EFFECT OF SALINITY ON GROWTH AND SURVIVAL OF *CLARIAS GARIEPINUS* (BURCHELL, 1822) PISCES: CLARIIDAE FRY.

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ABSTRACT

The effect of different salinity levels on the growth and survival of Clarias gariepinus fry was studied in indoor hatchery system for a period of three weeks. 1000 Clarias gariepinus fry of an average weight 0.37±0.06g were stocked at 100 fry in five replicated 20 liters plastic bowls. Five salinity levels of 0.2, 0.4, 1.1, 2.1 and 4.2 ppt were tested. The results indicated that significant difference P≥0.05 highest weight gain of 0.89±0.05g was presented by fry in 0.2ppt medium. All fry raised in 4.2ppt died within 24 hours. No significant difference P≤0.05 in weight gain is presented in fry raised in 0.2ppt – 2.1ppt. From this study, the weight gain decreases with increase in salinity. Also the survival rate decreases from 0.2ppt to 1.1ppt raised fry while the lowest significant difference P≥0.05 survivals were presented in fry raised in 2.1 and 4.2ppt. Based on these results and foregoing, salinity rate of 0.4ppt is favourable for growth and survival of C. gariepinus fry.

INTRODUCTION

The interest in the development of aquaculture in Nigeria has been on the increase in recent years, but the major constraints for expansion has been the insufficient production of fingerlings of culturable fish species with good potential for pond culture.

The only alternative for Nigeria is to improve implementation of the accelerated fish production programmes through Aquaculture by tapping the vast fishery resources of the country's numerous rivers, lakes and brackish water areas as well as areas unsuitable for Agriculture. With intensive fish farming through exploration of all available resources, potential fish production from aquaculture can be over one million tones a year if properly harnessed.

Due to the numerous successes achieved in the artificial breeding and culturing of *Clarias gariepinus* and other species in freshwater bodies in Nigeria by many fisheries scientists, hatchery and fish farm operators, the need to meet fish demand through diversification or exploration of other avenues of artificial breeding and culture of this species as already perfected in freshwater environment in a brackish water environment becomes imperative in order to make a better utilization of t the aquaculture potentials of this neglected and unutilized water body for the culture of the popular *Clarias gariepinus*.

The breakthrough in artificial induced spawning, production and rearing of catfishes fry depends on many factors which affect hatchery conditions because an error at this stage can lead to total mortalities due to environmental and other physico-chemical factors such as Temperature and salinity which are the two most important factors affecting aquaculture (Brett, 1979). Salinity is a physical water parameter that, in nature is often unpredictable (Conides, 1996), its fluctuations in surface waters (down to 5m) are controlled mainly by seasonal weather conditions (precipitation and evaporation rates etc) which may also vary considerably (Klaoudatos, 1996).

The purpose of this study is to determine the best salinity for the rearing and culturing of *Clarias gariepinus* fry. It is believed that the result arrived at will improve management practices

and production of this specie in water and promote further interest to recognize the importance of such work to the progress of fish culture in Nigeria.

MATERIALS AND METHOD

The experiment was conducted in the indoor hatchery of National Institute for Freshwater Fisheries Research (NIFFR) hatchery complex. The experimental fish were 7-day-old mudfish (*Clarias gariepinus*) fry of homogenous origin and size produced in the Institute hatchery by artificial induced breeding, stripping, fertilization and hatching.

When the fry were about 7 days old, they were scooped out, counted numerically, and weighed with sensitive weigh balance and are quickly acclimated in 10 different bowls containing aerated water in order to avoid stress.

Five different saline levels 0.0, 0.2 percent, 0.4 percent, 0.6 percent and 0.8 percent were prepared in the laboratory through the dissolution of 0.0, 0.2, 0.4, 0.6 and 0.8 grams of sodium chloride measured through electric weigh balance into 100ml distilled water respectively. Distilled water was used as the 0% or control salinity medium.

The experiment is a simple randomized design involving five different salinity levels of 0.2, 0.4, 1.1, 2.1 and 4.2ppt with 0.2 ppt as control .

100 fry with total mean weigh between 0.35 – 0.38g were introduced after acclimatization into each replicate (10 in number).

Each tank containing fry were fed with mixture of zooplankton and powdered fish meal. Feeding was *ad-libitum* on daily basis. All the fish in each tank received the same feed treatment.

Temperature was taken with mercury-glass thermometer, pH with pH meter while salinity and dissolved oxygen were determined using Boyd method (Boyd 1990) in each bowl before and after the fry are stocked.

All the above water quality parameters are measured to confirm or otherwise whether they fall within the range recommended for catfishes under culturable conditions by Huet (1975) and Boyd (1990).

Analysis of variance (ANOVA) was used to determine whether there was any significant difference in survival and growth of fry due to different salinity levels.

RESULTS

Table 1: Stocking rates, weight and salinity.

