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COMPARATIVE REPRODUCTIVE PERFORMANCE OF STRAINS OF *Clarias gariepinus* FROM TWO DIFFERENT HYDROLOGICAL ZONES OF NIGERIA

*** Modu, A.B.[1], Onyia, L.U.[2], Mohammed, A.M.[3], Gadaka, Y M [4]**

1. Alhaji Bukar Modu, Department of fisheries technology, Yobe State College of Agriculture, science and technology Gujba
2. Lucky Uche Onyia, Department of Fisheries, Modibbo Adama University Technology, Yola
3. Mohammed Abubakar Mohammed, Department of Fisheries and Aquaculture, Federal University wukari
4 Mohammed Yakubu Gadaka, Yobe state College of agriculture, science and technology Gujba.
Corresponding Author: alhajibukarmodu@gmail.com

ABSTRACT

This study was conducted between June and August 2019, to compare reproductive and growth performance of wild strains of Clarias. gariepinus from two different hydrological zones of Nigeria, (Lake Chad and Benue-Niger). Collection of broodstock for the study was made from Lake Geriyo, Adamawa state potion of upper River Benue and Nguru Lake of Yobe State. The fish were conditioned, fed and spawned in the Department of Fisheries Teaching and Research Farm, Modibbo Adama University of technology Adamawa State, Nigeria. Data obtained were analysed using Microsoft excel. The results revealed that, the female strains from Lake Nguru recorded higher fecundity. Excellent percentage fertilization were recorded, where all the crosses of GY♀×NG♂, NG♀×GY♂ and GY♀×GY♂ recorded 100% fertilization, except the hybrid of GY♀×NG♂ which was a bit lower with 95%. Pure breed of NG♀×NG♂ recorded the highest percentage hatchability with 75%, where 33% was the least, recorded from hybrid GY♀×NG♂. The hybrid NG♀×GY and pure breed GY♀×GY♂ had 46% and 57% respectively. Generally, the findings indicated that, the maternal strains of Clarias gariepinus from Lake Nguru, had influenced the performance. This implied that, we are likely to obtain fish seed of better reproductive potential in terms of fertilization and hatchability from Nguru Lake.

INTRODUCTION

Aquaculture refers to the breeding, rearing and harvesting of plants and animals in all types of water environments including ponds, rivers, lakes and the oceans (Atanda, 2007). In Nigeria, the prominence of aquaculture as fish food source is growing in recent times while supply from capture fisheries is dwindling due to undue fishing pressure and climate change among other factors. African catfish, *Clarias gariepinus*, is the most popularly cultured fish in Nigeria (Sogbesan and Ugwumba, 2006). This species has drawn attention of aquaculturists because of its biological attributes that include faster growth rate, resistance to diseases and possibility of high stocking density (Saad *et al*., 2009). One prerequisite of intensive fish culture technology is to have healthy fish seed in the required quantities. In the last decade, spectacular growth has been recorded in Catfish fingerlings production through artificial propagation, despite this breakthrough, the demand for the seeds still outstrips the supply (Madu *et al*. 2003),

The main goal of the aquaculture value chain is to optimize growth and to produce fish of high quality (Bello *et al.,* 2012). Fish farmers have the desire to produce table-sized fish within the shortest possible time (Ezenwaji, 1989) thus, the choice of species to culture is critical in the realization of this goal. In Africa, especially Nigeria, the species most cultured are *Clarias gariepinus, Heterobranchus spp*. and their hybrid (Adewolu *et al., 2008*).

MATERIALS AND METHODS

Study Area

The research was conducted in the Department of Fisheries teaching and research farm, Modibbo Adama University of Technology Yola, Adamawa State, Nigeria, which is located within Guinea Savanna zone, lies between Latitude 9° and 11 north and Longitude 11° and 14 east.

Experimental Setup

Four bowls of 50L capacity were used for experiment, tap water from borehole served as the source of water in the farm for hatchling production and maintenance throughout the experimental period.

Brood stocks Sourcing and Management

Two gravid male and female *C. gariepinus* weighing between 500*g*-1kg were obtained from Lake Geriyo, upper Benue River of Adamawa State and another two gravid male and female *C. gariepinus* were also obtained from Nguru Lake in Yobe State. The Brood stocks were transported, using 50L capacity jerry cans to the Department of Fisheries Teaching and Research Farm, Modibbo Adama University Technology, Yola, where the brood stocks were acclimatized for 1 week. During acclimatization period, they were fed commercial floating feed, (Coppens) twice a day at the rate of 3% body weight as recommended by Audu and Ofojekwu., (2010) and feeding stopped 24 hours prior to the breeding exercise.

Mode of Administration of Hormones

The hormone was administered intramuscularly above the lateral line and below the anterior end of the dorsal fin. After the injection, the site of injection was pressed slightly before removing the needle to prevent the hormone from running out. The injected brood stocks were kept separately in plastic containers with about 10 liters of water each for the period of stipulated latency period.

