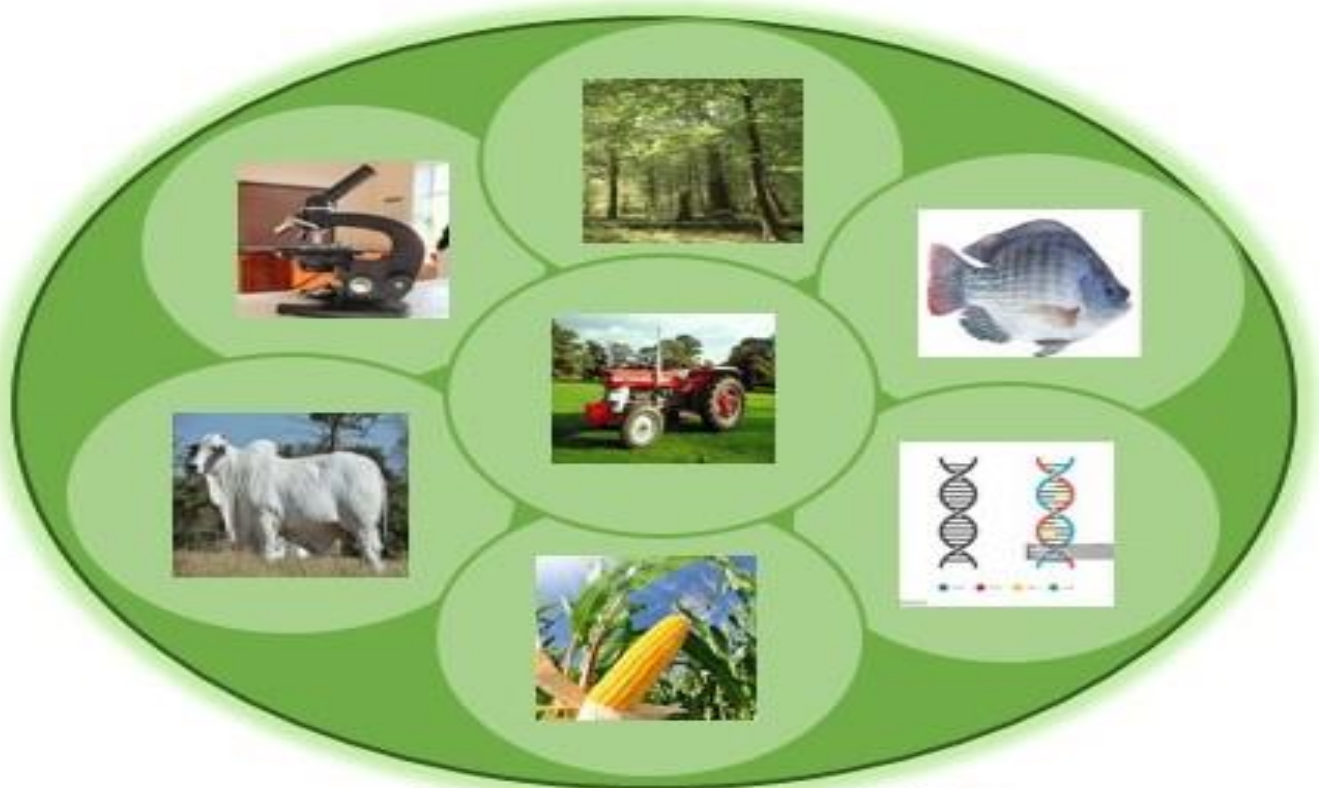




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ASSESSMENT OF HATCHABILITY AND SURVIVAL OF AFRICAN CAT FISH (*Clarias gariepinus*) HATCHLINGS USING MUNICIPAL, BOREHOLE AND LAKE WATER

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ABSTRACT

African catfish *Clarias gariepinus* broodstock was subjected to induced breeding in three different water sources (Lake Water KLW, Municipal Water MNW and borehole Water NBW). Each water source was triplicated and 11,200 eggs were incubated in the water. Water quality (pH, dissolved oxygen, conductivity, and turbidity) were monitored before and after the induced breeding. Hatchability was assessed after 24 hours of incubation. The results showed that eggs incubated in municipal water and borehole water recorded 63.79 and 30.31 % hatchability, respectively. The survival percentage was 55.37 for municipal water (NMW), 40.23 for Kainji Lake water (KLW) and 21.25 for Borehole water (NBW).

Keywords: *Clarias gariepinus*, Hatchability, Induced Breeding, Broodstocks.

Introduction

Clarias gariepinus is the most commonly cultured fish species in Nigeria. Hatchability is very important to initiate availability of fingerlings for fish growers in Nigeria. Fish breeders has problem with hatchability and survival of hatchlings (Awoke and Mpona, 2021). Water sources quality is critical to success of fish breeding in the hatchery. Water sources is essential for growth, survival, health, and breeding of fish seed (Farming, 2024). Catfish breeders are faced with problem of hatchability for catfish breeding depending on water quality sources available for them (Banrie, 2024).