Bowl No	Treatment	Salinity (ppt)	No. of fry	Weight (g)
1	$T_1 R_1$	0.2	100	0.37
2	$T_2 R_1$	0.4	100	0.36
3	$T_4 R_1$	2.1	100	0.37
4	$T_1 R_2$	0.2	100	0.36
5	$T_3 R_2$	1.1	100	0.38
6	$T_3 R_1$	1.1	100	0.36
7	$T_4 R_2$	2.1	100	0.36
8	$T_5 R_1$	4.2	100	0.36
9	$T_2 R_2$	0.4	100	0.37
10	$T_5 R_2$	4.2	100	0.38

Table 2: Mean water quality parameter during experimental period

Parameter	Minimum	Maximum	Mean	SD±
Temperature (°C)	27.0	29.0	28.0	±1.41
pH	6.3	7.0	6.68	±0.49
Dissolve Oxygen (mg/l)	4.9	5.6	5.25	±0.49
Salinity (ppt)	0.2	4.2	2.2	±2.83

Table 3: Percentage survival level of fry in treatments.

Treatments (salinity levels)	Average stock	Survival (%)	Mortality (%)
0.2 ppt	100	50	50
0.4 ppt	100	43	57
1.1 ppt	100	31	69
2.1 ppt	100	18	82
4.2 ppt	100	-	100

Table 4: Growth of *Clarias gariepinus* fry under salinity.

Treatments (Salinity levels)	Initial weight (g)	Final weight (g)	Weight gain (g)	Average daily growth (g)
0.2 ppt	0.36±0.01	1.2±0.1	0.89±0.05	0.04
0.4 ppt	0.36±0.01	1.0±0.1	0.69±0.06	0.036
1.1 ppt	0.36±0.02	1.1±0.1	0.78±0.04	0.035
2.1 ppt	0.36±0.01	0.46±0.3	0.11±0.02	0.005
4.2 ppt	0.36±0.02	-	-	-

Table 1 is a one factor Complete Randomized Design (CRD). The treatments (salinity) of 0.2 – 4.2ppt are randomized in ten aerated 20 litre capacity bowls with 100 fry of *C. gariepinus* mean wt. 0.37g in each. Analysis of variance showed that, there is significant difference ($P \leq 0.05$) among the treatments (salinity) of 0.4ppt and 4.2ppt.

Table 2 summarizes the mean value of water parameters and standard deviation for each water parameter for which the fry were stocked during the experimental period. expect for salinity with higher value from, 0.2 ppt to 4.2ppt (2.2ppt±2.83).

Table 3 shows the mean value of mortality and survival percentages after compilation was taken for all the replicate in each treatment. Survival is achieved at lower salinity of 0.2ppt – 1.1ppt.

Table 4 showed that the sizes of fry vary both in weight gain and average daily growth rate. Highest weight gain of 0.89±0.05 is recorded in 0.2ppt against 0.11±0.02 in 2.1ppt. No result in term of weight gain and average daily growth rate was recorded in 4.2ppt.

On analysis, no significant difference ($P \geq 0.05$) in weight gain and average daily growth rate of fry under salinity of 0.2ppt and 0.4ppt. However. significance difference ($P \leq 0.05$) exists in weight gain and average daily growth rate of fry in salinity of 0.2ppt and 1.1ppt. This indicates that salinity at higher-level affect growth in *Clarias* fry. The best salinity for maximum growth of *C. gariepinus* fry is the intermediate salinity of 0.4ppt to 1.1ppt.

DISCUSSION

The details of stocking rate of 100 fry per treatment in five different salinity were sh Table 1. Each treatment were replicated twice to avoid unbiased results emanating from treatment and also to allow valid comparisons among the treatments.

From the result of the water quality parameters (Table 2) the reading of wa temperature, Dissolve oxygen and pH falls within the acceptable levels for warm wat aquaculture by Dupree and Huner (1984); Boyd (1990). These readings are not known to affec fish behaviour, growth and reproduction in fresh water Aquaculture (APHA 1980). It was also noted from the readings after the dissolution of varying levels of salt solution that there was little or no alteration in earlier readings in temperature, oxygen and pH and when subjected to statistical analysis there was no significant difference ($P \geq 0.05$) in the values. However there were significantly higher ($P \leq 0.05$) values in salinity from 0.4 to 4.2ppt. This value is higher when compared with 0.5--1.0ppt obtained by Buttner and Sodeberg (1993) for freshwater aquaculture and this could have contributed to higher mortality recorded in 4.2ppt salinity level in treatment 5.

As indicated in Table 3, the results showed that as the level of salinity in water decreases there is an appreciable level of survival of fry in this medium. It is evident from this result also that there is higher significant difference ($P \leq 0.05$) among values of survival in the difference salinity levels when subjected to ANOVA. This mean that an inversely proportional relationship exist between salinity level and survival of fry because as the level of salinity in water increases from 0.2 – 4.2ppt the percent survival of fry decreases from 50% in 0.2ppt – 0% in 4.2ppt.

Table 4 showed the growth of *Clarias gariepinus* fry during this study. The growth rate is highest in salinity concentration of 0.2ppt closely followed by 0.42ppt and 1.1ppt. These values were significantly higher ($P \leq 0.05$) with the values from 2.1ppt and 4.2ppt. This result thus confirms Klaoudatos (1996) that increase in salinity causes an overall decrease in growth rate in fresh water fishes hence higher salt concentration could be said to hamper growth in freshwater fish.

The result of this study has shown that *C. gariepinus* fry can survive under a small range of water salinity from 0.2ppt to 1.1ppt and there is going be a lethal effect on fish fry from salinity of 2.1ppt and above in freshwater culture environment. Survival is optimum in 0.4ppt considering the fact that *Clarias gariepinus* fry is a freshwater fish at a developing stage of growth, higher concentration of salinity can lead to stress and death at this stage due to osmotic effect.

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