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COMPARITIVE EXPERIMENTAL FISH CULTURE ON THE RIVER BENUE AND IN A CONCRETE POND AT MAKURDI, NIGERIA

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ABSTRACT

An experimental culture of the mudfish, Clarias gariepinus was done in cages suspended on the River Benue at Makurdi for eight weeks to compare with culture in a concrete fish pond. A weight gain of 273g and specific growth rate, (S.G.R) of 5.2 g/day were obtained. These were not significantly different (p> 0.05) from the weight gain of 211g and SGR of 4.7 g/day in the concrete pond culture. River fish culture in cages can be used to increase aquaculture production of fish from River Benue.

Key words: aquaculture; rivers; concrete ponds; *Clarias gariepinus*

INTRODUCTION

Apart from the initial high capital input, other impediments to the growth of aquaculture in Nigeria are land and perennial supply of good quality water for its operations. Land suitable for conventional pond fish culture is prohibitive and unaffordable especially in urban centers because of competing demands from other users like land-based agriculture, urbanization and industrialization **(**Da Silva, 2001).

Good quality perennial source of water is vital for fish culture; the usual sources of water for aquaculture are rivers, streams, ponds, rain channels, wells, and boreholes. These sources may be seasonal, sporadic, intermittent or expensive for an average fish farmer. In Nigeria, commercial fish culture is done mostly in freshwater with earthen and concrete ponds, but not in the many rivers in the country.

River Benue, a major tributary of the River Niger, is the second largest river in Nigeria. It has its origin from the Adamawa Mountains in Cameroun, and flows eastward, through Makurdi and joins the River Niger at Lokoja to flow to the Atlantic Ocean through the Niger Delta (Okayi *et al*. 2001). The River Benue suggests a solution to the twin problems of land and water for aquaculture.

The mudfish, *Clarias gariepinus* belongs to the family Claridae are air breathing, fresh water fish without scales. It is an important and commercially valued fish for the Nigerian fishing industry; it is widely cultured in ponds and they occur freely in Nigeria's natural freshwaters (Ita, 1980). Its culture has spread wide largely because of its hardy and omnivorous nature. This makes it a good candidate for this experimental work on the River Benue. This study is to investigate the prospects of fish culture on the River Benue in cages as was advocated a decade ago (Olokun, 1979).

MATERIALS AND METHODS

Study area

Makurdi is longitude 7° 47, 10° 0, East. Latitude 6° 25 and 8° 8, North. The river flows from the Adamawa hills in Cameroon through Nigeria from the North East. It, geographically, bisects Nigeria into three areas then joins the River Niger at Lokoja and flow into the Atlantic Ocean. It supports about 238 native fish species (Fishbase reported in Okayi *et al*., 2001**).** This experiment was designed to investigate the growth and performance of the mudfish, *Clarias gariepinus* juveniles cultured in cages suspended on the river Benue, near the Benue State Department of Fisheries, Makurdi, and *hapas* suspended in concrete tanks in March 2016.

Cage Construction

Experimental square frame wooden cage 1×1×1m³ units were made with 210/9, 10 mm size metallic mesh. Styrofoam served as floatation devices which were attached to the frame of the cage, concrete blocks were used as anchors. The cages had a cover, which aided during feeding and removal of fish for collection of sampling data. The frame of the square cage was nailed to each other with ½ inch nail, before a metallic mesh was used to cover the frame. Floats were attached to the cage at the four edges. Anchors were attached to the frame of the cage with the use of a rope attached to the cage. The cages were in triplicates

Plate 1: Cages constructed in this experiment for the culture of the mudfish *Clarias* gariepinus in River Benue

Plate 2: Concrete pond partitioned into three for experimental fish culture for this experiment

The cages were placed near the Benue State Department of Fisheries premises away from the swift flow of the river, with their tops protruding from the river.

Fish Stocking, feeding and sampling

C. gariepinus fingerlings were obtained from Akor fish farm, Makurdi, acclimatized for 24 hours and starved for 12 hours prior to the onset of the experiment. The fish were stocked in the experimental tanks at 20 fingerlings of average weight 15±0,04g each with replicates for eight weeks (58 days). The fish were fed a commercial feed, Coppens (45% protein) at 3% body weight twice daily.

Two (2) fish (with replicates) were removed weekly for the assessment of Growth parameters of Weight gain (g) ($W_2 - W_1/t$: W_2 is final weight after 56 days and W_1 is initial weight; specific growth rate (SGR/day: $\ln W_2 - \ln W_1 / t_2$, Where $\ln W_2 - \ln W_1$ = Natural logarithm of initial and final weight over a period t_2-t_1 (Chiu, 1989). Feed conversion ratio (FCR) = total feed intake (g)/total wet weight gain (g); feed efficiency = Weight gain b / Feed intake a Where, a is Feed intake/ feed eaten by the fish and percentage survival = $N_i \times 100/N_0$
N_0 = Total number of fish stocked at the beginning of the experiment. N_i = Total number of fish alive at the end of experiment.

