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Effect of sizes of female broodstock on fry survival and condition factors of "*Clariabranchus*" (*Clarias gariepinus* ♀ x *Heterobranchus bidorsalis* ♂)

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Abstract
The effect of sizes of female broodstock on the fry survival and condition factors of "*Clariabranchus"* (*Clarias gariepinus* female X *Heterobranchus bidorsalis* male) was investigated. The experiment was designed into three treatments (I, II, III) representing three weight categories of female broodstock; 900-1000g, 600-700g and 300-400g and was replicated thrice. One male broodstock weighing 2,050g was used to spawn the nine females. The experiment was in two phases, first phase was for two weeks in the in-door hatchery unit where induction was done using Ovaprim and reproductive performance examined; the second phase was for four weeks in the out-door section where growth, condition factor and survival were examined. The result of the experiment showed that Treatment I (900-1000g) had highest survival 50.2(±6.78)% which was significantly superior ($P<0.05$) to treatments II; 26.7(±6.78)%, and III; 19.2(±6.78)%. There was no significant ($P>0.05$) difference between two or more treatments with regards to the condition factor.

Keywords: Sizes of female broodstock, fry survival, condition factor, hybridization and "*Clariabranchus*" hybrid.

1. Introduction
The continuous depletion of fish in the wild inland, brackish and marine waters, consequence of climate change (global warming), flooding, tsunami, siltation, obnoxious fishing methods (plant poison, explosives and dynamites), erosion, over exploitation and the ever increasing world population, has aroused the interest in many countries to look for alternative means to ensure availability of fish and fishery products [8]. Aquaculture of some selected species has proven to be of great potential in solving the aforementioned problem.
The African mud catfish, *Clarias gariepinus* (Family Clariidae) has gained widespread recognition as a promising species in aquaculture production. It is an economically important food fish, cultured primarily in freshwater ponds in tropical countries. *C. gariepinus* exhibits many qualities which makes it suitable for commercial culture. These include its rapid growth rate, hardiness, high disease resistance, high yield potential, high fecundity, air-breathing characteristics and good market potentials [2]. The African catfish, *Heterobranchus bidorsalis,* another Clariid catfish, is also a very important fish speciesused for aquaculture in Africa [9]. This is because of its high feed conversion, wide distribution, easy to culture, resistance to diseases, relatively high tolerance to poor water quality, fast growth rate, larger body size, ability to tolerate highstocking density and very excellent meat quality [9].
The continuous growth of aquaculture is hinged on the production of fish seeds with high fertilization and survival rates, high feed conversion efficiency, and high growth rate among other factors. This kind of seed can be obtained through
genetic manipulation and hybridization. Hybridization is the production of progeny of parents from different lines, strains and species.
The condition factor often referred to as "K" provides information on the wellbeing of a fish and is usually influenced by the fish, sex, season and maturity stage [2]. When fish of a given length exhibits higher weight it means they are in better condition.
The evaluation of biological phenomenon in terms of parental influence is not well understood in many species. Selection of broodstock in African catfish is largely through a disjointed, isolated and occasional effort, unlike in the case of channel catfish (*lctalurus punctatus*

Rafinesque, 1818) [7]. Works by [4] reported increased hatching success with increasing *Clarias gariepinus* female broodstock size. Be it as it may, much has not be done to evaluate the effect of varying female broodstock sizes on the survival and condition factors of "*Clariabranchus"* fry (*Clarias gariepinus* female X *Heterobranchus bidorsalis* male), which will enable fish farmers in the selection of the right broodstock for induced breeding with ease without banking on mere conjectures. Such accurate choice will translate to a high survival rate of the fry all things being equal. This study investigates the survival and growth performance of"*Clariabranchus"* (*Clarias gariepinus* female X *Heterobranchus bidorsalis* male) obtained from varying female sizes in concrete tanks.

2. Materials and Methods

Description of the Study Site

This study was conducted between the period of June to August, 2015 at a reputable Fish Hatchery of Egwenomhe Farms located at 3 Orogun Street, by S and T bus stop, Isihor, Benin City, Edo State.

Procurement of Broodstock

A total of ten (10) healthy broodstocks of both *Clarias gariepinus* (9females) and *Heterobranchus bidorsalis* (1male) was used for this study. The female broodstocks were collected from the Department of Fisheries Farm, Faculty of Agriculture, University of Benin, while the male was sourced from the Nigerian Institute for Oceanography and Marine Research (NIOMR), Sapele station for the breeding operation.

