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Effects Of Different Water Sources On Hatchability, Survival And Growth Performance Of African Catfish (Clarias Gariepinus)

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***Abstract:** This study was conducted to evaluate and compare the hatchability, survivability and growth performance of African catfish (Clarias garipinus) brood stock hatched and raised in different sources of water. The fishes in ratio 2 male to 1 female (1.2kg +/-0.02) were subjected to artificial propagation using Rain, Well, Stream and Borehole water. The latency period, number of eggs released, number of hatched fries, temperature, dissolved oxygen were recorded and hatchability, survivability were calculated. Latency and hatched period (10hrs and 48hrs) respectively were the same for all the treatments. The environmental temperature (25oC) was constants. However, number of egg released by the female fish in rain water (283,540.50) was significantly the highest (p>0.05) and least value of 54,520 eggs released was recorded for well water. However, highest number of hatched eggs (10,748) fries was recorded in borehole water which means fish hatched in bore hole had highest hatchability (8.99%) and least hatchability (3.78%) was observed in fish hatched with rainwater. In the same vein, Fish raised with bore hole also had highest survivability (91.13%). Although, Fish raised with stream water had the highest weight gain and least feed conversion ratio (103.90g and 0.28) respectively.*

Therefore, it can be concluded that bore hole water enhances hatchability and survival while the stream water greatly improved the growth performance of African catfish.

***Keywords:** water quality, fries production, Clarias gariepinus, artificial propagation, pituitary hormone,*

I. INTRODUCTION

Presently, aquaculture is growing at a faster rate compared with all other sectors in the world (FAO, 2006). In Nigeria, aquaculture is a fast growing sector contributing less than 5% of the total fish supplies ,but at growth rate of 2%per year (Moses, 2006) Therefore, aquaculture is regarded as the solution to the problem of insufficient fish supply because it bridges the gap between fish supply and demand due to higher trend in fish production. Fish farming has a promising future and supplies about 40% animal protein intake of the world population. (World Resource Institute, 2008). A steady growing in fish farming has compelled improvements in the technologies necessary for securing the initial and basic requirement for productive aquaculture, namely the production of quality fish seed (fries) for stocking.

Among the culturable fish in Nigeria include African catfish (Ayinla and Akande 1988), it is widely cultured and popularly known to fish farmers because it commands high market price value (Oladosu *et al*., 1991). African catfish is one of the most suitable species in aquaculture because it is hardy,

The needs for the production of quality African catfish seed for stocking the fish ponds and natural water bodies has indeed increased steadily (Brain and Army, 1980). Although, expansion of African catfish cultured in Nigeria is been limited by poor water quality (Akinwole *et al*., 2006).

Today, many hatcheries are facing several problems of which are reported by fish farmers in particular, poor egg quality, poor spawning and low hatchability (Oladosu *et al*.,1991) these problems are related to poor management practiced as well as poor water quality within the hatchery, although most of the problems are associated with water quality. Since, fish perform all of its activities in water; hence a huge success in production of fish particularly in the hatchery can be attained through proper water quality management.

The optimum water qualities determine the success or failure of an aquaculture operation to a greater extent. In various areas, water from several sources may be available for use in the hatchery such as, ground water from different depth (well and borehole water) and various surface water (stream, water) supplies, likely affect the production in hatchery system (Turker, 1991). Ground water generally is considered to be the best source of water for catfish hatcheries. Ground waters are usually free of suspended matter, pollutants, and fish disease organisms. Temperature and chemical composition are relatively constant, and, in regions with abundant ground water, the supply is dependable. Although ground waters are preferred for hatcheries, some waters may have to be treated to make them suitable for use. Depending upon the water, treatments may include aeration to increase dissolved oxygen concentrations; degassing to reduce total gas pressure and remove carbon dioxide and hydrogen sulfide; temperature regulation using water heaters or mixing of waters of different temperatures; sedimentation and filtration to remove iron; and addition of calcium to waters of low hardness. Surface water supplies include streams and rivers, ponds, lakes, and reservoirs. Unpolluted surface water offers several advantages over ground water as a hatchery water supply. For example, dissolved oxygen concentrations tend to be near saturation; dissolved carbon dioxide and hydrogen sulfide concentrations are usually low; total gas super saturation is seldom a problem; and iron concentrations are usually very low.

