Sahel Journal of Life Sciences FUDMA 3(2): 464-471, 2025

Sahel Journal of Life Sciences FUDMA (SAJOLS)
June 2025 Vol. 3(2): 464-471
ISSN: 3027-0456 (Print)
ISSN: 1595-5915 (Online)
DOI: *https://doi.org/10.33003/sajols-2025-0302-52*

Research Article

Influence of Brooders' Age on the Reproductive Performance of African catfish (*Clarias gariepinus* Burchell, 1822) Reared in Tank System

***A. K. Saidu, A. H. Bichi and A. B. Dauda**

Department of Fisheries and Aquaculture, Federal University Dutsin-Ma, P.M.B. 5100, Katsina State, Nigeria
****Corresponding Author's email***: sahmed2@fudutsinma.ed.ng; **Phone: +2348130620330**

ABSTRACT
This study investigated the influence of brooder's age on the reproductive performance of African catfish. The brooders were obtained and bred in an indoor hatchery using standard hypophysation protocol with ovaprim hormone. The fish seed were raised in tarpaulin tanks until they were used as brooders at the ages 6-, 9-, 12-, and 15-month-old. Three randomly selected brooders were weighed before ovaprim hormone was administered to the females (0.5ml/Kg), and the males were euthanized for milt collection. The fish were examined for reproductive qualities, including egg size before and after fertilization, sperm volume, count, and colour, and the results were compared among the brooders of different ages. Weight of the ovary and estimated number of eggs increased significantly (P<0.05) with an increase in the age of the brooders. The highest ovary weight of 62.84±0.02g and the no of eggs of 940.26±0.11 were both recorded in 15-month-old brooders. The egg size before and after fertilization increased significantly with an increase in the brooder's age. The highest sperm motility, 96.80±0.60% was observed in 15-month-old, and was only significantly different from 92.02±0.70% observed in 6-month-old brooders. Both sperm volume and spermatocrit were similar between 12 and 15-month-old brooders but were significantly different from 6 and 9-month-old brooders. The fertilization rate, hatched eggs, and larvae survival increased significantly with an increase in age; both 6 and 9-month-old brooders had survival of <50%. The study established that brooder's age influenced the reproductive performance, and a brooder African catfish of 12 months and above is recommended.

Keywords: African catfish; Brooders age; Fecundity; Hatchlings; Milt

Citation: Saidu, A.K., Bichi, A.H., & Dauda, A.B. (2025). Influence of Brooders' Age on the Reproductive Performance of African catfish (*Clarias gariepinus* Burchell, 1822) Reared in Tank System. *Sahel Journal of Life Sciences FUDMA*, 3(2): 464-471. DOI: *https://doi.org/10.33003/sajols-2025-0302-52*

INTRODUCTION

The increase in fish production from aquaculture in Nigeria is largely dependent on the increased production of African catfish, which is the major fish cultured in Nigeria (Dauda *et al*., 2018). However, like other fish species, African catfish production is still facing several challenges, with fish seed availability classified as one of the major challenges (Dauda *et al*., 2015). The need for more knowledge of artificial propagation of African catfish requires urgent attention since fish capture from the wild is declining as a result of climatic and environmental challenges (Otoh *et al.,* 2023). One of the major constraints of commercial fish farming is the availability of fish seed, which is largely influenced by broodstock quality and productivity (Savadkouhi and Khara, 2017; Abdulraheem and Olalekan, 2022). Broodstock quality is determined by the quality of the sperm (for males) and eggs (for females). Sperm quality is defined as the ability of sperm to successfully fertilize an egg (Jokthan, 2013). Generally, motility, volume, and concentration are used to determine the quality of sperm, while size, diameter, and weight are used to determine the quality of eggs. The quality of sperm is of high interest in commercial fish farming because it is one of the major determinants of the efficiency of artificial fish propagation (Hajirezaee *et al*., 2010; Otoh and Udoh, 2020). Aliniya *et al*. (2013) reported a higher duration of sperm motility in 3-year-old male broodstock compared to 2-year-old broodstock of *Cyprinus carpio*. Abdulraheem and Olalekan, (2022) stated that sperm volume increases with age. However, the success of aquaculture begins at the hatchery level where the reproductive performance of the fish is determined for seed production. Catfishes such as *Heterobranchus* and *Clarias species* remained the most cultured species of significance in Nigeria and beyond (Otoh and Udoh, 2018). This is due to the unique characteristics of these species such as fast growth rate, good taste, generally acceptance for consumption, high stocking density, high market price and high resistance to disease and ability to reproduce in captivity (Otoh *et al*., 2022; Otoh *et al*., 2023).

