

IMPROVING THE SURVIVAL RATE OF AFRICAN CATFISH, *Clarias gariepinus*

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ABSTRACT

A field study was conducted to alleviate the cannibalism phenomena among the African catfish, *Clarias gariepinus* fry via periodical grading to eliminate the number of jumpers fry. There were significant differences among treatments in favor of T1 (control without grading) at the 4th week. However, the middle frequency of grading (T2: grading each 3 days) realized the best survival rate (SR) of 49.17 % after 4 weeks and the highest fry body weight at the 2nd week. So, with middle labor (grading the newly hatched fry every 3 days) and economic efforts without great stress on the fry, man can elevate the SR by 41 and 27 times than without grading (T1) or grading each 7days (T3), respectively. So, the economic efficacy (from selling the fry) could be improved by the same rate.

Keywords: *Clarias gariepinus* – Fry - Cannibalism – Jumpers – Periodical grading.

INTRODUCTION

Culture of African catfish, *Clarias gariepinus* has received considerable attention since the early 1970s and 1980s (Clay, 1981). These studies confirmed the considerable culture potential of the species. African catfish is a suitable alternative to tilapia in subsistence fish farming in Africa and using low grade feed composed of some local agricultural by-products, the yields of catfish from ponds could be as much as 2.5 times higher than those of tilapia. Hogendoorn (1983) summarized the attributes of this species for culture as it can stand live in the hard conditions like, low dissolved oxygen levels, change of temperature, high levels of water pollution, and have high resistance of diseases. High feed conversion ratios and high growth rate. It grows fast and efficiently. It can culture in the intensive system to increase the fish production. It matures and is easy to reproduce in captivity. It tolerates high densities. It is hardy, and it survives in adverse water quality conditions. Used to control the overcrowding of tilapia. In addition, the purpose of fish culture is to increase the weight of fish in the shortest possible time under economically acceptable conditions (Steffens, 1989). Some problems are facing the wide spreading of catfish culture, e.g. fry cannibalism via jumpers. Therefore, the present research aimed to study the possibility of reducing cannibalism among newly hatched fry by grading.

MATERIALS AND METHODS

The chosen fry (9000, with an initial body weight of 0.38 g) from a part one of the experiment were divided into three treatments. Each treatment has three replicates. Fry were put in 9 hapas, one thousand fry in each hapa. The fry were fed on mach (40 % crude protein, 6.4 % crude fat, 5.23 % crude fiber,

and 4280 kcal/kg gross energy, from Hendrix Egypt, Sharkeia governorate, consisted of 25.2 % fish meal 72%, 21.3 % soybean meal 44%, 13.5 % rice bran, 13.2 % wheat bran, 13.02 % corn gluten 60 %, 10.4 % yellow corn, 1.7 % dicalcium phosphate, 0.7 % lime stone, 0.5 % soy oil, and 0.3 % vitamins and minerals mixture). This part continued for 4 weeks. Average body weight was taken each weak and water quality parameters were measured too. The fry which selected after each grading were removed into a separate hapa.

Treatment 1: without grading.

Treatment 2: grading each 3 days.

Treatment 3: grading each 7days.

Grading technique: it means the separation of the biggest fry from population.

Water quality analysis:

Samples of water from each treatment were taken weekly to determine the values of pH, dissolved oxygen concentration, and temperature degrees (Abdelhamid, 1994; 1996, 2009a and b). Water temperature in degree centigrade was measured by using a thermometer. The pH value of water was measured using an electric digital pH meter model (using Jenway Ltd, model 350-pH meter). Dissolved oxygen was determined weekly using an oxygen meter model (d-5509).

Statistical analysis:

The obtained numerical data were statistically analyzed using SAS (1998) for one-way analysis of variance. comparisons among treatment means were made by using Duncan multiple range test (Duncan, 1955).

RESULTS AND DISSCUSION

Water quality parameters:

Table (1) illustrates the means of water quality criteria measured in the grading ponds from 13/7 till 3/8/2009 including pH values, temperature, and dissolved oxygen (DO) at 6 a.m and 6 p.m, respectively. The values of water parameters are within the acceptable ranges recommended for pisciculture (Abdelhamid, 1996 and 2009b and Abdelhakim *et al.*, 2002). However, the optimum growth of African catfish requires 28 – 30 °C, < 5 ppt salinity, < 15 mg/l dissolved oxygen, 6.5 – 9.0 pH, and 50 – 100 mg/l hardness in the rearing water (Chapman, 2000).

Table (1): Ranges of pH values, temperature (T, °C), and dissolved oxygen (DO, mg/l) registered on the 13th of July till the 3rd of August 2009 in the grading ponds of the different treatments at 6 a.m and 6 p.m.

