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Growth Performance and Survival of the Progenies of Clarias gariepinus Broodstock from the Three Different Ecological Zones

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Abstract

Fish hybridization is considered as one of the major breeding strategies that have been used to improve and reproductive and growth performance. The demand for high-quality fish seed in Nigeria is very high, which is affecting the production of fish through aquaculture. This study evaluated the growth performance and survival of the progenies of *C. gariepinus* broodstock from the three different ecological zones: Gombe (GM), Jos (JJ), and Yola (YY). Hatchlings were maintained indoor in culture tanks, and were fed three (3) times daily *ad libitum* for a period of 56 days (8 weeks), waste and uneaten feed were removed via siphoning every day. The hatchlings were randomly collecting from each experimental unit, the length in centimeters and weight in gram were measured and the average were recorded. Growth performance showed that the pure strain ♂GM×♀GM had the highest final weight, weight gain, daily weight gain, and specific growth rate, (9.46±2.77, 8.93±2.92, 0.16±0.04 and 8.52±0.32) while the hybrid ♂JJ×♀YY recorded the highest length gain. The highest survival rate was observed in ♂GM×♀YY (55%) and least (21.6%) in ♂GM×♀GM crosses respectively. Physicochemical parameters remained within acceptable ranges for catfish culture. The study concludes that GM strains have better Growth performance. Ecological origin also influences Growth performance and survival of fish, and strategic intraspecific hybridization can improve seed viability in *C. gariepinus*.

Keywords: *Clarias gariepinus,* Progenies, Growth performance, Survival Rate, Ecological zones.

Introduction

Aquaculture is rapidly expanding worldwide, producing affordable source of good quality protein from animal sources in many developing countries, including Nigeria (Uno *et al*., 2025). Fish is one of the essential and cheapest sources of animal protein; however, inadequate supply and low availability make the consumption rate low (Idris *et al*., 2018). Culturing of African Catfish (*Clarias gariepinus*) has started since the early 1970s in central and western African countries and is widely accepted because of its suitability for aquaculture and its high economic value (Awe, 2017). In

Nigeria, the culture of *C. gariepinus* has become a dominant enterprise due to the species fast growth rate, high feed conversion efficiency, broad environmental tolerance, and consumer preference (Food and Agricultural Organization, 2022). Broodstock source from different zones or locations with different strains of *C. gariepinus* will enhance the production, survival rate, feed conversion ratio, high growth rate and disease resistance (Sule and Adikwu, 2023). Intraspecific hybridization improves reproductive performance, high growth rate and survival of hybrids of African catfish (Tilahun *et al.,*2016). This approach leads to the development of improved strains or hybrids with higher reproductive output and faster growth rates. The combine desirable characteristics from one species to another to improve the genetic quality of parental stock with respect to fast growth, high percentage survival, resistance against unfavourable environment and diseases (Yisa *et al*. 2017).

MATERIAL AND METHODS

Study Area

The research was carried out in the fish hatchery unit, Teaching and Research farm, Department of Fisheries, Modibbo Adama University Yola, Adamawa State, Nigeria. Modibbo Adama University is located on latitude 9.209.330 longitude 12.30 – 12.500E and an altitude of 185.9m. The area receives an average annual rainfall of approximately 759 mm and experiences a maximum temperature of about 39.7 °C. The rainy season generally extends from May to October, while the dry season begins in November and continues until April. January and February are usually the driest months of the year, during which relative humidity can fall to as low as 13%. (Canback Global Income Distribution Database, 2014).

Collection and Transportation of Broodstock

Matured and gravid *C. gariepinus* were collected from artisanal fishermen along the landing site of Lake Geriyo, Upper River Benue, Adamawa State, Dadin Kowa Dam located in Gombe State and Pandam Lake in Jos, Plateau State. Gravid females were identified by their swollen and reddish genital openings, whereas gravid males were selected based on the presence of reddish, pointed genital papillae (Onyia et al., 2021). The selected broodstock was transported from the sampling locations to the experimental site in 25-L jerrycans. Upon arrival, the fish were allowed to acclimatize and were subsequently maintained in a concrete pond under suitable conditions. The broodstock was fed twice daily throughout the conditioning period.