Nevertheless, all surface water supplies suffer the disadvantages of variable quality and availability with time and exposure to sources of pollution and turbidity. For these reasons, the need to carefully evaluate any surface water before use as a hatchery water supply is imperative. Because quality and availability vary over time, historical record is necessary to predict whether the water will be suitable. Such records are not available for most waters, however, and changes in water temperature, chemical composition, and water availability caused by unusual weather events cannot be predicted by records.

Therefore, the study will investigate the effect of different source of water on hatchability survival and growth performance of African catfish.

II. MATERIALS AND METHOD

EXPERIMENTAL SITE

The research work was carried out at fishery units teaching and research farm, Ladoke Akintola University of Technology, Ogbomoso.

EXPERIMENTAL ANIMAL

Eight brood stock of African catfish (1.2kg+/- 0.2) were procured from a reputable fish farm. The fish are ratio of 4 male and 4 females.

PREPARATION AND ADMINISTRATION OF PITUITARY GLANDS AS HORMONES

One of the male brood stock African catfish1.2kg+/-0.2 was sacrificed in this process to donate the pituitary gland which was extracted, mashed in saline solution to form suspension. Three mils (3ml) of pituitary suspension was administered using calibrated syringe and needle to a mature female African catfish.

The female fish was injected between the lateral line and dorsal fin close to head region. And the fish were kept in the tanks at water temperature of 25oC.

SPAWNING PROCESS

After 10hrs of administering pituitary suspension, the female fish injected with pituitary gland was read for spawning and the eggs were stripped out from the female fish by applying a gentle pressure on the abdomen.

FERTILIZATION OF EGGS

Another male brood stock of African catfish1.2kg+/-0.2 was sacrificed, the sperm sac was cut opened and the contents was empty on the stripped eggs which were stirred with a plastic spoon and fertilization took place within 45-60sec.

HATCHING OF EGGS

The fertilized eggs were incubated in a re-circulatory system having four tanks (60L). The eggs were spread homogenously in one single layer on mosquitoes net which was immersed slightly in water tanks to allow constant running of oxygenate water which enhanced hatchings. And temperature of 25oC was maintained in the re-circulatory system through out of the period of incubation. Then, hatching took place within 28 -32 hrs.

EGGS SEPARATION

15g of sodium sulphate were weight and dissolved in 100ml of distilled water making up the concentration stock solution needed. The solutions breaks the tissues that joined the eggs together in mass and enhanced the easy counting of eggs.

MANAGEMENT OF HATCHED EGGS

After 32hrs of incubation, the hatched eggs swim out into the tanks, the nets were lifted and un-hatched were siphoned out of the tanks to avoid pollution. After 72hrs the fries has consume their yolk, the feeding commence immediately. The fries were fed with artermia at three hours interval (8 time / day). The tanks were kept clean and water qualities were maintained (temperature 25 oC, oxygen 3-5ppm, 6.5-8.5pH).

Data collection

Data were collected on latency period, number of hatched eggs, un-hatched egg and survive fries for rain, stream and well water.