The effects of fish age on breeding success and gamete quality vary. Studies have shown a positive relationship between the age of broodstock and sperm volume (Shamspour, 2008; Abdulraheem and Olalekan, 2022). Rahbar *et al*. (2012) reported an increase in sperm with increase in the age of broodstock of Caspian Brown trout (*Salmo trutta caspius*). Egg size has been reported to increase with the increase in the size and age of broodstock (Abdulraheem and Olalekan, 2022). Shamspour and Khara (2016), who studied the effects of broodstock age on the reproductive efficiency of adult rainbow trout, observed that 4 and 5-year-old female broodstock produced eggs with larger diameters than 3-year-old female broodstock. The study further reported that older females had higher absolute fecundity than younger individuals. Bichi *et al*. (2014) also reported an increase in egg weight and fry size as the size of the brooders increased. Jokthan (2013) reported that the age of female and male brooders affects the quantity of eggs and milt, as well as the subsequent growth performance of the fry.

Clarias gariepinus (African catfish), is known as a hardy fish species for aquaculture purposes, and it is generally recognized in the tropical regions as well as commands good profitable value (Dauda *et al*., 2018). This species (*C. gariepinus*) does not readily breed in captivity, hence the need for artificial fish seed production (Bichi *et al.*, 2014). Nutrition, size, age, etc. of broodstock influences the eggs size as well as growth rate of fingerling production in addition to its performance (Uedeme-Naa and Nwafili, 2017). It has been observed that egg sizes rise once there is an increase in the size and age of broodstock. Several researchers (Hajirezaee *et al*., 2010; Jokthan 2013; Otoh and Udoh, 2020) have also reported variation in milt quality for fish species of different ages. However, there is a paucity of information on the optimum age of African catfish brooders, in order to return the maximum output on the input for hatchery operations. This study evaluated the influence of different ages of brooders on the reproductive performance of African catfish (*Clarias gariepinus*) reared in a tank system.

MATERIALS AND METHODS

Study area

The experiment was conducted at the mini-hatchery of the Department of Fisheries and Aquaculture, Federal University Dutsin-Ma, Katsina state. Dutsin-Ma is a Local Government Area in Katsina State, Nigeria, within the coordinate 12^o 27’18" N and 7^o 29' 29" E.

Experimental Design and Set up

The experiment was conducted in multiple stages, as described by Saidu *et al*. (2025). Briefly described below;

Stage one – Brooders acquisition and initial breeding activities

Four brooders (two males and two females) with average body weight of 2 kg were obtained from a commercial farm at Garhi village, Dutsin-ma local government. The male and female breeders were separated and taken live to the Department of Fisheries and Aquaculture's hatchery in two 50-litre black plastic jerricans. After acclimation for three days, they were used for breeding using hypophysation method with Ovaprim hormone as described by Madu (2014). The breeding was carried out in the indoor hatchery with three dark-blue incubation troughs with a diameter of 70 cm and a height of 50 cm. The hatchlings obtained were raised in the indoor hatchery for two weeks.

Stage two- Raising of the hatchlings to brooders of different ages for the experiment.