Experimental Design

In this study, completely randomized design was adopted for the experiments. The Crosses served as treatment (YY♂xYY♀, YY♂xGM♀ YY♂xJJ♀, GM♂xYY♀, GM♂xGM♀, GM♂xJJ♀, JJ♂xYY♀, JJ♂xGM♀ and JJ♂x JJ♀) that comprise nine treatments with three replicates each. Twenty-seven plastic bowls (25 litres water capacity) were used for the experiment.

Management of Hatchlings

Fish were maintained indoor in culture tanks, and were fed three (3) times daily *ad libitum* for a period of 56 days (8 weeks) (Onyia *et al*., 2021). Waste and uneaten feed were removed via siphoning every day.

Determination of Growth Parameters

The weight of fish for each experimental unit was measured using electronic kitchen weighing scale calibrated and length were measured using ruler in centimeters (cm). The weight and the length of hatchlings were measured at seven days intervals. Five (5) fish randomly collecting from each experimental unit, the length in centimeters and weight in gram were measured and the average were recorded.

Weight gained (WG).

Weight gain of hatchlings at the end of this research was calculated according to Adewolu *et al.* (2010) as shown below.

Weight gain (WG) = $W_2 - W_1$

Where W1 = initial mean body weight.

W2 = final mean body weight.

Daily Weight Gain (DWG)

$$DWG = \frac{W2-W1}{t}$$

Where W1 = initial mean body weight.

W2 = final mean body weight.

T = time (days)

Specific growth rate (SGR)

$$\text{Specific growth rate (SGR)} = \frac{\ln(W2) - \ln(W1)}{T} \times 100$$

Where W_1 = Initial weight,

W_2 = Final weight,

ln = Natural log to base e,

T = Experimental period (days)

Determination of Water Quality Parameters

Water samples were collected using water sampling bottles. The bottles were dipped into the culture system and cover under the water when filled (Onyia et al., 2021). The physicochemical parameters (Temperature, Dissolved Oxygen and pH) were tested and recorded with the following equipment: Temperature was measured using clinical thermometer, Dissolved Oxygen was measured using DO meter and pH were measured using pH meter.

Statistical Analysis

Data for growth and survival (8 weeks) were analyzed using one-way analysis of variance (ANOVA), the means were separated using Duncan's Multiple Range Test (DMRT).

Growth parameter of Clarias gariepinus from three different ecological zone and their hybrids.

The growth performance in term of weight and length differentials are presented in Table 3. The highest final weight (9.46±2.77), weight gain (8.93±2.92) and daily weight gain (0.16±0.04) were recorded in Purebred of ♂GM×♀GM while lowest were recorded in hybrids of ♂GM×♀YY with (5.05±0.87), (4.98±0.87) and (0.07±0.05) respectively and the values varied significantly($P<0.05$) across the genetics crosses. However, the final length and length gain were found higher (8.83±0.82 and 7.56±0.73) in hybrids of ♂JJ×♀YY, while ♂YY×♀GM recorded the lowest (7.90±0.26 and 6.80±0.26) of final length and length gain respectively. The growth performance (in length) showed significant different at ($P<0.05$). Interestingly, pure bred ♂GM×♀GM had the highest SGR of (8.52±0.32) and ♂JJ×♀JJ recorded the least (6.60±0.14). the highest survival rate was observed in ♂GM×♀YY (55%) and least (21.6%) in ♂GM×♀GM crosses respectively.

Table 1: Growth parameter of *Clarias gariepinus* from three different ecological zone and their hybrids.

