UNDER PEER REVIEW

Original Research Article

THE EFFECT OF HAPA ON GROWTH, SURVIVAL AND CONDITION FACTOR OF *CLARIAS GARIEPINUS* FRY IN LARGE VOLUME OF WATER.

ABSTRACT

Fry management in aerated, non aerated aquarium and hapa system were determined in Fish Hatchery of Faculty of Agriculture**,** Shabu Lafia to assess condition factor, percentage survival rate, total body length and percentage weight gain. 200 hatchlings of C.gariepinus fry were put into a 35 x 30 x 15cm aquarium with aerator and without aerator; hapa with aerator and hapa without aerator in 3 replicates. The hapas were made of brown colour plankton net. The fry were fed with 5% of their body weight with Artemia shell free four times daily for the period of sixteen days. Temperature (27.45 ± 0.05^0C), pH (7.56±0.03); Dissolved oxygen (8.20±0.03 mg/L), total alkalinity (15.36±0.03 mg/L) and free carbon dioxide (4.30±0.03 mg/L) monitored in each of water quality parameter of the various treatments was not significantly different from each other. The Percentage weight gain (1117and 1067), percentage survival rate (92.83 and 91.33), total body length(1.07 and 1.07cm) and condition factor (11.99 and 11.44) of C. gariepinus fry in hapa system (aerated and non aerated respectively) are significantly($p<0.05$) higher than those of aquarium in the study although they are not significantly different ($P > 0.05$) from each other. The use of hapa as an improved system for mass production of C. gariepinus fry is highly recommendable in the large body of water.

Key words: aquarium, aerator, fry, hatchlings, hapa.

1. INTRODUCTION

Clarias gariepinus is one of the widely cultivable fish in Nigeria due to acceptability and its resistance to poor water quality. In spite of remarkable success on the hatching of *Clarias gariepinus,* the survival at fry stage is still a limiting factor. This can be attributed to lack of proper awareness and technicality involved in principles of hatchery management especially the problem of ammonia accumulation and fungi from waste food and faecal materials. The fry of *Clarias gariepinus* fish is mass produced in most hatcheries but the percentage survival rate of the fry is low compared to the number of hatchings in every hatchery operation. [1] identified some causes for low and variable survival of *C. gariepinus* in Cameroon as predation (primarily by amphibians and aquatic arthropods) and cannibalism (exacerbated by low food availability). The mortality rate fry is still high even when those listed factors are still in place.

Therefore, there is need for solution to the problem of fry mortality in the hatchery especially in the first two weeks of active live. The uses of Hapa for mass production of *C.gariepinus* fry need to be re examined and re-tested especially when [1] factors are controlled. Nylon or "mosquito" net cages commonly referred to as hapas or net-hapa hatchery/nursery system has been reported to be very efficient for the production of high quality Tilapia fish seeds for stocking ponds [2]. In this study, the efficiency of this hapa system in *C. gariepinus* fry production is examined to

UNDER PEER REVIEW

assess it effect on condition factor, percentage survival rate, total body length and percentage weight gain in sixteen days.

2. MATERIALS AND METHODS

200 hatchlings of *C.gariepinus* fry were put into a 35 x 30 x 15cm aquarium with aerator, without aerator, hapa with aerator and hapa without aerator in 3 replicates. The hapas were made of brown colour plankton net. The fry were fed with 5% of their body weight with Artemia shell free four times daily for the period of sixteen days.

The condition factor, percentage weight gain, total body length (cm), and percentage survival rate were determined as follows:

Condition factor (k) = (weight gain / L^3) x 100

Where L = total length attained during the experiment. [3].

Total body length = final length – initial length at the start of the experiment. [4].

Survival rate (%) = (No. alive after the experiment/Total No. of fry at the start of the experiment) x100

Percentage weight gain = (final weight – initial weight/initial weight) x 100 [5].

The weight were taken during digital sensitive scale while the total length were collected using a tape rule graduated in millimeter and centimeters. Cannibalism was eradicated by feeding the fry adequately and timely. All dead fry were collected and recorded on daily bases just before feeding using siphoning method. Replacement of 2/3 of the water in aquarium was done daily.

Temperature (^{O}C), pH (Hydrogen ion concentration), alkalinity (mgL^{-1}), free Carbon oxide (mg/L) and dissolved oxygen (mL^{-1}) in water used for each treatment were collected in depth of 2cm below the water surface. The methods of [6] were employed for the determination of water quality parameters in this experiment. The data obtained were analyzed using descriptive statistics, analysis of variance and Duncan's multiple range tests for the level of significant difference between means at probability of 0.05.

3. RESULTS AND DISCUSSION

3.1 Water Quality Parameters

Table 1 shows water quality parameters monitored in this study. The temperature for each of the treatment 'Awa', 'Awta', 'Hapwa' and 'Hapwta' in all the treatments were not significantly different ($p>0.05$) from each other. Similar results of insignificant difference were recorded for Carbon dioxide, Total alkalinity, dissolved oxygen and pH throughout the period of the experiment. Results of each treatment were not altered by water parameters in this experiment as they were not significantly different in the treatments and the water was from same source. The average temperature, dissolved oxygen, total alkalinity and carbon dioxide for the various treatments observed in this study were within acceptable range [7].