Hatchability = no. of hatchlings/no. of eggs

Survival rate = no. of survived fries/no. of hatchlings x100

Mortality rate = no. of dead larvae / no. of hatchlings x 100

III. RESULTS

Parameter	Rain	Well	Stream	Borehole	SEM
Ph	7.54a	7.51b	7.11c	6.07d	0.00030
Conductivity	ND	3.71b	3.55c	3.92a	0.13000
Alkaline (ppm)	87.50a	52.00c	22.00d	84.00b	0.8560
Total dissolved solid	236.50b	483.25a	10.25d	90.00c	0.6980
Nitrate	0.00	0.00	0.00	0.00	-
Dissolved oxygen (ppm)	5.01d	5.38a	5.23b	5.10c	0.00003

a, b and c mean in the same row with different superscripts are significant different (p<0.005)

SEM: Standard error of mean

Table 1: Water Quality Parameter of Rain, Well, Stream and Borehole

Parameter	Rain	Well	Stream	Borehole	SEM
Number of egg released	283,540.50a	54,520.50d	178,447.50b	119,598.50c	1.38
Number of egg hatched	10,713.50b	2,809.00d	7,442.50c	10,748.50a	1.15
Number of un-hatched eggs	272,811.00a	51,711.00d	171,002.5b	108,848.50c	3.62
Percentage hatchability	3.78d	5.15b	4.17c	8.99a	-
Percentage survived fries (%)	57.05c	54.05d	60.50b	91.13a	0.13
Survived fries	6,122.00b	1,528.00d	4,552.00c	10,248.50a	0.76
Mortality	4,591.50a	1,276.00c	2,885.50b	998.50d	1.52
Latency period (hrs)	10.00b	15.00a	10.00b	9.00b	-
Hatching period (hrs)	48.00	48.00	48.00	48.00	-

Table 2: Effects of different water sources on Hatchability, Fecundity and Survival rate of African catfish (Clarias gariepinus)

Parameters	T1 Rain	T2 Well	T3 Borehole	T4 Stream	SEM
Initial weight(g)	36.43	36.43	36.43	36.43	-
Final weight(g)	80.33d	108.14b	103.79c	140.3a	0.30
weight gain (g)	28.10d	71.71b	67.37c	103.90a	0.30
% weight gain (g)	77.13d	213.31b	184.93c	285.28a	0.75
Specific growth rate(g)	0.41d	0.56b	0.54c	0.70a	0.08
Feed intake	28.75c	29.70a	28.35d	29.12b	0.30
Feed conversion ratio	1.02a	0.41c	0.42b	0.28d	0.24

Table 3: Growth performance of African catfish raised in different sources of water

IV. DISCUSSION

In hatchery production the dissolved oxygen level is very critical to its survival (Boyd, 1992) and the required level of oxygen needed by aquatics species varies with the size of the animal temperature and stress (Boyd, 1998). it has been observed that lower lethal dissolved oxygen level impaired feeding and feed utilization while at upper lethal dissolved oxygen level, death may occur (Adeyemo, 2006) Therefore, higher level of dissolved oxygen recoded for well and stream water above the recommended value of 4-5ppm may be responsible for low hatchability and reduced survival of fries recorded in this study .

Fish being a poikilothermic animal, their metabolic rate is determined by the water temperature. Although fish has a preferred water temperature range at which feeding, metabolism and growth are optimal (Viveen *et al*, 1987). The optimal temperature define as the temperature at which weight gain is greatest (Boyd,1991) and feeding occurs, fish experience no signs of abnormal behavior due to thermal stress (Ellitos,1975). Although, fish suffer thermal stress and die at upper and lower temperature limit (Viveen *et al*, 1987). At lower temperature hatching and development prolonged and often invade egg mass, however at high water temperature, embryo develop too fast and there may be incidence of malformed or nonviable fry which may likely be the cause of lower latency period in stream, low hatchability recorded in well and stream where the temperature is lower and low survival rate recorded for fries raise with stream water. The pH is a measure of acidity or alkalinity of water sample. All the acid and alkaline toxic level at which death occur is pH 4 and11 respectively. Although, the pH of rain, well and stream water used were within the pH range of 6.5 – 8.0 that support good growth performance (Viveen *et al*, 1987). In spite of this the hatchability and fry survival are still very low and may attributed to other factors such as temperature , alkalinity, dissolved carbon dioxide , dissolved oxygen and hardness. Nitrite is an intermediate product that is quickly formed into nitrate by bacterial. At high concentration it is toxic to fish because it react s with hemoglobin to form net hemoglobin which is not effective carrying oxygen there by lead to hypoxia (Boyd, 1991). Nitrate levels in fresh water are usually less than 1mg/l but manmade source of nitrate may elevate above 10mgl in drinking water can caused potential fatal diseases in fries and also contribute to eutrophication Although, nitrite level was zero in rain, well, and stream water which likely responsible for no outbreak of disease during hatching and survival of fries.