The hatchlings were transferred to outdoor tarpaulin tanks (3m x 2m x 2m), where they were raised and fed commercial pellets with size and crude protein changing as the fish grow in age and size (from 0.8 mm of 45% CP to 6 mm of 35% CP), and water changes from two to three times a week. After another six weeks, when the juveniles can easily be distinguished sexually, all the fish were harvested, and one of the tarpaulin tanks was stocked with 200 males while the other was stocked with 200 females. The fish were raised in each of the tarpaulin tanks till they attained the targeted ages of 6, 9, 12 and 15 months before they were used for the reproductive quality evaluation and experimental breeding.

Stage three – Reproductive quality evaluation

Hormonal inducement, stripping of eggs and milt extraction

Once the fish attained the targeted ages of 6, 9, 12 and 15 months, the breeders were selected and evaluated. Three females were selected at random from the tank at different ages, measured for length and weight, and transferred to the indoor hatchery, where Ovaprim was administered at 0.5 ml/kg body weight of the fish to induce breeding (Asangusung *et al*., 2020). The fish were gently kept in separate bowls to observe their latency period, when the eggs will start to run freely. When the latency period was attained (and recorded) for the different fish, the eggs were carefully stripped into dried bowls, one for each fish, after which 1 g of eggs from each sample was counted under an Olympus microscope and the average diameter of the ova was measured with sage micrometre and ocular micrometre. Three males of the *C. gariepinus* breeders were also randomly selected from the tarpaulin tank, measured for length and weight before the fish were euthanized for milt extraction. The right and left testicles of each of the fish were weighed before excised for milt extraction. The milt from each of the fish was measured for volume, sperm cell counted and the motility was observed under an Olympus microscope following the description of Adebiyi (2013) and Rurangwa *et al*. (2004).

Stage four – experimental breeding

The eggs from each fish were weighed using a sensitive weighing balance, and 3 g from each fish was measured into a bowl, where milt was added for fertilization, using dry fertilization method as described by FAO (2014). The eggs were measured for diameter before and after fertilization, and the fertilized eggs were set on the spawning mat in each incubation trough (40 cm x 30 cm x 30 cm), one for each of the three brooders. The fertilized ova were observed, and the incubation time was also observed and recorded. After the hatching was concluded, the tanks were cleaned, and hatchlings were estimated. The hatchlings were reared indoor for 10 days, while the feeding was commenced at day three and the fish were fed with artemia. The number of larvae from each trough was estimated again at day 10 (Madu, 2014).

Performance evaluation

The performance of the brooders at the different ages was estimated as described by Sahoo *et al*. (2015);

% motility of spermatozoa = (number of motile spermatozoa/total number of spermatozoa) x 100

Fertilization rate (%) of eggs = (Number of eggs fertilized /total number of eggs) x 100

Hatchability (%) = (number of hatchlings / total number of fertilized eggs) x 100

Survival rate = (number of larvae at day 10 / total number of larvae hatched) x 100.

Data Analysis

The data were presented using descriptive statistics, mean±standard deviation. The data were analysed using one-way analysis of variance (ANOVA), where a significant difference was observed at a 95% confidence level. Duncan multiple range test (DMRT) was used as a follow-up test to differentiate the significant means (P<0.05). All the analysis was carried out using IBM SPSS version 27.

RESULTS

The results of the morphometric characteristics of the brooders and parameters of the eggs are shown in Table 1. The female brooders had the weight, length, ovary weight and estimated number of eggs increased significantly (p<0.05) with an increase in age. The highest ovary size of 62.84 ± 0.02g was observed in 15-month-old brooders while the least (44.01± 0.05 g) was observed in 6-month-old brooders. Similarly, the estimated number of eggs per gram body weight was highest, 940.26±0.11in 15-month-old, while the least, 740.22±0.11, was recorded in 6-month-old brooders.