Cat fish can survive for more than seven days without eating but cannot survive in bad water with poor chemistry for 30 minutes (Adebanjo, 2024). Water clarity does not guarantee it's usage for successful breeding. Water sources readily available not polluted is required to

ensure growth and survival of fish (Adebanjo, 2024). Physical chemical variables of water sources play a critical role in the physical and chemical development of general fish well-being. They are very important for growth, survival and development of fish in culture water bodies (Ajayi, 2017).

Cat fish breeding to a large extent is influence by the physical and chemical variables of the different water sources (Akombo *et al.*, 2018). Water quality will determine the success of fish breeding on cat fish hatchery. Optimum hatchability of cat fish induced breeding and survival of hatchlings depend on water quality (Ajayi, 2017). A lot of fish hatcheries are challenged with some operational difficulties such as low survival rate of the hatchlings, fries and fingerling (Kareem *et al.*, 2017).

The objective of this study was to assess the best water sources that will enhance high hatchability and survival of fish larvae in

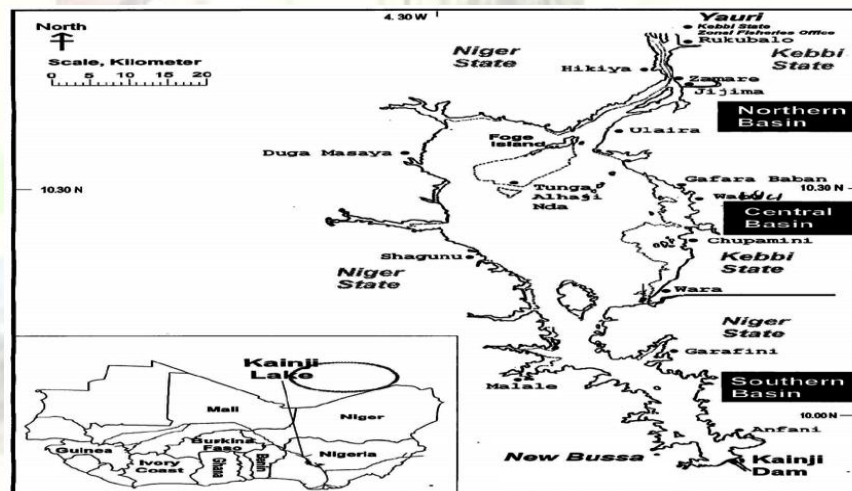
catfish hatchery, so as to make recommendation for catfish breeders.

Materials and Methods

Description of the study Area

Kainji lake is located along River Niger in North western Nigeria. It was impounded in 1968 along the Guinea savannah vegetation zone. This water body is located between longitude $9^{\circ} 50'$ and $10^{\circ} 55'$ East and Latitude $4^{\circ} 20'$ and $4^{\circ} 45'$ North. Kainji Lake is the largest man made lake in Nigeria (Adekola *et al.*, 2010). It has a length of 134 km, maximum width of 21.1 km, maximum depth of 60 m and

a surface area of 1270 km². The lake with its large sizes after impoundment, attracted many fishermen both within and outside the country who settled along the bank with their families and depend on the lake for aquaculture and domestic usage .The three water sources are located within environment of kainji lake.It should be noted that New bussa municipal water ,source their water from kainji lake.The borehole water in NIFFR quaters few kilometers from the basin of kainji lake.The water sources were aged to stabilize the water quality.



Map of Kainji Lake
(Source: Abiodun, 2003)

Sample Collection

Water sample was collected well screened with 50um mesh size in 50 litres gerican from lake in a vehicle to NIFFR limnology laboratory.The water was triplicated and aged for two weeks before the commencement of the induced breeding.The water was collected from kainji lake Reservoir during white flood season.The lake water level was low during the period of the experiment.

Municipal water: The water was treated for house holds usage which was gotten from the lake (kainji lake water).The water was

collected in 50 litres gerican to the laboratory which was aged before the induce breeding.

Borehole water: The water was screened with 50 um net mesh size and collected from borehole water behind NIFFR Limnology laboratory.The water was triplicated in aquarium and aged for breeding.The water quality was taken for all the sources.

Methods

Water Quality Parameters

The water quality parameters were measured using method described by American Public Health Association (APHA, 2020). The water temperature, dissolved oxygen, turbidity were taken *in-situ in all the sources and in the NIFFR limnology laboratory in New bussa.*

Hatchability

Hatchability was done by counting the number of eggs fertilized and the number of hatchlings after the induced breeding (FAO 2011). The number of hatchlings over the total eggs spawned multiply by hundred to get percentage hatchlings.

Survival Rate

Fish fries that survived after three days of hatching. Survival rate is the number of hatchlings after 72 hours divide by number of hatchlings multiply by hundred (FAO 2011).

Fertilization Rate

The number of hatchlings divided by the total number of eggs fertilized multiply by one hundred.

Data Analysis

All data collected was expressed as mean and standard deviation. The test significant difference was performed by SV 26/IBM SPSS using one way Analysis of variance (ANOVA) follow by a Duncan multiple range test.