Artificial Fertilization, Incubation And Hatching

Dry method of fertilization was used where the milt obtained from the male fishes was squeezed onto the stripped eggs obtained from the females accordingly and stirred gently and thoroughly using plastic spoon for about 1-2 minutes to allow contact and adequate fertilization (Megbowon *et al*., 2013), after which normal saline was added before spreading the eggs on the spawning nets in the incubation units for incubation. The eggs were distributed in a single layer on the spawning nets in the well aerated incubation bowls provided for the experiment for easy assessment of breeding performance. The viable and dead eggs were determined and counted. The viable eggs were translucent while the non-viable eggs were white and opaque and these were carefully removed by siphoning. Hatching started at about 20 hours after incubation and lasted for about 6 hours.

Experimental Crosses

Intra-specific crosses of *Clarias gariepinus* from two hydrological zones.

	GY	NG
GY	GY♀ × GY♂	GY♀ × NG♂
NG	NG♀ × GY♂	NG♀ × NG♂

Where:

GY *C. gariepinus* strains from Lake Geriyo

NG *C. gariepinus* Strains from Nguru Lake

Fecundity

Gravimetric method was used to estimate the number of eggs spawned. A quantity of eggs stripped was weighed using weighing sensor and reading was taken which was used for further estimate of all the stripped eggs. Sub-sample was randomly taken, washed with saline water, counted and then weighed. Fecundity was calculated as follows:-

$$F = \frac{nG}{g}$$

Armando *et al.* (2009)

Where

F = fecundity

n = No. eggs in the subsample

G = Total weight of the ovaries

g = weight of the subsample in the same unit

GONADO-SOMATIC INDEX (GSI)

$$GSI = \frac{\text{weight of gonad}}{body\ weight} \times 100$$

Anderson and Gutreuter, (1983).

Percentage Fertilization Determination.

The percentage fertilization was estimated using the following equation.

$$Pf = \frac{N-n}{N} \times \frac{100}{1}$$

Source: Omitoyin *et al.* (2011)

Where *Pf* = Percentage fertilization

N= Total number of spawned eggs

n= Number of unfertilized eggs

Percentage Hatchability.

Unhatched eggs was counted using hatchery method (sampling about 50 eggs from each treatment and wait for about 18-24 hours) and below equation was used to determine percentage hatchability.

$$\text{Percentage hatchability} = \frac{No.of\ incubated\ eggs - No.of\ unhatched\ eggs}{Total\ No.of\ eggs\ incubated} \times 100$$

Source: FAO, (1996)

RESULTS

Table 1: Fecundity of the female strains *Clarias gariepinus* from two different hydrological zones

Strains	Weight of the fish (g)	Weight of the ovary (g)	No. of the eggs/1g	Total No. of eggs	GSI	Relative fecundity(g)
Lake Geriyo	800	67.8	572	38,782	8.47	4.48
Lake Nguru	1000	146.52	720	105,494	14.65	105.49
Mean	900	107.16	646	72138	11.56	73.99
SD	141.42	55.66	104.65	47172.51	4.37	31.50
CV	15.71	51.94	16.20	65.39	37.78	42.58

Key: SD = Standard deviation
CV = Coefficient of variability
GSI = Gonadosomatic index

Table 2: Body weight, Length and weight of Testis of Male strains of *Clarias gariepinus* from two different hydrological zones

Strains	Body Weight (g)	Weight of Testis (g)	Weight of right lobe (g)	Weight of left lobe (g)	Length of right lobe (cm)	Length left lobe (cm)
Lake Geriyo	500	1.19	0.55	0.64	3.4	3.75
Lake Nguru	1900	4.29	2.43	1.86	6.4	6
Mean	1200	2.74	1.49	1.25	4.9	4.875
SD	989.94	2.19	1.32	0.86	2.12	1.59
CV	82.49	80.00	89.21	69.01	43.29	32.63

Key: SD = Standard deviation
CV = Coefficient of variability
GSI = Gonadosomatic index

Table 3: Percentage Fertilization and Hatchability for intraspecific crosses of *Clarias gariepinus* from two different hydrological zones of Nigeria

Parameters (%)	T1 (NG♀×NG♂)	T2 (NG♀×GY♂)	T3 (GY♀×NG♂)	T4 (GY♀×GY♂)
Fertilization	100	100	95	100
Hatchability	75	46	33	57

Keys:

NG♀×NG♂ = Nguru × Nguru (Pure breed)
NG♀×GY♂ = Nguru × Geriyo (Hybrid)
GY♀×NG♂ = Geriyo × Nguru (Hybrid)
GY♀×GY♂ = Geriyo × Geriyo (Pure breed)

DISCUSSION

Induced Breeding and Fecundity of Female Strains of *Clarias gariepienus* from Two Different Hydrological Zones

Relationship between weight of the fish and number of eggs produced, that is, relative fecundity, which is expressed as number of eggs produced/weight of the fish. Relative fecundity showed increase in number of eggs produced as the size of female broodstock increases, Lake Nguru broodstock which was 1000g in weight had higher number of eggs produced per gram of 720, as compared Lake Geriyo (800g) which had 572. This showed that difference in size and maturity could affect the number eggs produced by the fish.