The egg size increased significantly (P<0.05) with age both before and after fertilization. The biggest egg was 1.30±0.11 mm before fertilization and 1.62±0.10 after fertilization, and both were observed in 15-month-old brooders. The latency period ranged between 12.05±1.00 hours in 6-month-old and 11.52±0.90 hours in 15-month-old, while the incubation period ranged between 20.04±4.22 hours and 19.10±4.46 hours. There was no significant difference (P<0.05) in both latency and incubation period among the treatments (Table 2).

Table 1. Variations in weight, length and estimated number of eggs per gram ovary weight of the female brooders

Age of the female brooders	Weight of the female brooders (g)	Length of the female brooders (cm)	Weight of ovary of the female brooders (g)	Estimated No. of egg per gram of body weight
6-month-old	880.20±16.00[d]	29.33±0.60[d]	44.01± 0.05[d]	740.22±0.11[d]
9-month-old	990.30±19.00[c]	32.71±1.00[c]	49.52 ± 0.08[c]	844.25±0.12[c]
12-month-old	1100.10±18.00[b]	35.49±1.00[b]	55.01 ± 0.06[b]	862.14±0.20[b]
15-month-old	1256.70±0.9.00[a]	38.63±1.00[a]	62.84 ± 0.02[a]	940.26±0.11[a]

NB: Values are provided as mean±standard deviation (n=3), different alphabets along the same column indicate significant difference (P<0.05)

Table 2. Variations in egg diameter, latency period and incubation time of the experimental brooders

Age of the female brooders	Egg size before fertilization (mm)	Egg size after fertilization (mm)	Latency period hours	Incubation time (hours)
6-month-old	1.01±0.11[d]	1.31±0.33[d]	12.05±1.00	20.04±4.22
9-month-old	1.10±0.20[c]	1.41±0.32[c]	12.03±0.20	19.46±5.11
12-month-old	1.21±0.21[b]	1.50±0.21[b]	11.64±1.11	19.12±5.61
15-month-old	1.30±0.11[a]	1.62±0.10[a]	11.52±0.90	19.10±4.46

NB: Values are provided as mean±standard deviation (n=3), different alphabets along the same column indicates a significant difference (P<0.05)

The results of the reproductive parameters of the male brooders are shown in Table 2, the weight of the male brooders increased significantly (P<0.05) with increase in weight. The highest sperm motility of 96.80% was observed in 15-month-old brooders but it was not different significantly (P>0.05) from other ages except 6-month-old with 92.02%. All the treatments had significantly (P<0.05) higher motility compared to 6-month-old. The length of the genital papilla was significantly (P<0.05) lower in 6-month-old compared to all other ages. It was similar between 9 and 12-month-old, while the highest 6.76±1.00 cm was observed in 15-month-old and it was significantly higher (P<0.05) than all other treatments. The testicular weight for both right and left showed a similar pattern. 15-month-old had the highest which was differently significantly from all other treatments, while the leas was in 6-month-old.

The results of testes semen volume, sperm count, spermatocrit and semen colour are presented in Table 4. The highest left and right testes volumes 3.57±0.40 ml and 3.21±0.48 ml respectively was observed in 15-month-old and they were different significantly from all other treatments, except 12-month-old in right testes semens volume. There were no differences in sperm count for both left and right testes. However, the spermatocrit also increased with increase in the age of the brooders. The least spermatocrit of 6.67±0.30% and 7.00 ±0.52% in left and right testes respectively were observed in 6-month-old and they were different significantly (P<0.05) from others. The colour of the semen also changed from whitish brown in 6-month-old to milky colour in 12 and 15-month-old.

The number of eggs released ranged between 4033.00±4.22 in 15-month-old and 2237.50±35.10 in 6-month-old, and the difference was significant among the treatments. The highest percentage fertilization was 98.22±0.31% in 15-month-old and it was different significantly (P<0.05) among the treatments. The percentage survival ranged between 36.80±0.02% in 6-month-old and 70.00±0.01% in 15-month-old, and the different was significant among all the treatments (Table 5).