Genetic Crosses	Initial weight (g)	Final weight (g)	Weight gain (g)	Daily weight gain (g)	Initial length (cm)	Final length (cm)	Length gain (cm)	Specific growth rate	Survival rate (%)
♂**GM**×♀**GM**	0.08±0.01^{bc}	9.46±2.77^{a}	8.93±2.92^{a}	0.16±0.04^{a}	1.13±0.15^{a}	8.16±0.35^{a}	7.03±0.41^{a}	8.52±0.32^{a}	21.66±5.77^{b}
♂**JJ**×♀**JJ**	0.13±0.04^{a}	5.22±1.20^{c}	5.08±1.16^{c}	0.09±0.01^{cd}	1.36±0.15^{a}	8.16±0.57^{a}	6.80±0.10^{ab}	6.60±0.14^{c}	36.66±14.82^{ab}
♂**YY**×♀**YY**	0.08±0.01^{bc}	5.80±0.66^{bc}	5.72±0.07^{bc}	0.10±0.01^{c}	1.16±0.25^{a}	7.93±0.51^{a}	6.76±0.16^{ab}	7.64±0.21^{b}	43.33±7.63^{ab}
♂**GM**× ♀**JJ**	0.13±0.01^{a}	6.46±2.77^{bc}	6.32±2.75^{b}	0.11±0.04^{b}	1.13±0.11^{a}	8.50±0.81^{a}	7.36±0.73^{a}	6.96±0.20^{bc}	30.00±13.22^{ab}
♂**GM**×♀**YY**	0.07±0.007^{c}	5.05±0.87^{d}	4.98±0.86^{d}	0.08±0.01^{cd}	1.06±0.19^{a}	8.23±0.25^{a}	7.16±0.23^{a}	7.63±0.05^{b}	55.00±15.00^{a}
♂**JJ**×♀**GM**	0.13±0.05^{a}	6.13±0.69^{b}	5.99±0.75^{bc}	0.07±0.05^{d}	1.10±0.17^{a}	7.93±0.15^{a}	6.83±0.28^{ab}	6.87±1.30^{c}	38.66±12.58^{ab}
♂**JJ**×♀**YY**	0.12±0.02^{ab}	6.03±0.62^{b}	5.90±0.65^{bc}	0.10±0.01^{c}	1.26±0.05^{a}	8.83±0.83^{a}	7.56±0.73^{a}	6.99±0.23^{bc}	31.66±10.42
♂**YY**×♀**GM**	0.11±0.01abc	6.60±1.55^{b}	6.64±1.36^{b}	0.11±0.02^{b}	1.10±0.17^{a}	7.90±0.26^{a}	6.80±0.26^{ab}	7.33±0.22^{b}	51.66±24.66^{a}
♂**YY**×♀**JJ**	0.12±0.003^{abc}	6.76±2.68^{b}	6.64±2.68^{b}	0.11±0.04^{b}	1.10±0.17^{a}	8.33±0.58^{a}	7.13±0.68^{a}	7.19±0.29^{b}	31.66±10.40^{ab}

Values with corresponding superscript in the same column are not significantly different (P <0.05)

Weekly mean growth performance in (weight and length) of *Clarias gariepinus* from three different Eco-zones.

The weekly mean growth performance (in weight) of *C. gariepinus* is presented in table 4. The highest weight in week 1 were found in hybrids of ♂**JJ**×♀**GM** (0.213±0.01) and pure breed of ♂**JJ**×♀**JJ** (0.210±0.000), while pure bred of ♂**GM**×♀**GM** (0.159±0.005). in week 2, hybrids of ♂**JJ**×♀**GM** recorded the highest weight (0.313±0.04) and ♂**YY**×♀**JJ** has the lowest (0.242±0.15). Interestingly,

