken and K. Becker, 1998. Individually reared female Nile tilapia (*Oreochromis niloticus*) can grow faster than males. *J. Appl. Ichthyol.*, 14: 43-7
- Sosa, I.D.L.A.B., M.D.L.J. Adillo, A.L. Ibanez and J.L.I.A. Figueroa, 2005. Variability of tilapia (*Oreochromis spp.*) introduced in Mexico: Morphometric, meristic and genetic characters. *J. Appl. Ichthol.*, 20: 7-10
- Steel, R.G.D., J.H. Torrie and D.A. Dinkkey, 1996. *Principles and Procedure of Statistics: A Biomaterial Approach*, (2<sup>nd</sup> Edition). McGraw Hill Book Co., Singapore

(Received 09 October 2007; Accepted 19 March 2008)