Therefore, in hatchery system, water quality parameters such as, dissolved oxygen, temperature, dissolved carbondioxide, water pH should be familiar with.

Adequate dissolved oxygen is critical in hatcheries because eggs and fry have high metabolic rates and thus a high requirement for oxygen. Dissolved oxygen concentration should not fall below 4-5ppm at any time within the hatchery (Boyd, 1991).

The optimum temperature range for development of eggs and rearing of fry is between 78 and 85^{0}F (26^{o}C and 28^{o}C). If the temperature is too low, hatching and development are prolonged and fungi, which thrive in cool water, often invade the egg mass .At high water temperature, embryos develop too fast and there may be incidence of malformed or non-viable fry(Boyd, 1991)

High levels of dissolved carbon dioxide interfere with respiration by eggs and fry. Ideally, water supplies for catfish hatcheries should contain measurable level of dissolved carbon dioxide, but concentration up to at least 10ppm seem to be well tolerate, provided that dissolved oxygen concentration are adequate.

PH expresses the intensity of the acidic or basic character of the water. The PH scale is usually represented as ranging from 0 to 14. Conditions become more acidic as pH values decrease and more basic as they increase .At 770F, pH scale 7.0 is the neutral point .The pH of most fresh water is a function of total alkalinity and dissolved carbon dioxide concentration.

Generally, if the level of those variable are within the desire range, pH will be between 7.0 and 8.5 which is desired pH range for incubating egg and rearing fry.

GROWTH

The pH levels for rain, well, borehole and stream water were within the range of 6.5 and 7.24 respectively which is acceptable according to Ariole *et al.*, (2012) because lower pH levels can lead to loss of the fishes although the Alkalinity level values recorded for borehole, well and runoff are within the recommend value for Alkalinity (<50ppm) and relatively optimal range of +/- 0mg/l which may be responsible for high fecundity and survival rate recorded in the treatment three (Michael *et al.*, 1998).

Water temperatures for all the treatments were also maintained at not more than 28oC (Temperature 2.45oC). For them three treatment. This agrees with the finding of Tucker (1991).Has it was observed at the first water analysis, the dissolved oxygen was highest in T3 (4.7mg/l) and T2 (4.2mg/l) while least value was T1 (4.0mg/l) observed in T1 which might result to the weight observed and recorded at the second week. And also it was observed in the last water analysis that dissolved oxygen was highest in T1 (5.2mg/l) and T3 while the least value was observed in T2 (4.8mg/l) which might result to the final recorded weight at weeks 10. It was also observed that presence of high dissolved oxygen in water enhance the growth performance of fish in the water it increased their feeding rate therefore improve the growth rate

The fish survived in all three source of water because there was no mortality recorded in any of the treatments during the period of experiment.

Also, looking closely at the result of the growth performance of all the treatments, the mean weight gain, the specific growth rate, the percentage mean weight gain of well water T1 is observed to give the best growth performance than borehole and stream T2 and T3.

V. CONCLUSION

From the results obtained, it can be concluded that borehole water enhances hatchability and survival better while stream water was proved to be the best for the growth performance of African catfish than other water sources due to its value in terms of dissolved oxygen, Alkalinity, Temperature and ph. Although, all the three water sources were suitable for the production of African catfish.

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