♂**JJ**×♀**GM** also had the highest (0.695±0.06) weight in week 3, while ♂**JJ**×♀**JJ** recorded the lowest weight (0.293±0.02). However, purebred ♂**GM**×♀**GM** had the highest (1.326±0.20) weight in the fourth week and lowest (0.786±0.09) found in ♂**GM**×♀**JJ.** In the fifth week, ♂**GM**×♀**GM** and ♂**GM**×♀**JJ** recorded the highest (2.512±0.43) and lowest (1.630±0.09) respectively. In week 6, ♂**GM**×♀**YY** recorded the highest (3.840±1.48) while ♂**YY**×♀**JJ** recorded the lowest (2.915±0.30) and there was significant different. Purebred ♂**GM**×♀**GM** in seventh week had the highest weight with 6.573±0.32 and hybrid ♂**GM**×♀**YY** had the lowest weight 4.202±0.31. Finally, in week 8, Purebred ♂**GM**×♀**GM** also has the highest weight (9.356±2.37) and ♂**GM**×♀**YY** had the lowest weight (5.034±1.01). The results showed that fish weight varied significantly ($p<0.05$) across the genetic crosses.

The Weekly mean growth performance in length of *C. gariepinus* from three different Eco-zones is shown in Table 5. The results revealed that the highest growth in length (2.13±0.20) was recorded in purebred ♂**JJ**×♀**JJ** in the first week while lowest was recorded in ♂**YY**×♀**JJ** (1.63±0.11) and there was significant differences($P<0.05$) across the crosses. In week 2, ♂**YY**×♀**YY** had the highest (2.76±0.20) length and the lowest (2.40±0.17) was recorded in pure bred of ♂**JJ**×♀**JJ.** However, ♂**JJ**×♀**YY** in week 3 had the highest length (4.03±0.15) while ♂**JJ**×♀**GM** had the lowest (3.50±0.49) respectively. In week four, ♂**GM**×♀**GM** recorded the highest (5.80±0.20) length and ♂**JJ**×♀**GM** had the lowest (4.03±0.15). In the fifth week, the highest length (6.63±0.20) was recoded in ♂**YY**×♀**GM** while ♂**JJ**×♀**YY** had the lowest (5.60±0.80). ♂**JJ**×♀**GM** recorded the highest and ♂**JJ**×♀**YY** recorded the lowest (6.43±0.20 and 5.96±0.20) in week 6 respectively. In week seventh, purebred ♂**JJ**×♀**JJ** had the highest length (7.80±0.36) and ♂**GM**×♀**JJ** had the lowest (6.96±0.56) and there was significant different. In week 8, ♂**JJ**×♀**YY** had the highest (8.83±0.83) and lowest (7.90±0.26) was recorded in ♂**YY**×♀**GM** and there were significant differences in length across the genetic crosses.

Table 2. Weekly mean growth performance in weight of *Clarias gariepinus* from three different Eco-zones

Genetic Crosses	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
♂**GM**×♀**GM**	0.156±0.005^{c}	0.273±0.03^{abc}	0.526±0.07^{b}	1.326±0.20^{a}	2.512±0.43^{a}	3.740±0.70^{a}	6.573±0.32^{a}	9.356±2.37^{a}
♂**JJ**×♀**JJ**	0.210±0.000^{a}	0.293±0.02^{ab}	0.293±0.02^{c}	1.129±0.15^{ab}	1.889±0.35^{ab}	3.245±0.78^{a}	5.477±1.08^{abc}	5.228±1.20^{c}
♂**YY**×♀**YY**	0.186±0.03^{ab}	0.252±0.02^{bc}	0.550±0.02^{b}	1.211±0.01^{ab}	2.191±0.33^{ab}	3.513±0.32^{a}	5.043±0.74^{abc}	5.790±0.67^{bc}
♂**GM**× ♀**JJ**	0.180±0.01^{bc}	0.273±0.005^{abc}	0.426±0.03^{b}	0.786±0.09^{c}	1.630±0.09^{b}	3.290±0.45^{a}	4.832±1.16^{bc}	6.462±2.77^{b}
♂**GM**×♀**YY**	0.103±0.005^{b}	0.285±0.02^{abc}	0.538±0.01^{b}	1.088±0.19^{b}	1.966±0.53^{ab}	3.840±1.48^{a}	4.202±0.31^{c}	5.034±1.01^{c}

