EFFECT OF BOREHOLE AND AGED TAP WATER ON SURVIVAL AND GROWTH OF *CLARIAS GARIEPINUS* FRY

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Abstract

The experiment was conducted for the period of 56 days to determine the effect of borehole and aged tap water on the survival and growth of Clarias gariepinus fry. Two water sources (aged tap and borehole water) were used for fish breeding. Fecundity increased with body weight and hence larger fish had higher fecundity (978,608). The fertilized eggs were incubated which were temperature dependent. The hatchlings with initial mean total length and weight 1.41 cm, 0.126 g and 1.40 cm, 0.122 g respectively were stocked in six glass aquaria tank measuring 0.6 m x 0.3 m x 0.2 m length, breadth and height respectively. There were two treatments (treatment I borehole and treatment II aged tap water) with three replicates. 170 hatchlings were stocked in each aquarium and managed for 56 days. Tap water was aged by keeping it under open air to de-chlorinate through evaporation for 24 hours before use. Water quality parameters such as temperature, conductivity, Dissolved Oxygen and pH were monitored regularly and were within the tolerance range for fish culture. At the end of the experiment, the mean total length were 3.75 cm and 3.52 cm, mean weights were 3.80 g and 3.38 g for treatment one and two respectively. The percentage survivals were 98.85 % and 97.53 % respectively for treatment one and two. There was no significant difference (P> 0.05) in the survival and mortality of the two treatments. The result also indicates that the fish under treatment one (borehole) had better growth and survival when compared with treatment two (aged tap water). The two water sources as they were in their present state are good to culture Clarias gariepinus.

Keywords: Aged tap water, borehole water, *Clarias gariepinus* fry and survival.

Introduction

Aquaculture is the culture of fish and other aquatic organisms under a controlled aquatic environment (Balarin, 1988). In Nigeria, the first trace of fish farming was the practice by some missionaries in the early 1920's in Ilara, Oyo State, where fish was raised to supplement the protein intake of pregnant women (Omitoyin, 2007). The author stressed that the aim of fish culture principally is to produce quality fish food for human consumption. It is also to enhance culture based fishery by providing enough fingerlings for re-stocking open waters like natural and artificial lakes, reservoirs and running streams in order to prevent the extinction of commercially important species of fish especially when and where there is over-exploitation. The author emphasized that fish culture provides additional income to farmers thereby alleviating poverty. It also serves as a source of foreign exchange provides employment opportunities and through fish farming, land that cannot be used for other agricultural purposes can be put to productive use.

However, despite the laudable achievements in aquaculture practices, Nigeria as a nation is lagging behind in fish production. FAO (2000) estimated the projected population to be about 139.10 million people in 2007 and fish demand was about 1.06 million tonnes with domestic fish production of about 0.81 million tonnes leaving a deficit of 0.25 million tonnes (http: //www.fao.org/fi/fcp/en/NGA/body.htm,March2000). Fasasi (2003) reported that the fingerlings demand-supply gap is about 500 million tonnes and water is very critical to fingerlings production. Water availability, quality, management and its sustainable management is key to fish production and management. In view of this, an attempt is hereby made to determine the suitability and effect of two water source (aged tap water and borehole) located at Federal University of Technology, Bosso Campus, Minna in breeding *Clarias gariepinus* and manage their fry and compare their survival and growth rates as well as determination of fecundity, percentage fertility and hatchability.

Materials and Methods

Experimental Site: The experiment was conducted at the fish hatchery unit of Federal University of Technology (F.U.T.), Bosso Campus, Minna between June and July, 2012. The two water sources were located inside the Campus near the fish farm.