Results and Discussion

Table 1 shows water quality assessment of different water sources after induced breeding. There is no significant differences between

water from Kainji Lake and Municipal water ($P>0.05$), Their mean values of pH were as follows 7.20, 7.20 from Kainji lake and Municipal water respectively, while there is significant difference between both of them and borehole water ($P<0.05$) which is 7.56 for pH concentration. There was significant difference between total dissolved solids of all the water sources ($P<0.05$), with borehole water significantly higher than municipal water and Kainji lake water. Water electrical conductivity also has significant difference for all the water sources ($P<0.05$). Water temperature has no significant difference ($P<0.05$) in all the sampling stations. Air temperature around all the three water sources has no significant difference ($P<0.05$). No nitrite and ammonia were found on the water sources immediately after induced breeding.

Table 2 shows the percentage Hatchability and survival of *Clarias gariepinus* fish larvae in different water sources.

In Kainji Lake Water the percentage hatchability is 63.79 percent, municipal water (NMW) 72.33 percent and borehole water is 30.31 percent.

40.23 percent survival in Kainji Lake water (KLW), 55.37 percent in Municipal water (NMW) and 21.25 percent in Borehole water (NBW). There are significant differences percentage hatchability and survival for all the water sources ($P<0.05$).

Table 1: Water Quality Assessment of different water sources after induced breeding. Parameters

	Kainji Lake Water	Municipal	Borehole	Standards
pH	7.20 ± 0.10 ^a	7.20 ± 0.10 ^a	7.53 ± 0.12 ^b	7.0-7.3
TDS (mg/L)	41.00 ± 1.73 ^a	53.67 ± 2.08 ^b	146.67 ± 5.77 ^c	<180
Conduc. (µs/cm)	65.60 ± 2.77 ^a	86.33 ± 2.83 ^b	224.00 ± 16.00 ^b	<200
Water Temp. (°C)	28.50 ± 0.36 ^a	28.63 ± 0.06 ^a	27-32	28.33 ± 0.06 ^a
Air Temp. (°C)	27.00 ± 0.50 ^a	27.05 ± 0.13 ^a	27.06 ± 0.23 ^a	28-31
DO (mg/L)	6.20 ± 0.10 ^a	6.20 ± 0.10 ^a	6.00 ± 0.23 ^a	>5
Nitrite (mg/L)	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	< 0.02
Ammonia (mg/L)	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	< 0.05

The values were expressed in mean ± SD. Values with same superscript across each row indicate no significant difference (P>0.05) while values with different superscript showed a significant difference (P<0.05).

The significant difference observed between the water sources (P<0.05) in Total dissolved solids and conductivity could be as a result of infiltration of mineral salts in those water sources. EPA (2010) stated that water quality will always reflect Lakewaters geology and soil characteristics. The fact that there were no traces of nitrites and ammonia in all the water sources was due to absence of dissolution of organic matter. CSP (2010) reported that ammonia is produced in culture water as a

result of breakdown of organic waste. Hydrogen ion concentration (pH) was within the favourable range of 6.5 to 8.5 as recommended by Watzel (2017). Borehole water had the highest pH level (7.53) which could be as a result of nutrient or salt infiltration. Also, high level of conductivity and total dissolved solids were all connected to dissolve salts from the rocks and soil from which the water is gotten.

Table 2. Percentage hatchability and survival of *Clarias gariepinus* fish larvae in different water sources.

Parameters	Municipal Water (NMW)	Kainji Lake Water (KLW)	Borehole Water (NBW)
No. of Hatchlings	8063.00±206.99 ^c	7144.67±420.30 ^b	3395.00±484.07 ^a
No of Survival	4466.67±289.37 ^c	2867.33±42.44 ^b	715.67±36.83 ^a
Percentage Hatchlings	72.33±2.02 ^c	63.79±4.19 ^b	30.31±4.32 ^a
Percentage survival	55.37±2.69 ^c	40.23±2.40 ^b	21.25±1.84 ^a

The values were expressed in mean ± SD. Values with the same superscript across each row show no significant difference (P>0.05), while values with different superscript showed a significant difference (P<0.05).

The high survival (55.37±2.69%) and hatchability (72.33±2.02%) in municipal water (NMW) and Kainji Water could be due to

optimum favourable water quality. Manju *et al.* (2021) highlighted that fish feed solely on artificial formulated diets have poor

percentage survival and low growth, therefore zooplankton have been widely used for feeding or rearing fish larval stages of fish, most studies confirmed fry performed better when fed with live zooplankton than dried artificial diets. They are heterogenous size distribution of wild zooplankton which make it more suitable for target species of *Clarias gariepinus*.

Conclusion and Recommendation

The study found that hatchability and survival of African Catfish *Clarias gariepinus* can be enhanced to meet Nigeria's Aquaculture demand for fingerlings. They were fed with live zooplankton which also support the growth and survival of *Clarias gariepinus* fish larvae. Kainji Lake Water (KLW) is next to municipal water (NMW), with average hatchability and survival of fishes. Municipal water for optimum hatchability and survival to meet national fingerlings demands.

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