3.2 Percentage Weight Gain

Results in Figure 1 shows that the percentage weight gain of the *C.gariepinus* fry were not significantly different in the aerated and non aerated hapa. The aerated and non aerated hapa

UNDER PEER REVIEW

systems significantly (P<0.05) had the best weight gain (%) in this experiment. The aerated and the non aerated aquarium were significantly the same in percentage weight gain. Regular changing of (2/3) of the volume of water in the aquarium could have minimize deterioration of the water quality in the culture in aquarium but in mass production of fry, hapa system will lessens effort and inputs with better results compared to aquarium tanks.

3.3 Percentage Survival Rate

The results of percentage survival rate of the experiment are shown in Figure 2. The Hapa system (Hapwta and Hapwa) and aquarium (Awa, Awta) were significantly different from each other (P < 0.05). Although the survival rate of fry was very encouraging and values were very close for the Hapwta and Hapwa (92.83 and 91.33 respectively). Hapwa was not significantly better than Hapwta in large volume of water. In a small volume of water, such as in small tanks there is need of aeration as the dissolved oxygen can be depleted by the fry. In all the results, hapa system, whether aerated or not, stands significantly the best in the production of *C. gariepinus* fry because it take care of ammonia level, predators, and aquatic arthropods which may directly and indirectly affect the fry. The least value of survival rate (%) of fry was in aquarium without aerator because of dissolved oxygen utilization. This is clear indication that additional accessories are needed to run the non hapa system in successful rearing of *C.gariepinus* fry.

3.4 Total Body Length (cm)

The results of the fry total body length during the period of the experiment are shown in Figure 3. Aerated and non aerated hapa were significantly same (P>0.05) and they were significantly (P<0.05) better than the body length of those of aerated aquarium tanks. This also indicated that expected growth in length was also achieved in hapa system of the fry culture.

3.5 Condition Factor

Results of the effects of treatments on the condition factor of the fry are shown in Figure 4. *C.gariepinus* fry in Hapa with aerator (Hapwa) and Hapa without aerator (Hapwta) significantly had the highest condition factor (11.99, 11.44) they were significantly different from other (P<0.05) treatments of the experiment. The least condition factor (8.18) was found in aquarium without aerator and it is not significantly different from the aquaria with aerator. The regular changing of 2/3 of the water daily in the aquarium must have minimized the adverse effect of the non-aeration of the aquarium, hence the non-significant difference recorded. The Hapa system produced a good result because of the large volume of water and the plankton net that allow for the ammonia from waste food and faecal material to go out of the hapa. Holding fry in hapas to protect them from both amphibians and aquatic arthropods decreased mortality by 5.7 per cent and installation of bird-netting over the hapas reduced mortality by 21.7 per cent. [8]. Although the fry were restricted in the same size of 35x30x15cm, the water volume from the surrounding normalizes the water quality in the Hapas. The hapa with aerator yielding significantly the same result (p > 0.05) with hapa without aerator, indicates that in hapa system of large body of water, the naturally, dissolved oxygen can always sustain the given fry. This results show that with or without aeration, the fry can survive in hapa system in a large volume of water.