Table 3. Variations in gonadal parameters of the *Clarias gariepinus* male brooders

Age of male brooders	Weight of the male brooders (g)	Sperm motility %	Length of the genital papilla (cm)	Weight of the left testicular (g)	Weight of the right testicular (g)
6-month-old	627.80±0.80[d]	92.02±0.70[b]	1.71±0.70[c]	2.77±0.40[c]	3.01±0.41[c]
9-month-old	749.30±0.90[c]	96.82±1.00[a]	2.23±0.30[b]	4.67±1.00[b]	4.35±0.70[b]
12-month-old	842.20±0.70[b]	96.9 1±0.71[a]	2.23±0.10[b]	4.23±0.10[b]	4.35±0.70[b]
15-month-old	1,256.70±0.90[a]	96.80±0.60[a]	6.76±1.00[a]	5.76±0.80[a]	5.67±1.00[a]

NB: Values are provided as mean±standard deviation (n=3), different alphabets along the same column indicates significant difference (P<0.05)

Table 4. Variations in testes semen volume, testes sperm count (cell/ml) and semen colour of the male brooders

Age of male brooders	Left testes semen volume (ml)	Right testes semen volume (ml)	Left testes sperm count (cell/ml)	Right testes sperm count (cell/ml)	Left testes spermatocrit %	Right testes spermatocrit %	Semen colour
6-month-old	1.02±0.60[d]	1.10±0.06[c]	$3.58x10^{10}±8.33x10^{9}$	$2.58x10^{10}±4.55x10^{9}$	6.67±0.30[c]	7.00 ±0.52[c]	Whitish brown
9-month-old	1.90±0.50[c]	1.90±047[b]	$3.93x10^{10}±9.84x10^{9}$	$2.61x10^{10}±4.62x10^{9}$	13.67±0.60[b]	12.33±1.10[b]	whitish
12-month-old	3.35±0.40[b]	3.20±0.48[a]	$9.72x10^{10}±2.01x10^{9}$	$6.76x10^{10}±2.61x10^{9}$	16.00±1.09[a]	20.33±1.05[a]	milky
15-month-old	3.57±0.40[a]	3.21±0.48[a]	$9.72x10^{10}±2.01x10^{9}$	$6.76x10^{10}±2.61x10^{9}$	16.20±1.24[a]	20.32±1.20[a]	milky

NB: Values are provided as mean±standard deviation (n=3), different alphabets along the same column indicates significant difference (P<0.05)

Table 5. Variations in egg hatchability, fertilization, and early larval survival from the experimental *Clarias gariepinus* brooders

Age of female brooders	Weight of female brooders	No of eggs released	Fertilization of eggs (%)	No of eggs hatched	Larvae survival (%)
6-month-old	880.20±0.21[d]	2237.50±35.10[d]	58.42±0.31[d]	198.00±13.14[d]	36.80±0.02[d]
9-month-old	990.30±19[c]	3423.00±0.04[c]	67.53±0.84[c]	2110.24±48.75[c]	48.22±0.01[c]
12-month-old	1,100.10±18[b]	3800.00±0.50[b]	73.44±1.00[b]	3201±47.74[b]	58.70±0.03[b]
15-month-old	1,256.70±0.16[a]	4033.00±4.22[a]	98.22±0.31[a]	4000.75±73.89[a]	70.00±0.01[a]

NB: Values are provided as mean±standard deviation (n=3), different alphabets along the same column indicates significant difference (P<0.05)