Brood stock Procurement and Selection: The ripe and matured brood stocks (350 g -500 g) of *Clarias gariepinus* were purchased from Minna fresh fish market and transported in 20 liter jerry can water holding capacity to the indoor concrete ponds in the fish hatchery of (F.U.T.) Minna. Before stocking, the broodstocks were disinfected with 0.5% salt bath 5 g Nacl/1litre water according to the method of Tonguthai *et al*. (1993). After disinfection, the broodstocks were acclimatized in the nursery concrete ponds for 2 weeks; they were maintained under optimum water temperature and fed with 40% crude protein commercial diet. Ripe and mature broodstocks were carefully selected and examined for gonad development according to the method of Blythe *et al*. (1994). Males were examined for rigid and reddish infusion of the genital orifice and for females, genital orifice for reddish infusion, distension of the belly and release of eggs when gentle pressure is applied on the abdomen. The selected samples were properly maintained separately by ensuring good water quality management and adequate feeding before use for breeding.

Inducement of Brood stock: The brood stocks were injected intraperitoneally with Ovaprim at the dose of 0.5 ml per kg body weight as recommended by Wonarovich and Hovarth (1980) to induce maturation and ovulation. The injected female and male were kept separately and the inducement was done at the water temperature of about 27^{o}C with latency of 11 hours, (FAO, 1996) observed that as temperature increases the latency period decreases.

Removal of Testes and Stripping for Eggs: Male broodstocks were sacrificed to remove testes to obtain milt to fertilized eggs as stated by (Schoonbee *et al*; 1980; Hecht *et al*; 1982). The ripe and matured female was held tightly by two persons at the head and tail regions with towel. The abdomen was gently pressed with hand towards the genital papilla and eggs oozed out and were collected into dry clean Petri dish.

Artificial Fertilization: The stripped eggs were weighed using weighing balance Metler P M Model 2000 to determine the egg fecundity of the fish using the formular thus:

$$\frac{\text{Weight of Total Number of eggs stripped}}{\text{Weight of eggs in sub-sample}} \times \frac{\text{Total Number of eggs count in sub-sample}}{1}$$

The testes were collected in the Petri dish and macerated with scapel and mixed with eggs using feather and some drops of saline solution were added to prevent sticking together of eggs.

The macerated testes were then poured unto eggs and shaken well for proper fertilization. Fertilized eggs were spread in a monolayer on the kankabarn inside the glass aquarium tank that contained clean water. Water was aerated by 6 volts electric powered aerator of 35 B HYFLO as reported by Delince *et al*. (1987). The tap water was de-chlorinated (aged) by keeping it under open air for 24 hours. Initially 170 hatchlings were stocked in each glass aquarium tank. The hatchlings were fed with hatched artemia cysts after yolk absorption. The feeding was at the rate of 3 % per body weight and was fed thrice per day at the interval of 4 hours. Body weight of the hatchlings was determined using sensitive electronic scale (P.E. Balance mx Rady 300 g max).

Determination of Percentage Mortality and Survival Rate

Total mortality of fry was recorded daily and percentage mortality and survival calculated thus:

$$\text{Percentage mortality} = \frac{\text{No. of death x100}}{\text{Total number stocked,}}$$

$$\text{Percentage survival} = \frac{\text{No. of survivors} \times 100}{\text{Total number stocked}}$$

and

$$\text{Specific Growth Rate (SGR)} = \frac{\text{Log Mean Final weight- Log Mean Initial weight x 100}}{\text{Time } (T_2\text{-}T_1)}$$

(After Bargenal, 1978 as reported by Yisa et al., 2010).

Also, percentage fertilization, hatchability and egg fecundity were determined according to method described by (Oyelese, 2006) using the formulae:

$$\text{Percentage Fertilization} = \frac{\text{No. of fertilized eggs} \times 100}{\text{No. of eggs stripped}}$$

$$\text{Percentage Hatchability} = \frac{\text{No. of fry} \times 100}{\text{No. of fertilized eggs}}$$

$$\text{Egg Fecundity} = \frac{\text{Total weight of stripped eggs}}{\text{Weight of eggs in sub-sample}} \times \text{Total No. of eggs in sub-sample}$$

The hatchability rates of eggs were determined based on the method of percentage in hatched eggs as described by Aluko and Ali (2001).