Treatment No.	pH		T		DO	
	6 am	6 pm	6 am	6 pm	6 am	6 pm
T ₁	7.9 – 8.1	8.1 – 8.5	25.7-28.2	28.0-29.5	3.5 – 4.5	6.2 – 7.1
T ₂	8.0 – 8.2	8.3 – 9.2	26.3-28.1	27.7- 29.8	3.6 – 5.3	6.3 – 7.2
T ₃	7.9 – 8.4	8.4 – 8.9	26.8-28.3	27.3-29.7	3.7 – 6.2	6.1 – 9.2

Body weight and survival rate:

The effect of grading intervals on the average body weight of the African catfish fry as well as on their survival rate (SR) throughout four weeks

was studied in this part of the experiment. Data given in Table (2) and Figure (1) cleared that there were no significant ($P \geq 0.05$) differences among treatments neither in the initial body weight nor at week 1. Yet, there were significant differences among treatments at the following weeks (2, 3, and 4) in favor of T1 (control without grading) at the 4th week because of the low number of fry remained (12 from 1000), since the SR of this treatment was calculated as 1.2 %. However, the middle frequency of grading (T2: grading each 3 days) realized the best SR valued 49.17 % after 4 weeks and the highest fry body weight at the 2nd week. So, with middle labor (grading the newly hatched fry every 3 days) and economic efforts without great stress on the fry, man can elevate the SR by 41 and 27 times than without grading (T1) or grading each 7days (T3), respectively. So, the economic efficacy (from selling the fry) could be improved by the same rate.

Table (2): Data of body weight (g / fry) and survival rate of African catfish fry (means \pm standard errors) as affected by the grading system.

Traits	Treatment			P Value
	T ₁	T ₂	T ₃	
Initial weight	0.38	0.38	0.38	-
AWW ₁	0.49 \pm 0.04	0.51 \pm 0.13	0.45 \pm 0.06	> 0.05
AWW ₂	0.97 \pm 0.03 ^b	1.62 \pm 0.22 ^a	1.32 \pm 0.15 ^{ab}	= 0.06
AWW ₃	1.27 \pm 0.15 ^a	0.73 \pm 0.09 ^b	0.93 \pm 0.15 ^{ab}	= 0.06
AWW ₄	3.07 \pm 0.43 ^a	0.90 \pm 0.15 ^b	0.90 \pm 0.15 ^b	< 0.05
Initial number of fish	1000	1000	1000	-
Final number of fish	12.0 \pm 3.51 ^c	491.7 \pm 24.9 ^a	323.3 \pm 66.7 ^b	< 0.05
SR %	1.2	49.17	32.33	

AWW₁: Average weight after 1st week; AWW₂: Average weight after 2nd week; AWW₃: Average weight after 3rd week; AWW₄: Average weight after 4th week.

a-b: Means with similar superscript letter are not significantly ($P \geq 0.05$) different.

T₁: without grading; T₂: grading each 3 days; and T₃: grading each 7days.

Appelbaum and Kamler (2000) recommended light restriction as a simple, low-cost technique for intensification of production of *C. gariepinus* stocking material. Since in dark, the ratio of total metabolism for body growth was depressed, hence in the dark, energy used for locomotor activity may have been low, leading to sparing energy in growth. So, fish reared in dark were larger than those reared in light. Moreover, Adewolu *et al.* (2008) showed that growth, feed utilization and survival of *C. gariepinus* fingerlings were improved when cultured for 24 h darkness.

Baras and d'Almeida (2001) found that cannibalism in mixed groups was intermediate between those in pure progenies, and was positively correlated ($R^2=0.803$, $P \leq 0.01$) with initial size heterogeneity, irrespectively of fish origin.

During the larval rearing trials for 30 days for African giant catfish, *Heterobranchus bidorsalis*, $\geq 82\%$ survival rates were achieved (Adebayo and Fagbenro, 2004).

However, Coulibaly *et al.* (2006) reported that the main constraint of the culture of the African catfish *Heterobranchus longifilis* is the high mortality

rate due mainly to cannibalism. Results showed that all the parameters (mortality, cannibalism, survival, final weight variation coefficient and feed conversion ratio) were influenced by the stocking densities. Higher average final weight, average daily gain, and survival and lower final weight variation coefficient, cannibalism, mortality, and feed conversion ratio were recorded at the lowest stocking densities (6 and 12 fish/m³).