DISCUSSION

The need for quality fish seeds has been continuously expressed as a major factor for successful aquaculture production (Dauda *et al*., 2015; Abdulraheem and Olalekan, 2022). Researchers have documented age as a major factor influencing the reproductive performance of fish, these include Aliniya *et al*. (2013) for *C. carpio* and Shamspour and Khara (2016) for *Salmo trutta caspius*. In this study, weight of the ovary, estimated no of eggs per gram body weight of African catfish were all influenced by the age of the brooders and the quality increased gradually with increase in the age. This observation is in line with the reports of Uedeme-Naa and Nwafili, (2017). Tahoun *et al*. (2008) observed that 3-year-old female broodstock of *Oreochromis niloticus* had a higher absolute fecundity than 1-year-old. They concluded that age of broodstock significantly influenced the female fecundity in terms of fingerlings production. Mair *et al*. (2004) confirmed that the age-fecundity relationships were in line with absolute fecundity. Based on findings on large age differences, relative fecundity was observed to decline with age (Ridha and Cruz, 1989; Abdulraheem, and Olalekan, 2022). However, the latency and incubation period were not different significantly among all the brooders despite their age differences. The gonadal parameters of the male brooders did not completely follow the pattern in the female brooders, where 15-month-old brooders consistently showed superior performance for all the examined female reproductive parameters. As for the male brooders. Sperm motility was not different significantly among the 9-, 12- ad 15-month-old brooders, only 6-month showed significantly inferior performance. Length of the genital papilla and weight of both the left and right testicular were higher in 15-month-old brooders compared to other ages, but they were not different between 9 and 12-month-old brooders. Semen volume, left and right testes spermatocrit were similar between 12- and 15-month-old brooders but they were different from other treatments. The sperm count did not show significant difference among the treatments. The colour of the semen was also similar between 12- and 15-month-brooders. While there are similarities in the gonadal qualities of 12 and 15-month-old, they still revealed influence of brooders age, as they both showed superior performance compared to 6 and 9-month-old brooders. The research is in tandem with that of Ali *et al.* (2024) who reported increase in sperm motility, sperm volume and concentration due to increase in brooder's age. Rurangwa *et al*. (2004) stated that milt quality mostly depends on qualitative parameters of milt i.e., milt volume, composition of seminal fluid, sperm density and sperm motility. Hajirezaee *et al*. (2010) and Ali *et al*. (2024) had reported that the milt quality parameters (i.e., sperm production, spermatozoa motility and seminal fluid composition) are influenced by several factors including brooders biological features (length, weight, age, rearing conditions nourishment and animal welfare). The ability of milt to fertilize an egg is strongly linked to its motility, as a large milt volume could translate to more numbers of sperm cells, though some sperm cells may not be motile (Ataguba *et al*., 2013). The fertilization rate, no of eggs hatched and larvae survival all increased with increase in age of the brooders. Abdulraheem and Olalekan (2022) reported a high correlation between sperm fertility and spermatozoa motility and stated that a higher percentage of motile sperm is significantly related to fertilization capacity in catfish. The study also revealed the number of hatchlings and larvae survival are influence by the brooder's age. Only the 12 and 15-month-old brooder led to over 50% larvae survival. The result follows a similar pattern with that of Umanah (2020) and Adams (2016) who reported that the survival of the fry increases with the age of the brooders.

CONCLUSION

The study established that age of the brooders influenced the reproductive qualities of African catfish. The 15-month-old females consistently showed superior performance over other ages, while for the male 12-month-old showed some similarities with 15-month-old in terms of sperm motility and sperm volume. Fertilization rate, eggs hatched and larvae survival were higher in 15-month-old. Both 12- and 15-month-old brooders had larvae survival of above 50%. Therefore, for a successful hatchery operation, brooders of 12-month-old and above is recommended.

REFERENCES

Abdulraheem, I. and Olalekan, S. O (2022). Effect of Age on the Productivity of the African Catfish (*Clarias* *gariepinus*, Burchell 1822) Broodstock. *Nigerian Journal of Fisheries and Aquaculture* 10(1), 1 – 8.

Adams, A. (2016). Relationships of egg sizes of *Clarias gariepinus* on fertilization, hatching and frys survival rates. *Journal Biochemical Res*., 1: 11.21.