Broodstock Selection

All brood fish were selected by their external morphological characteristics using the method of [11]. These were done through identification of the genital papilla, in males a protruded and reddish genital papilla was seen while in females, a gravid, round, soft and bulging abdomen, or slight swollen with pinkish and protruding reddish genital of two openings was also observed. Also the females were sampled by applying a little pressure in their abdominal area and checking the form and nature of the eggs that were released. The ones with golden green eggs coming out singly showed ripeness and readiness for use, and was selected. Their eggs were also noticed with visible nucleus, "eyed eggs" [11].

Experimental Procedure

The experiment was divided into two broad stages:

- Artificial propagation of fish, using synthetic hormone and raising the fry for 14 days.
- Rearing of the 14 days old fry for another 28 days.

Broodstock Size and Age

The female broodstocks were selected under three (3) size/weight categories; 300-400g, 600-700g, and 900-1000g. All the females were of the same age; 12 months old. The male was over 2 years old and weighed 2050g. Only one (1) single male was used across all treatments.

Artificial Propagation

The broodstocks used for the experiment were conditioned for two weeks in a broodstock concrete tank of dimension 2.7 x 2.2 x 1.25 m^3 and were fed 40% crude protein pelleted feed *ad-libitum* twice daily. The female broodstocks were weighed and induced by injecting Ovaprim, a synthetic hormone at the rate of 0.5 ml / 1000 g body weight. Ovulation occurred at about twelve (12) hours after injection and gentle pressure was applied to the anterior-posterior direction on the abdomen of the female broodstocks to collect the eggs which were counted, weighed and their diameter taken with a digital venier caliper. The milt was obtained by sacrificing the male fish. The testes were removed, mopped with clean towel from stains of blood and water. Milt was collected after dissection of the testes and immediately preserved in 0.9% NaCl solution. Stripped eggs were then fertilized with milt. After about 1min of gentle stirring, fertilized eggs were rinsed in fresh water to remove excess milt spread evenly on the spawning mats to prevent clumping and suffocation of eggs before hatching. Eggs were incubated in concrete tanks (1.5 x 1.45 x 0.92 m^3) containing water with a temperature range of 24-28^{0}C. Three hours later, the translucent eggs containing embryonic eyes were considered fertilized (Hogendoom and Visman, 1980). After 18-24 hours of incubation, the hatching was completed. The viable and dead eggs were determined. The viable eggs were translucent while the non-viable eggs were white and opaque which was carefully removed by siphoning.

The larvae were left for three days in the hatchery tanks to absorb their yolk. After yolk absorption, the post-larvae were fed Gemma wean containing 54% crude protein. They were fed three times daily to satiation (*ad libitum*) at 7:00 – 8:00 am, 1:00 – 2:00 pm and 6:00 – 7:00 pm for fourteen (14) days. Aeration was done continually through a water flow-through system and the water changed regularly to avoid mortality resulting from pollution.

Growth of Fry Weaned on Commercial Feed

After two weeks, 200 weaned fry for each replicate were taken to the out-door section of concrete tanks (4.8 x 1.5 x 1.25 m^3) and fed on multi-feed containing 53% crude protein and 14% fats, the feed was made up of different particle sizes ranging from 0.2 – 0.3mm, 0.3 - 0.5mm and 0.5 - 0.8mm. The fry were fed thrice daily to satiation in each tank. The length and weight of fry stocked were measured with a digital venier caliper and an electronic weighing balance; OHAUS SCOUT PRO (NX – 400g) on weekly basis in each tank and used as growth parameter.

Analytical Procedure

Weight of the broodstock, spawning fecundity, percentage fertilization, and hatchability were recorded for each treatment to determine the fry survival from a given broodstock size category. The length and weight monitored on weekly basis were used to calculate growth parameters such as weight gain, percentage weight gain, increase in length, percentage length, and condition factor, and at the end of the experiment, the survival rate was calculated.

%Fertilization = $\frac{\text{No of fertilized eggs}}{\text{Total no of eggs counted}} \times 100$

%Hatchability= $\frac{\text{No of hatchlings (three days old)}}{\text{Total no of fertilized eggs}} \times 100$

Mean weight gain (g) = Final mean weight (g) - Initial mean weight (g)

Condition Factor (CF) = $\frac{100 \times W}{L^3}$

Where W = Mean final weight of the fish (g),
L = Final total length of the fish (cm) and

Survival Rate (SR)= $\frac{Ni}{N0}$ ×100 Where Ni = total number of fry at the end of the experiment

No = total number of fry breed at the beginning of the experiment

Statistical Analysis
The data obtained were subjected to one way analysis of variance (ANOVA) to determine significant differences among treatments and the treatment means were separated by Duncan's Multiple Range Tests (DMRT) at 5% probability level. Computer analysis was carried out using the GenStat Eight Edition (GenStat, 2005) Release 8.0 version for windows.