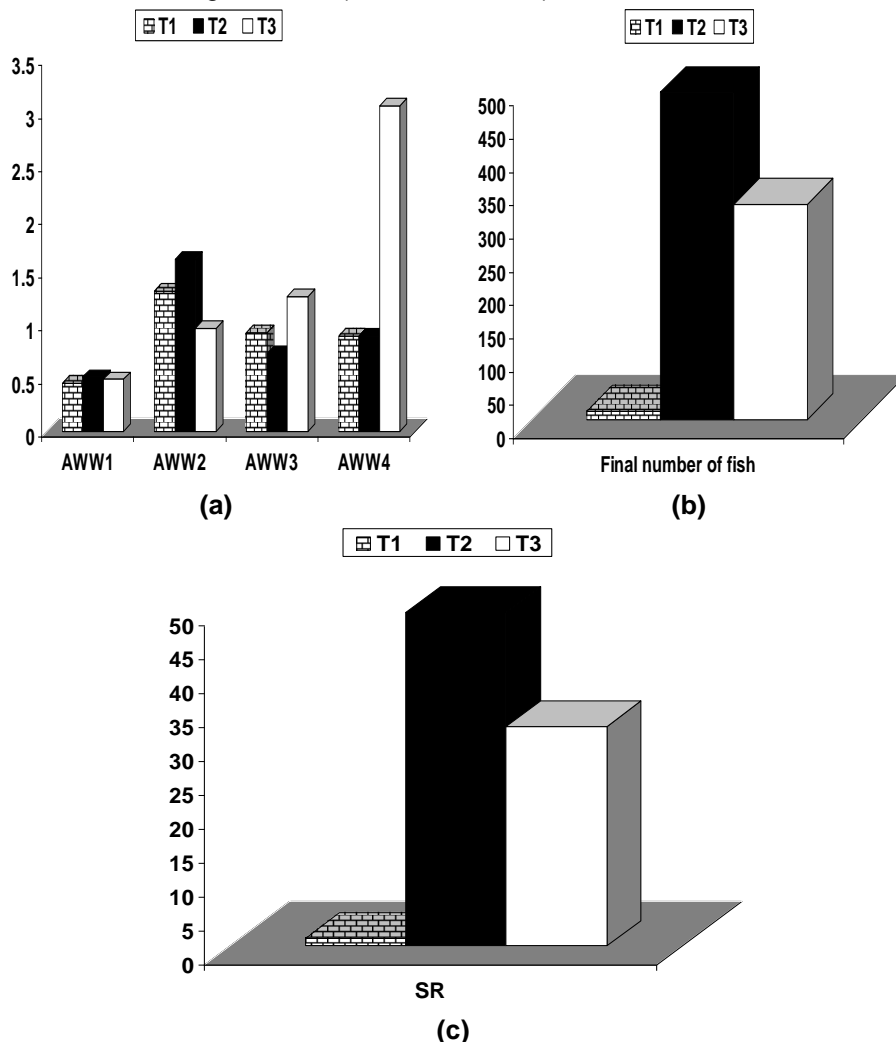


Fig. (1): Data of body weight (g/fry), final number of fish and survivalrate of African catfish fry as affected by the grading system, (a): AWW₁: Average weight after 1st week; AWW₂: Average weight after 2nd week; AWW₃: Average weight after 3rd week; AWW₄: Average weight after 4th week, (b) Final number of fish, (c): SR: Survival rate (%), T₁: without grading; T₂: grading each 3 days; and T₃: grading each 7 days.

Van de Nieuwegiessen *et al.* (2009) mentioned that previous studies on the effects of stocking density on the behavior of African catfish have shown that at low densities, especially directly after restocking of tanks, aggression might increase. This aggression may directly affect the welfare of the fish. In addition, the resulting skin damage may also lead to the release of chemical alarm cues from the skin of the fish, possibly acting as a secondary stressor in a farming situation.

However, El-Gaedy (2009) concluded that the dietary requirements of catfish fry were (40% crude protein and 8% oil) and for fingerlings were (35% crude protein and 8% oil) in terms of growth performance and economic evaluation. So, the diet used in the 2nd experiment of the present study contained 40% crude protein.

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تحسين معدل الحياتية لأسماك القرموط الأفريقي

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تم إجراء دراسة حقلية لخفض ظاهرة الإفتراس بين زريعة القرموط الأفريقي عن طريق التدرج على فترات لخفض عدد الزريعة فائقة النمو. فكان هناك إختلافات معنوية بين المعاملات فى صالح المعاملة (رقم 1) المقارنة فى الأسبوع الرابع، لكن التكرار المتوسط للتدرج (معاملة رقم 2) أى كل 3 أيام قد حققت أعلى معدلات حياتية (49.17%) بعد 4 أسابيع وأعلى وزن جسم للزريعة فى الأسبوع الثانى. لذلك فالعمل المتوسط (تدرج الزريعة حديثة الفقس كل 3 أيام) والجهد الإقتصادى بدون إجهاد كبير على الزريعة قد حقق زيادة فى معدل الحياتية بقدر 41 و 27 مرة أكثر من عدم التدرج أو التدرج كل 7 أيام على الترتيب، ومن ثم يُحسن الكفاءة الإقتصادية (من بيع الزريعة) بنفس المعدلات.

قام بتحكيم البحث

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