♂**JJ**×♀**GM**	0.213±0.01^{a}	0.313±0.04^{a}	0.695±0.06^{a}	1.074±0.07^{b}	1.966±0.38^{ab}	3.508±0.20^{a}	5.990±0.58^{ab}	6.136±0.69^{b}
♂**JJ**×♀**YY**	0.166±0.02^{bc}	0.293±0.14^{ab}	0.540±0.01^{b}	1.022±0.95^{b}	1.979±0.38^{ab}	3.023±0.25^{a}	5.173±0.90^{abc}	6.031±0.62^{b}
♂**YY**×♀**GM**	0.208±0.007^{a}	0.265±0.008^{bc}	0.475±0.05^{ab}	1.145±0.10^{ab}	2.244±0.58^{ab}	3.328±0.12^{a}	5.605±1.16^{abc}	6.608±1.35^{b}
♂**YY**×♀**JJ**	0.191±0.003^{ab}	0.242±0.15^{c}	0.524±0.09^{b}	0.992±0.04^{bc}	1.841±0.29^{ab}	2.915±0.30^{a}	5.217±0.19^{abc}	6.734±2.72^{bc}

Values with corresponding superscript in the same column are not significantly different (P <0.05)

Table 3. Weekly mean growth performance in length of *Clarias gariepinus* from three different Eco-zones

Genetic Crosses	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
♂**GM**×♀**GM**	1.73±0.25^{a}	2.73±0.40^{a}	4.00±0.00	5.80±0.20^{a}	6.36±0.45^{ab}	6.26±0.61^{a}	7.13±0.88^{d}	8.16±0.36^{a}
♂**JJ**×♀**JJ**	2.13±0.20^{a}	2.40±0.17^{a}	3.86±0.11^{abc}	4.90±0.52^{b}	5.63±0.30^{b}	6.26±0.20^{a}	7.80±0.36^{a}	8.16±0.57^{a}
♂**YY**×♀**YY**	1.80±0.26^{a}	2.76±0.20^{a}	3.93±0.05^{abc}	5.86±0.05^{a}	6.26±0.15^{ab}	6.50±0.20^{a}	7.06±0.55^{g}	7.93±0.15^{e}
♂**GM**× ♀**JJ**	1.70±0.36^{a}	2.56±0.05^{a}	3.63±0.05^{bc}	4.03±0.15^{c}	5.73±0.05^{b}	6.00±0.26^{a}	6.96±0.56^{h}	8.50±0.81^{b}
♂**GM**×♀**YY**	1.66±0.32^{a}	2.73±0.20^{a}	4.10±0.10^{ab}	5.30±0.45^{ab}	5.70±0.17^{b}	6.00±0.26^{a}	7.13±0.35^{d}	8.23±0.15^{d}
♂**JJ**×♀**GM**	1.86±0.40^{a}	2.70±0.17^{a}	3.56±0.49^{c}	5.46±0.23^{ab}	5.70±0.36^{b}	6.43±0.20^{a}	7.50±0.43^{c}	7.93±0.15^{e}
♂**JJ**×♀**YY**	2.00±0.60^{a}	2.66±0.20^{a}	4.03±0.15^{a}	5.10±0.36^{b}	5.60±0.80^{b}	6.00±0.45^{a}	7.10±0.96^{f}	8.83±0.83^{a}
♂**YY**×♀**GM**	1.83±0.28^{a}	2.66±0.49^{a}	3.83±0.11^{abc}	5.26±0.55^{ab}	6.63±0.20^{a}	6.60±0.26^{a}	7.26±0.41^{e}	7.90±0.26^{f}
♂**YY**×♀**JJ**	1.63±0.11^{a}	2.66±0.23^{a}	3.86±0.15^{a}	5.03±0.20^{b}	5.93±0.89^{ab}	5.96±0.20^{a}	7.60±0.45^{b}	8.33±0.58^{c}