Statistical Analysis

All data were subjected to Analysis of variance (ANOVA) on SPSS 14 statistical package for variation between the two cultures.

RESULTS

Average temperature in the two cultures was 28°C. There was progressive weight gain from the 1st to the final 8th week in *C. gariepinus* in both cultures. Thou the cage fish culture in the river appeared to show better growth rate from the culture in the terrestrial concrete tanks (Fig 3), it was not significantly different ($p > 0.05$).

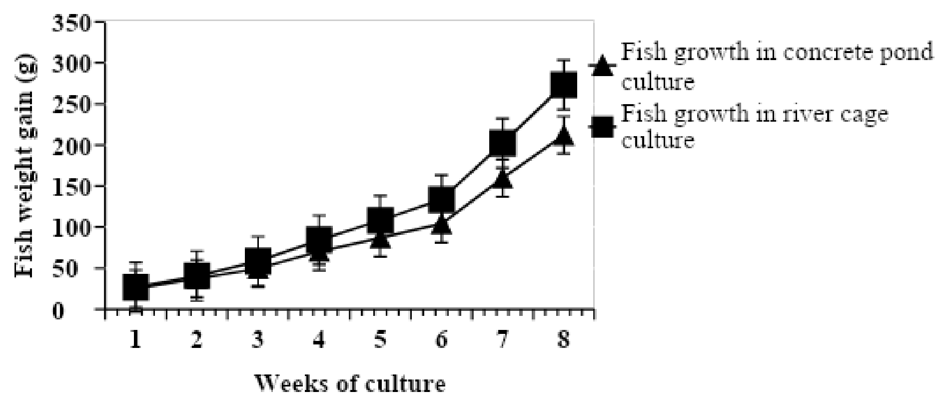

Fig 1: Growth pereformance of *Clarias gareiepinus* in concrete pond and cage cultures on River Benue,Nogeria

There was no significant difference ($p > 0.05$) in the Specific Growth Rate (SGR) and survival rates between the two cultures. There was, however, significant difference ($p < 0.05$) in food conversion ratio, FCR, and food conversion efficiency, FCE (Table 1).

Table 1: Growth parameters in *Clarias gariepinus* cultures in two media after eight weeks

Growth parameter	Concrete tanks	Cage
SGR	4.7 ± 0.1^{a}	5.2 ± 0.2^{a}
FCR	0.1 ± 0.4^{b}	0.2 ± 0.1^{a}
FCE	722.9 ± 23.4^{a}	544.3 ± 31.1^{b}
SURVIVAL	98.3 ± 1.6^{a}	95.0 ± 2.9^{a}

DISCUSSION

The almost 100% Survival rate, 5% specific growth rate in the cage cultured fish suggest that river cage fish culture can be used to increase fish production by aquaculture. Cage cultures avail the fish with not only supplemental feeds but natural food in the river which may be increased by leached nutrients from the supplemental feeds used in cages. The significantly lower (P>0.05) food conversion, FCE of 544 in the cage cultures compared to the 723 in the concrete pond cultures may be attributed to leaching of supplemental feeds in cages This work has reported, comparatively, equal fish production in cages on the river with that in terrestrial concrete ponds which suggests that cage fish culture is feasible on the River Benue in Makurdi.

Cage culture is practiced in both freshwater and marine environments and its popularity for fish culture is increasing for inland waters in reservoirs, raceways and rivers (DeSilva, 2003). These resources abound in Nigeria. It has become the largest contributor to annual aquaculture production in Zambia, where ancillary concerns like cage and fish feed makers also increased Hashima *et al*., (2019). They have relatively low initial cost, with simple technology and management methods when compared to fish culture in concrete tanks which are more expensive (Okayi *et al.*, 2001). Earthen and concrete ponds are expensive to acquire and construct and may not advance the millennium development goal (MDG) of increasing fish production by 250% by 2015 in Nigeria.

The river cage culture does not, however, have this problem. Nets for cages are the major requirement in cage cultures, and there are many commercial fish culture cages available now to remove the hassle of cage construction by aquaculture practitioners. Fish culture on the River Benue will attempt to alleviate the twin problems of scarcity and cost of land; and good quality water. This thought agrees with the findings of Pant *et al* (2014) that even the landless, socially marginally and poor can also participate in aquaculture for enhancement of nutrition and food security. Cash poor households will have greater and easier access to fish proteins from low scale freshwater fish cultures (Cleasby *et al*., 2014).

Where direct fish culture on the river may not be possible, water can be pumped from the river to nearby terrestrial fish culture ponds. Interactions with some fishers indicated their eagerness to embrace the concept. Water allocation policies in Nigeria should also incorporate fish cultures along other river usages. Combined fish cultures with rice, poultry or piggery will help maximize water productivity (Dugan *et al*., 2003).

CONCLUSION

There is potential for cage fish culture on the River Benue. With the availability of the river, difficulties of water and land acquisition for fish culture will be overcome to increase fish production for food security.

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