Determination of Water Quality Parameters: Water quality was monitored to ensure that the water used have the optimum required quality for fish culture. The parameters measured include Dissolved Oxygen using Winkler method as described by Golterman *et al.* (1978). pH was determined using KENT EIL pH meter Model 7045146 according to the method described by Lind (1979). Conductivity was measured with conductivity meter, JENWAY Model 4010 according to the method described by Lind (1979). Reading was expressed in µ-ohms/ cm. Temperature was measured with thermometer and expressed in degree Celsius. Water was exchanged every other day.

Experimental Design: Completely Randomized Design (CRD) was used for the experiment. Each treatment was replicated thrice T_1 $R_1T_1R_2T_1R_3$ (borehole) and $T_2R_1T_2R_2T_2R_3$ (aged tap water).

Statistical Analysis: T-Test was used to compare the results of mean values obtained in terms of growth and survival of fry. The specific growth rate, initial and final body weight, body weight gain, initial and final total length, total length gain for the cultured fry of the two treatments were determined and compared using T-Test.

Results

Table 1 shows mean initial and final total lengths and weight of the experimental fish for treatment I (borehole) and treatment II (aged tap water) as 1.41 cm, 3.75 cm and 0.126 g, 3.80 g ; 1.40 cm, 3.52 cm and 0.122 g, 3.38 g respectively. Table 2 shows the cumulative mortality/survival rates and percentages of the cultured fish. Treatment I had the higher percentage cumulative survival (98.85 %) while Treatment II was 97.53 % given percentage cumulative mortality as 1.24 % and 2.47 % respectively. Table 3 shows the egg fecundity of the brood stocks used and percentage hatchability as well as Specific Growth Rate (SGR). The result of water quality parameters monitored during the experiment was shown in Table 4 (Temperature, conductivity, Dissolved Oxygen and pH), all were within the tolerance range for fish culture. Table 5 shows T-Test analysis of mean percentage mortality and survival of the cultured fish. Treatment I (borehole) and II (aged tap water) had mortality and survival of 1.24 and 98.85; 2.47 and 97.53 respectively.

Discussion

The inducement which was done at the water temperature of 27^{o} C with the latency period of about 11 hours, this corroborates report of (FAO 1996) and Oyelese (2006) that as temperature increases the latency period decreases. The water quality parameters monitored during the experimental period had a range of mean temperature to be 26-27^{o} C, conductivity 260-263 µ-ohms/cm, pH of 6.80-6.82 and Dissolved Oxygen range 7.52-7.93 mg/l. This corroborates with Ovie and Adeniji (1990) that a minimum value of 5 mg/l of Dissolved Oxygen is optimum for fish culture. Donald (1993) reported that catfish readily spawn in shallow water with optimum temperature of between 25-32^{o}C. Ovie and Adeniji (1990) stated that pH range between 6-10 is suitable for fish culture, the result agrees with their findings. Fecundity increases with body weight and size hence larger fish has higher fecundity. The *Clarias gariepinus* brood stocks used in this study under treatment I had an average Total Body Weight (TBW) of 480-500g hence higher fecundity (23,038). This observation is in accordance with observations made by Anene and Keke (2009) that fecundity increases with body weight. The high survival and growth rate was attributed to quality and viability of egg and milt resulted in vigour hatchlings. Similarly, the high percentage hatchability could be attributed to same reason. The growth rate of the bred hatchlings was measured weekly and the mean total lengths and weights obtained were subjected to T-Test analysis. The result indicates that the growth in length and weight are not different significantly ($P > 0.05$). This might be as a result of the same type of feeds (hatched artemia cysts) used to feed fry in both treatments and ultimately fed with floating feeds (Coppens) of 40% crude protein at four hours interval, good and adequate management practice with good water quality. However, Table 1 showed that fry managed under borehole water gave better growth and weight compared to aged tap water. The percentage mortality was low in the two treatments. This was probably because of good water quality management ensuring that it was free of pollution, and quality and viability of egg and milt as reported by Ajana and Anyanwu (1995). The results of percentage mortality and survival were subjected to T-Test analysis as shown in Table 5. The mortality was low because the eggs and milt used in this experiment were qualitative and viable.