Values with corresponding superscript in the same column are not significantly different (P <0.05)

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Mean physicochemical parameters from each experimental Treatments

The physicochemical parameters of the experimental treatments were shown in Table 6. The Temperature recorded from the experimental treatment's ranged between 29.8^{0}C to 30.6^{0}C, dissolved Oxygen were measured between 3.57 to 5.03mg/l pH between 6.83 to 7.14 and there was no significant different at $p<0.05$ level of significant.

Table 4. Mean physicochemical parameters from each experimental Treatments

Genetic crosses	Temperature	Dissolved Oxygen	pH
♂GM×♀GM	30.6±0.56^a	5.02±0.03^a	6.83±0.11^a
♂JJ×♀JJ	29.9±0.17^a	5.03±0.02^a	6.83±0.18^a
♂YY×♀YY	29.8±0.43^a	5.06±0.05^a	7.14±0.21^a
♂GM× ♀JJ	30.3±1.11^a	4.57±0.66^a	6.89±0.02^a
♂GM×♀YY	30.1±0.01^a	4.81±0.28^a	6.88±0.23^a
♂JJ×♀GM	30.0±0.03^a	4.54±012^a	6.89±0.18^a
♂JJ×♀YY	30.1±0.11^a	4.36±1.14^a	6.89±0.07^a
♂YY×♀GM	30.2±0.54^a	4.27±0.80^a	7.17±0.13^a
♂YY×♀JJ	30.3±0.05^a	4.83±0.29^a	7.12±0.05^a

Mean in the same column with different superscript are significantly different ($P<0.05$)

DISCUSSION

Growth Performance of Offspring of *Clarias gariepinus* from Three Ecological Zones

The final weight, weight gain, daily weight gain and specific growth rate were significantly higher in pure bred ♂GM×♀GM than other genetic crosses. This agreed with the findings of other previous authors. Ataguba *et al*. (2009) and Ndimele and Owedeinde (2012) where pure bred of *C. gariepinus* performed better than hybrid in terms of growth parameters. This pattern suggested that the GM strain possesses superior growth potential under hatchery condition, likely as a result of better genetic quality, feed utilization efficiency and adaptation to the culture environment. Onyia *et al*. (2021) revealed that fish growth correlates with its feed intake, other factors such as genetic makeup of the parent, hormonal heredity, water quality and internal physiological status equally determines the growth rate of the fish.

Similarly, Otoh *et al*. (2025) and Ataguba *et al*. (2010) reported that growth performance among catfish crosses varied widely on the compatibility of the parental line and some hybrid crosses may exhibit hybrid depression particularly at early stage of development. The highest growth parameters recorded in pure bred from this study was not in agreement with the findings of Onyia *et al*. (2021) and Ishaku *et al*. (2022) that recorded highest growth parameters (final weight, weight gain and specific growth rate) in hybrid compared to pure breeds.

The least weight performance of ♂GM×♀YY in the present study may be attributed to genetic incompatibility, reduced growth efficiency, or maternal effects influencing early feeding response and physiological development. Ataguba *et al*. (2010) reported reduction in growth performance of fish

may indicate the occurrence of hybrid depression. Additionally, maternal effects may have contributed to the observed difference, since egg quality, yolk reserve and early larval vigor strongly influence early growth performance in fish (Gjedrem and Robinson, 2014).