Adebiyi, A.M. (2013). The Sex Ratio, Gonadosomatic Index, Stages of gonadal Development and Fecundity of sompat Grunt; *Pomadasys Jubelini* (cuvier, 1830). *Pakistan Journal, zool., 45(1)*, 41 – 46.

Ali, M.R., H. Basharat., A. Ahmed., M. Fakhar and Shamim Akhter. (2024). Brood stock development, reproductive performance and breeding of African catfish (*Clarias gariepinus*) in Pakistan. *Sarhad Journal of Agriculture*, 40(3): 988-997.DOI | https://dx.doi.org/10.17582/journal.sja/2024/40.3.988.997

Aliniya, M., Khara, H., Noveiri, S. B. and Dadras, H.(2013). Influence of Age of Common Carp (*Cyprinus carpio*). Broodstock on Reproductive Traits and Fertilization. *Turkish Journal of Fisheries and Aquatic Sciences*, 13:19-25.

Asangusung, P. S., Uka, A. and Otoh, A. (2020). Economic evaluation of three hormonal preparations in artificial propagation of *Heterobranchus longifilis* (Valenciennes, 1840). *Journal of Aquatic Sciences*, 35(2): 173-179

Ataguba, G.A., Okomoda, V. T. and Onwuka, M. C. (2013). Relationship Between Broodstock Weight Combination and Spawning Success. In: African Catfish (*Clarias gariepinu*s). *Croatian Journal of Fisheries*, 71:176 – 181.

Bichi, A.H., Isyaku, S., Danba, E.P., Kurawa, I.A. and Nayawo, A. A. (2014). Effect of Brood Stock Size on Egg Fertilization, Hatchability and Fry Survival Rate of African Catfish (*Clarias gariepinus*). *Bayero Journal of Pure and Applied Science*s, 7(2), 150 – 154

Dauda A. B., Dasuki A and Bichi, A.H. (2015) Analysis of Constraints to Aquaculture Development in Sudano-Sahelian Region of Nigeria. *Tropical and Subtropical Agroecosystems*, 18 (2): 189 -193. http://www.veterinaria.uady.mx/ojs/index.php/TSA/article/view/2074.

Dauda**,** A.B., Ikhsan N., Karim, M., Kamarudin, M.S. and Bichi, A.H. (2018). AfricanCatfish Aquaculture in Malaysia and Nigeria: Status, Trends and Prospects. *Fisheries and Aquaculture Journal* 2018, 9,1 DOI: 10.4172/2150-3508.1000237 (....).

FAO, (2014). Cultured Aquatic Species Information Programme. *Clarias gariepinus*. Cultured Aquatic Species Information Programme. Text by Pouomogne, V. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 1 January 2010. (Accessed: 12 June 2016).

Hajirezaee, S., B.M. Amiri and A. Mirvaghefi. (2010). Fish milt quality and major factors influencing the milt quality parameters: A review. *Afr. J. Biotechnol*., 9(54): 9148-9154.

Jokthan, G. E. (2013). Effect of Age of Spawned Catfish *(Clarias gariepinus*) Broodstock on Quantity ofEggs and Milt Produced and Growth Performance of Fry. *Journal of Agriculture and Veterinary Science, 5(3), 59-61*.

Madu C.T. (2014). The Effect of broodstock size on the economy of catfish *Clarias anguillaries*) fry production using the hormone induced natural breeding techniques. *Journal Aquatic Science* 21:19-22.

Mair, G. C., Lakapunrat, S., Jere, W. L. and Bart, A. (2004). Comparisons of reproductive parameters among improved strains of Nile Tilapia *Oreochromis niloticus*. Proceeding of the Sixth International Symposium on Tilapia in Aquaculture, Manila, Philippines (ed. by R. Bolivar, G. Mair and K. Fitzsimmons). 142 – 156.

Otoh, A. J. and Udoh, J. P. (2018). Semen quality of adult male offspring of *Heterobranchus longifilis* of different parental age groups fed two different iso-nitrogenous feeds. *Tropical Freshwater Biology,* 27:1-22.