UNDER PEER REVIEW

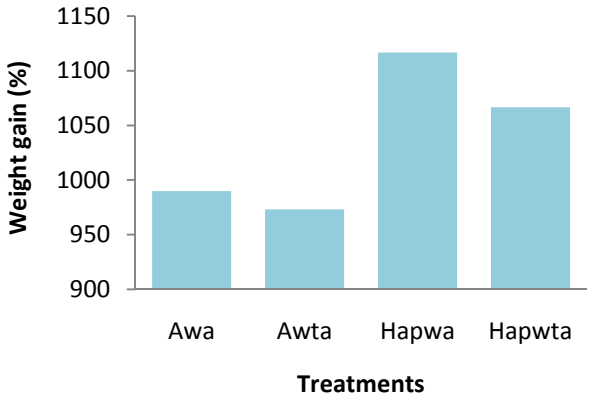

Figure 1: Effect of treatment on weight gain (%) *Clarias gariepinus* fry

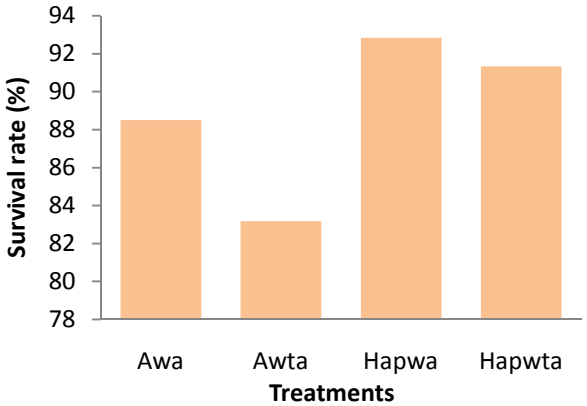

Figure 2: Effect of treatments on survival rate (%) *Clarias gariepinus* fry

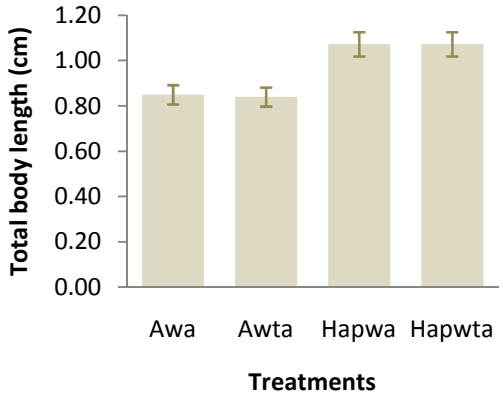

Figure 3: Effect of treatment on total body length (cm) *Clarias gariepinus* fry

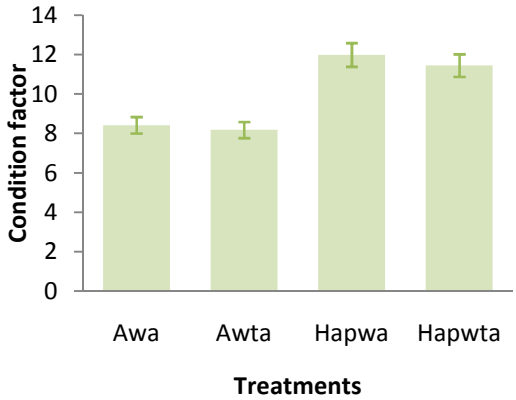

Figure 4: Effect of treatments on condition Factor of *Clarias gariepinus* fry

Awa = Aquarium with aerator, Awta = Aquarium without aerator, Hapwa = Hapa with aerator, Hapwta = Hapa without aerator.

Table 1 Water quality parameters during the period of the study.

Parameter	Awa	Awta	Hapwa	Hapwta
Temperature (^{o}c)	27.43±0.04	27.43±0.06	27.44±0.02	27.43±0.05
PH	7.45±0.02	7.46±0.03	7.47±0.03	7.46±0.03
Total alkalinity (mg-^{1})	15.21±0.03	15.21±0.01	15.21±0.02	15.21±0.03
Dissolved oxygen (mg-^{1})	8.20±0.03	8.21±0.03	8.20±0.03	8.20±0.01
Carbon dioxide (mg-^{1})	4.20±0.01	4.20±0.03	4.20±0.02	4.20±0.03

Awa = Aquarium with aerator, Awta = Aquarium without aerator, Hapwa = Hapa with aerator, Hapwta = Hapa without aerator.

4. CONCLUSION AND RECOMMENDATION

The use of hapa in mass production of *C. gariepinus* fry is significantly better than the aquarium especially in large volume of water body. The Percentage weight gain, percentage survival rate,

UNDER PEER REVIEW

total body length and condition factor of *C. gariepinus* fry in hapa system is significantly higher than those of aquarium studied. The uses of hapa as an improved system for mass production of *C. gariepinus* fry is highly recommendable in the large body of water.

REFERENCES

[1] Nguenga D, Forbin I, Teugles G G, Ollevier F. Predation capacity of tadpoles (*Bufo regularis*) using African catfish *Heterobranchus longifilis* larvae: impact of prey characteristics on vulnerability to predation. Aquaculture Research. 2000; 31:931-936.

[2] Otubusin SO, and Opeloye G. Studies on fish production'using floating bamboo net-cages and hapas in Kainji Lake Basin. Kainji Lake Research Institute Annual Report. 1985; 82 – 87.

[3] Adewolu M A, Ogunsanmi AO, Yunusa A. Studies on growth performance and feed utilization of two *Clarias* catfish and their hybrid reared under different culture systems. *European Journal of Scientific Research vol. 23* No. 2. 2008; pp. 252-260.

[4] Madu C T, Okwuego C C, Madu I D. Optimum Dietary protein level for growth and gonadal maturation of female *Heterobranchus Longifilis* (velenciennes 1840) Brood stock. *Journal of Aquatic Science.* 2003; 18 (18): 29-34.

[5] Odedeyi DO. Survival and growth of hybrid (female) *Clarias gariepinus* (B) and male Heterobranchus *longifilis* fingerlings: Effect of broodstock sizes American-Eurasian *Journal of Scientific Research*. 2007; 2(1): 19-23.

[6] APHA/AWWA/WPCF (American Public Health Association, American Water work Association, Water Pollution Control Federation). Standard methods for the examination of water and waste water, 16th edition, Washington, DC, American Public Health Association. 1995; 1268p.

[7] Adewunmi AA. Catfish culture in Nigeria: prospects and problems. *Aquaculture Research* volume 36 issues. 2009; pp. 479-585.

[8] Sulem SY, Brummett RE. Relative Importance of Various Predators in *Clarias gariepinus* Fry Mortality in Cameroon. NAGA, WorldFish Center Quarterly Vol. 29 No. 3 & 4. 2006; pp74-77