Conclusion

From the fore going, it could be concluded that the borehole and aged tap water under study in their present condition could be use to culture *Clarias gariepinus* fry, because water of good quality ensures better survival and growth of hatchlings hence boosting fish production.

Table 1: Mean initial and final morphomometric measurements of *Clarias gariepinus* fingerlings reared for 8 weeks in indoor glass aquaria tanks using 2 different water source

Water source	Initial BW (g)	Final BW (g)	BW Gain (g)	Initial SL (cm)	Final SL (cm)	SL gain (cm)	Initial TL (cm)	Final TL (cm)	TL gain (cm)
Borehole	0.126	3.80	3.68	1.32	3.65	2.33	1.41	3.75	2.34
Aged tap water	0.122	3.38	3.26	1.32	3.38	2.06	1.40	3.52	2.12

Key: BW= Body Weight, SL=Standard Length and TL= Total Length.

Table 2: Cumulative mortality/survival rates and percentages of *Clarias gariepinus* fingerlings reared in indoor glass aquaria tanks for 8 weeks using 2 different water source

	Borehole					Aged tap water				
Period (weeks)	No.Sto.	Mort.	% CM	Surv.	% CS	No.Sto.	Mort.	% CM	Surv.	% CS
1	170	3	1.76	167	98.23	170	5	2.94	165	97.05
2	167	2	2.00	165	98.80	165	4	2.42	161	97.58
3	165	0	0.00	165	100.00	161	0	0.00	161	100
4	165	1	0.61	164	99.39	161	7	4.34	154	95.65
5	164	4	2.43	160	97.56	154	8	5.19	146	94.80
6	160	5	3.13	155	96.88	146	3	2.05	143	97.94
7	155	0	0.00	155	100.00	143	4	2.80	139	97.20
8	155	0	0.00	155	100.00	139	0	0.00	139	100
	Total	15	8.82	155	91.18		31	18.2	139	81.76
	$\bar{x}$		1.24		98.85			2.47		97.53
	SD		1.468		1.468			1.986		1.986
	±SEM		±0.201		±0.203			±0.205		±0.207

No.Sto. = Number Stocked, Mort. Mortality, %CM = Percentage Cumulative Mortality, Surv. = Survival and %CS = Percentage Cumulative Survival.

Table 3: Fecundity, percentage fertilization, hatchability and specific growth rate (SGR) of *Clarias gariepinus* Brood stocks

Water source	Fecundity	% Fertilization	%Hatchability	SGR
Borehole	23,038	68	89	0.16
Aged tap water	13,604	55	64	0.13

Table 4: Grand Mean values of water quality Parameters of the rearing tank of *Clarias gariepinus* fingerlings managed for 8 weeks using 2 different water sources

Water source	Dissolved Oxygen (mg/l)	Temperature (^{0}C)	Ph	Conductivity (µ0hm/cm)
Borehole	7.93	26.61	6.80	263.21
Aged tap water	7.52	27.92	6.82	260.93

Table 5: T-test analysis of mean percentage mortality of *Clarias gariepinus* fingerlings reared in borehole and aged tap water for 8 weeks

Percentage (%)	Treatment (Borehole)	Treatment (Tapwater)
Mortality (SS)	1.24 ± 7.65^a	2.47 ± 0.48^b
Survival (SS)	98.85 ± 0.01^b	97.53 ± 0.59^a

Values on the same column with different superscripts were significantly different from each other.

SS = Statistically Significant ($P<0.05$).

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