The present study revealed that the highest final length and length gain were recorded in the hybrid ♂JJ×♀YY. The significant differences observed in length traits suggest that linear growth responded differently to genetic crossing compared to weight gain. This indicated that some hybrids may possess enhanced skeletal or morphometric development without corresponding improvement in body mass. This is in agreement with the findings of Ishaku *et al*. (2022) who reported highest (final weight and weight gain) in hybrids of NB♂×YY♀ and highest (final length and length gain) in pure breed of NB♂×NB♀. This study also supported earlier reports that growth trait such as length and weight may not always correlate strongly in fish, especially at early developmental stages (Dunham, 2011). The improved length performance of ♂JJ×♀YY suggests possible heterosis for linear growth in this hybrid group.

The highest survival rate was recorded in the hybrid of ♂GM×♀YY, whereas the pure bred ♂GM×♀GM had the lowest despite its superior growth performance. This could possibly be a trade-off between rapid growth and survival, particularly at the hatchling stage. Ataguba *et al*. (2010) and Dunham (2011) reported that fast growing fry often establish dominance, leading to increased aggression and cannibalistic behavior which significantly reduces survival. The highest survival recorded from this study in hybrids agree with the findings of Onyia *et al*. (2021) who reported that hybrids had the highest percentage survival meanwhile pure bred had the least survival. Similarly, Diyaware and Onyia (2014) recorded high survival across the hybrid crosses compared to pure bred. The high survival recorded can be attributed to the management practice during the process of rearing, handling and adaptation to the environment. This is in agreement with Uruku and Abur (2023), that reported that the survival rate of hatchlings could be related to its growth adaptability to the environment. Tilahun *et al*. (2016) concluded that the survival of hybrids was heavily correlated to the maternal parent stocks.

5.4 Mean physicochemical parameters from each experimental Treatments

Physicochemical parameters are critical in the physiology, reproduction and growth of fish and all other aquatic organisms (Amachree *et al*., 2018). In the present study, the physicochemical parameters measured showed slight differences among the treatments. Although, these values generally fall within the acceptable range for the culture of *C. gariepinus*. The water physicochemical parameters in this study were within the acceptable ranges recommended for hatchery of African catfish as reported by Alabi and Ocholi, (2019). According to Ukwe and Abu, (2016) and Akombo *et al*. (2018), physicochemical parameters especially DO play important role in the physiological development, reproductive performance, growth, survival and general well-being of all aquatic organisms including fish.

Temperature is a key factor that affects their metabolic rate, feeding behavior and survival. This assertion agrees with previous studies on the physiology of *C. gariepinus* (Viveen *et al*., 1985 and Imam *et al*., 2019). The dissolved Oxygen (DO) values are crucial in supporting normal growth stages of fish. The DO obtained from this study was within the acceptable limit for growth and survival of hatchlings, this agrees with the findings of Pronob-Das *et al*., (2011) who revealed that DO level >

4mg/l is good for fish growth and survival. Imam *et* al. (2019) also stated that growth and reproduction of fish is optimum at DO of 5mg/l, above 5mg/l almost all aquatic organism can survive. Low DO levels often result in poor growth and mortality. Low DO level can be lethal, resulting in acute fish anoxia leading to retarded growth, retardation of embryo, juveniles and electrical mortality (Imam *et al*., 2019). The pH values recorded (6.63–7.34) has no effects to the experimental organism as it falls within the recommended pH range for fish survival. This is in agreement with Imam *et al.* (2019) which stated that the suitable pH range for fish culture is between 6.7 and 9.5 and ideal pH level range between 7.5–8.5.

Conclusion

The study was designed to determine of survival and growth performance of the progenies from three different ecological zone. The results showed that pure bred ♂GM×♀GM performed better in terms of growth performance and showed that this strain may be genetically more suited for faster biomass accumulation under hatchery rearing conditions. The highest survival rate was recorded in the hybrids of ♂GM×♀YY. In conclusion, this study demonstrated that both broodstock origin and selective crossing can be applied strategically to improve seed production, survival, and growth in African catfish.

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