Synthetic hormone (Ovulin) successfully induced spawning in *C. gariepinus*. The dosage of the hormone administered influenced the weight of eggs produced, Bruton, (1979), reported that, the increase in dosage resulted in more eggs being produced and this varied with the size. The dosage of the hormone administered also influenced the latency period in the experiment as the increase in dosage resulted in reduced latency period. This was consistent with what was observed by Achionye-Nzeh and Obaroh (2012). This study indicated that, female *Clarias gariepinus* broodstock obtained from Nguru lake has higher fecundity of 105,494 egg, as compared that Lake geriyo which has lessser fecundity of 38, 782 eggs. This variation may be due to environment factors, natural nutrient present in the lakes which could influence the number eggs. This is inconsistent with Ochokwu *et al*. (2016) which recorded 163,054 from Katsina which is lesser as compared to 198,205 recorded from Ibadan. The higher fecundity rate (198,205) recorded was higher in the female of *C. gariepinus* from Ibadan which agrees with Shinkafi and Ipinjolu, (2012) who reported higher fecundity in most of the larger fishes than the smaller fishes in *A. occidentalis*. He stated that the lower the number of eggs in the species, the larger the size of eggs. Thus, the larger the fish, the higher its egg number and this may be due to more available visceral volume for holding the eggs. (Hirpo, 2013).

Mean Body Weight, Length and Weight of Testis of Male Strains of *Clarias gariepinus* from Two Different Hydrological Zones.

Lake Nguru and Lake Geriyo differed in there average length of the testes where Lake Nguru had 3.6 and Lake Geriyo had 6.2. The difference could due to difference in size and weight between the two strains, as recorded by Ochokwu *et al.,* (2016). Studies have shown that qualitative parameters of the milt (sperm motility, sperm lobe length, milt volume and count) can be influenced by several factors such as feeding regime, the quality of the feed (Cerovsky *et al*., 2009), environmental factors, variations between individual, age, weight, length of the fish (Ochokwu *et al*., 2015), stress, uptake of nutritive and genetic materials, physiochemical properties of water (pH, salinity and temperature and dissolve oxygen) (Brooks *et al*., 1997). Meanwhile temperature, Dissolve Oxygen and pH during breeding, process agree with the findings of Onyia *et al*. (2010). Aluko and Ali (2001), It is however important to acknowledge that differences that arise from breeding history, may be affected by water quality and age of the fish, Variations in seasons can also lead to such differences, as rightly observed by (Shah *et al*., 2011)

Percentage Fertilization and Hatchability for Intraspecific Crosses of Clarias gariepinus from Two Different Hydrological Zones

The 100% in all treatment except treatment 3 which is 95% fertilization recorded in this experiment, may be an indication of the efficacy of ovulin used as Adebayo and Popoola (2008) reported fertilization rate of 84.50% for *C. gariepinus* using ovaprim while Haniffa and Sridhar (2002) reported fertilization rate of 70% for *Channa punctatus* also using ovaprim. The high hatching rate (82.07%) and larval survival rate of 84.23% recorded in this experiment was higher than what was obtained by Shinkafi and Ilesanmi (2014) for *C. gariepinus* using ovaprim and Sahoo *et al.* (2005) for *C. batrachus* using ovatide. Ochokwu *et al.,*(2016) observed fertilization of Intra-specific hybridization between Ibadan and Katsina strains of *C. gariepinus*. Where the highest fertilization recorded was (98%).

Highest percentage hatchability recorded from a pure breed T1 with 75 % where 33% is the least, which observed from the hybrid T3, the hybrid T2 and pure breed T4 had 46% and 57% respectively. This indicates compatibility with findings of Ochokwu *et al.,* (2016) which showed higher percentage Hatchability in the pure breed of Katsina and Ibadan with 84 and 88 respectively. The differences in hatchability can be explained in terms of biological developmental process from fertilization to hatching, which is dependent on water temperature. Olaniyi and Omitogun (2013) reported the hatching time of 17 hour at temperature of 28.5^{o}c, and hatchability of 85% in their embryological study of *C. gariepinus*.

CONCLUSION

Generally, the pure breed T1 and its reciprocal cross T2 had the best performance in terms of fecundity, fertility, and hatchability, compared to the other treatments. This is an indication that, the maternal strain of Clarias broodstock from Nguru Lake has influenced the reproductive performance. Hence it has a great potential for producing viable fingerlings for farmers to embark on profitable aqua business.

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