3. Results and Discussion
The percentage fertilization between all the treatments showed a significant difference and also supports relative fecundity which invariably related positively to the weight of fish. On the other hand, there was no significant difference between the treatments as regards % hatchability. Though [3] had recorded positive correlation with fecundity, egg weight, fertilization, weight of female and hatchability. The result of this study is different from the observation of [5] on Vendace (*Coregonus albula*) which reveals that smaller broodstock had increased hatchability compared to larger ones.

Mean weight gain
The mean weight gain showed a significant difference between the treatments with treatment II having the highest value of 1.11 ± 0.08. This shows that medium sized brood stocks are best for faster weight gain all things being equal.

Table 1: Mean weight gain of "*Clariabranchus"* fry weaned on commercial feed (Multi-feed) for 4 weeks in the outdoor section.

			Time (weeks)		
Treatments	**1**	**2**	**3**	**4**	**Mean ***
I	0.332	0.164	0.233	0.699	0.36^c(±0.08)
II	0.455	0.458	0.812	2.700	1.11^a(±0.08)
III	0.366	0.254	0.663	1.031	0.58^b(±0.08)
Mean **	0.38^{bc}(±0.09)	0.29^b(±0.09)	0.57^c(±0.09)	1.48^a(±0.09)	

Note: Means with different alphabetic remarks are significantly different as 5% probability level.
* Horizontal comparison only ** Vertical comparison only.

Percentage weight gain
The percentage weight gain showed no significant difference between the treatments. This is in contrast to the work of [1] who observed an inverse relationship between stocking density and daily average increase in weight of *C. gariepinus*. Hence, the higher mean weight of treatment II may be attributed to its lower survival rate which invariably translates to lesser fish number per square metre when compared to treatment 1 with a higher survival rate and lower mean gain

Table 2: Percentage weight gain of "*Clariabranchus"* fry weaned on commercial feed (Multi-feed) for 4 weeks in the outdoor section

			Time (weeks)		
Treatments	**1**	**2**	**3**	**4**	**Mean ***
I	539	41	41	88	177^a(±38.6)%
II	403	76	78	146	176^a(±38.6)%
III	319	53	91	79	135^a(±38.6)%
Mean **	420^b(±44.6)%	57^a(±44.6) %	70^a(±44.6) %	104^a(±44.6)%	

Note: Means with different alphabetic remarks are significantly different as 5% probability level. * Horizontal comparison ** Vertical comparison only.

Condition factor (K)
The condition factor showed no significant difference among the treatments at the final stage of the experiment. The condition factor values of > 1.00 gotten shows that the fishes were in good health condition. This is also better and higher than values recorded by [2] for *C. gariepinus* fingerlings. The reason for the higher condition factor values in this study is attributed to the fact that "*Clariabranchus"* performs better than *C. gariepinus* in terms of growth (length and weight gain).

Table 3: Condition factor (K) of "*Clariabranchus"* fry after 4 weeks in the outdoor section.

		Treatments *	
Parameters	**I**	**II**	**III**
Initial condition factor (Ki)	8.17^a(±0.57)	9.55^a(±0.57)	11.12^b(±0.57)
Final condition factor (Kf)	1.01^a(±0.01)	1.14^a(±0.01)	1.28^a(±0.01)

Note: Means with different alphabetic remarks are significantly different as 5% probability level.*: Horizontal comparison only.

Survival rate (SR)
There was a significant difference in the survival rate across the treatments and this correlates positively to the weight of the fish as can be seen with treatment I having the best (50.20 ± 6.78%) survival rate. Similar result was recorded by [10] where survival of 52.30 ± 0.41% was gotten for "*Clariabranchus"*. [6] reported a lower survival rate of 40.00 ± 0.58% of "*Clariabranchus"*.

Table 5: Survival rate (SR) of "*Clariabranchus"* fry after 4 weeks in the outdoor section.

		Treatments *	
Parameter	**I**	**II**	**III**
Survival rate	50.2[a](±6.78)%	26.7[b](±6.78)%	19.2[b](±6.78)%

Note: Means with different alphabetic remarks are significantly different as 5% probability level.*: Horizontal comparison only.

4. Conclusion and Recommendations

This study has shown that the survival of hybrid "*Clariabranchus"* (*Clarias gariepinus* female X *Heterobranchus bidorsalis* male) fry are best when large size (900g - 1000g) female broodstock are used and the condition factor is non-dependent on any size category of the female broodstock but on good feeding and management practices. Therefore it is recommended that large size (900g - 1000g) female broodstock should be used in the hatchery production of hybrid "*Clariabranchus"* (*Clarias gariepinus* female X *Heterobranchus bidorsalis* male) fry in order to achieve the highest survival rate as fish fry and fingerlings are sold in number.

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