Otoh, A. J. and Udoh, J. P. (2020). Age-Related Sperm Quality of Male *Heterobranchus Longifilis.* Broodstock Fed Different Isonitrogenous Feeds. *Tropical Freshwater Biology*,27: 31-42.

Otoh, A. J., Umanah, S. I. and Udo, M. T. (2022), Influence of feed type and age of parent broodstock on sex ratio of the African catfish, *Heterobranchus longifilis* offspring. *Nigerian Journal of Agriculture, Food and Environment*. 16(4) 113-118

Otoh, A. J, Umanah S. I and Udoh, M.T. (2023). Comparative study of the effect of feed types and ages of broodstock on reproductive performances of *H.longifilis* in concrete pond. *Nigerian Journal of Agriculture, food and environment* 16(4):43-50.

Rahbar, M., Sh. A. Nzami, H. Khara, A. Golpour, R. Abaspour & Mesgaran Karimi, J. (2012). Influence of Broodstock Age on Reproductive Performance and Fertilization Success in Males Caspian Brown Trout; Salmo Trutta caspius. International Conference on

Agriculture, *Chemical and Environmental Sciences* (ICACES'2012) Oct. 6-7, 2012 Dubai (UAE). 62 – 65.

Ridha M, and Cruz, E. M. (1989). Effect of age on the fecundity of the tilapia *Oreochromis spilurus*. *Asian Fish. Sci.*, 2(2), 239-247.

Rurangwa, E., D.E. Kime., F. Ollevier, and J.P. Nash. (2004). The measurement of sperm motility and factors affecting sperm quality in cultured fish. *Aquaculture* 234(1-4), 1-28. https://doi.org/10.1016/j.aquaculture.2003.12.006

Sahoo, S. K., Giri S. S. and Sahu, A. K. (2015). Effect of Breeding Performance and Egg Quality of *Clarias batrachus* (Linn.) at different doses of Ovatide during spawning induction. *Asian Fisheries Sci.,* 18: 77-83.

Saidu, A..K. Bichi, A.H and Dauda, A.B (2025). Comparative Assessment of Embryonic Development in *Clarias gariepinus* from Brooders of Different Ages. *FUDMA Journal of Agriculture and Agricultural Technology* 11 (2) Special Issue*: 153-164.* https://doi.org/10.33003/jaat.2025.1102.019

Savadkouhi, E.B. and Khara, H. (2017). Effect of age on reproductive performance of Kutum, Rutilus frisii(Nordmann, 1840) in Shirood River, the southern coast of the Caspian Sea. *Caspian J. Environ. Sci*., 15(3), 205-212.

Shamspour, S. (2008). Investigation of effect broodstocks on fertilization rate, incubation rate and larvae survival in rainbow trout (*Oncorhynchus mykiss)*. M. Sc. Thesis. Islamic Azad University of Lahijan, p.92.

Shamspour S. and Khara H. (2016). Effect of age on reproductive efficiency of adult rainbow trout, Oncorhynchus mykiss Walbaum, 1972. *Iranian Journal of Fisheries Science* 15(3), 945-956

Tahoun, A. M., Ibrahim, M. A-R., Hammouda, Y. F., Eid, M. S. Zaki El-Din, M. M. A. and Magouz, F. I. (2008). Effects of age and stocking density on spawning performance of Nile Tilapia, *Oreochromis niloticus* Broodstock reared in hapa. International Symposium on Tilapia in Aquaculture, 329 – 343.

Uedeme-Naa B. and Nwafili S. A. (2017). Influence of African catfish *(Clarias gariepi*nus) brood stock size on fingerlings growth rate. *Appli*ed Science Reports, 19(3), 85-88.

Umanah, S.I. (2020). Maternal age influence on fry survival, growth and size variation in *Clarias gariepinus, Asian Journal of Animal Science. 14:145-152.*