GROWTH PERFORMANCE OF CLARIID CATFISHES *(Clarias gariepinus, Heterobranchus bidorsalis* AND HETEROCLARIAS*)* CULTURED IN PLASTIC TANKS

Okonji, V. A., Aikpitanyi, I. and Ihenyen*, H. E.

ABSTRACT

Department of Aquaculture and Fisheries Management, University of Benin, Benin City, Nigeria.
**Corresponding Author: Ihenyen, H. E. Department of Aquaculture and Fisheries Management, University of Benin, Benin City, Nigeria. Email address: edowayehilda@yahoo.com. Phone number: +2348077818456.*

Study was carried out to determine the growth performance of the Clariid Catfishes; Clarias gariepinus, Heterobranchus bidorsalis and Heteroclarias in plastic tanks. Growth parameters (survival, biweekly weight gain, absolute growth rate, fish yield and feed utilization) were measured. Nine tanks were stocked with juveniles at the rate of 15 fishes/m^{-3} and fed commercial diets containing 45 % crude protein for 24 weeks. The results showed that C. gariepinus had better ($p<0.05$) growth performance in terms of survival (97.0%), bi-weekly weight gain (341.9g) and absolute growth rate (0.73g). However, Heteroclarias had a better Feed Conversion ratio (1.06) than C. gariepinus and H. bidorsalis. Therefore from this study, C. gariepinus is more suitable for culture in plastic tanks compared to H. bidorsalis and Heteroclarias.

Keywords*: Clariid Catfishes, Growth Performance, Plastic tanks*

INTRODUCTION

The Clariid Catfishes constitute an important and excellent food fish of high commercial value. *H. bidorsalis* and *C. gariepinus* are the two main genera of the African mud catfish (Clarias and Heterobranchus) widely cultured in Africa, Asia and Europe (Adewolu and Adoti, 2010). This is due to their outstanding culture characteristics like the ability to withstand unfavourable environmental conditions, fast growth response, resistance to diseases, high survival rate and ability to attain maturity faster. Studies have shown that *Heterobranchus spp* has some advantages such as higher growth rate, feed conversion over *C. gariepinus* (Anibeze and Eze, 2000) and remarkable yield (Legendre, 1986) while *C. gariepinus* matures earlier and has higher fecundity (Nwadukwe and Ndome, 2000) particularly in pond culture. The development of a hybrid 'Heteroclarias' was as a result of the yearnings of farmers and scientists to have a farmed catfish that combines the fast growth traits of *Heterobranchus* spp and early maturing traits of *C. gariepinus* (Omitoyin, 2007).

One of the main characteristics of urban aquaculture is its integration into the local urban economic and ecological system. Many of the production systems appear to meet the growing needs among urban people for fresh and culturally preferred types of fish. Fish farming in or around cities varies from the relatively small-scale semi extensive culture system to the high-tech, intensive culture of catfish in concrete/plastic tanks. Wide range of production systems have been exploited for culturing fish. These systems include cages, raceways, tanks and ponds. Culture in earthen ponds was the dominant production system in Nigeria (Susana and Graham, 2006). With increased urbanization and the attendant increase in fish demand, large expanse of land required for intensive aquaculture earthen pond is becoming seemingly unavailable in many areas. For Nigeria to make significant contribution in aquaculture at global level and meet her Millennium Development Goals (MDGs) of increasing fish production by over 250% by 2015, efforts need to be geared towards achieving higher production intensities. One way of achieving this is through encouraging urban aquaculture system (Ayoola and Fredrick, 2012). This system of production makes use of varieties of culture facilities that provide needed environment for the growth of the fish.

The use of tanks represents a unique way to farm fish. Instead of the traditional method of growing fish outdoors in open ponds and raceways, this system rears fish at high densities, in indoor tanks with a "controlled" environment (FAO, 2010). Tanks can be made of any suitable material that should be easy to manage during production, allow flexible use and be made of non-toxic materials. Tanks can be constructed of plastic, concrete, fiberglass, treated plywood, cement blocks, epoxy coated steel, rubber, plastic sheeting or any other material that will hold water, not corrode, and are not toxic to fish (Akinwole, 2011). Production will be optimum and more fish made available with a fish species with the better growth performance ability in a given culture facility. The use of plastic tanks for fish culture is on the increase in Nigeria. This study was aimed at comparing the growth performance of Clariid catfish types in plastic tanks, so as to determine the best species for plastic tank culture.

MATERIALS AND METHODS

The experiment was layed out as a factorial experiment. The factors of the experiment were Clariid Catfish types (*C. gariepinus, H. bidorsalis* and Heteroclarias) and culture period (weeks). Thus, the experiment was designed as 3 fish type X 24 weeks culture period factorial in complete randomized design. A total of one hundred and thirty five (135) Clariid Catfishes were used for the study. Forty five juveniles of *C. gariepinus* which were sourced from the Department of Fisheries experimental tanks, Faculty of Agriculture, University of Benin and forty five juveniles each of *H. bidorsalis* and Hetroclarias which were sourced from Molly Ventures, Ikorodu, Lagos State. Nine tanks with a capacity of 160 litres were used. The tanks were stocked at a density of 15 fishes/m^{-3}/tank. The fishes were fed to satiation twice daily (9.00hrs and 16.00hrs) with commercial diets of 45% crude protein throughout the duration of the study.

Calculation of growth response in experimental fish species

Survival rate (%)

$$\text{Fish survival (\%)} = \frac{\text{No. of fish that survived}}{\text{No. of fish stocked}} \times 100$$

Mean weight gain (g) (MWG)

MWG = Weight 2 – Weight 1

Where Weight1 = initial mean weight of fish at time T1

Weight 2 = final mean weight of fish at time T2

Absolute growth rate (g) (AGR)

$$\text{Absolute growth rate} = \frac{\text{Final mean weight gain- initial mean weight gain}}{\text{Time in days}}$$

Fish yield

$$\text{Fish yield} = \frac{\text{Weight of fish}}{\text{180 days (culture period)}}$$

Feed conversion ratio (g) (FCR) (Hepher, 1988)

$$\text{Feed conversion ratio} = \frac{\text{Weight of feed consumed}}{\text{Fish weight gain}}$$

RESULTS AND DISCUSSION

Survival

The result on the survival rate of the three Clariid catfish types are shown in the Table 1. There was significant ($p<0.05$) difference in the survival rate. *C. gariepinus* and Heteroclarias had significantly higher survival rate (97 and 90.7%) than *H.bidorsalis* (84.3%). This disagrees with findings of Adam *et al*., (2014) who reported *H. longifilis* showed a higher survival rate value of 86.21% against 66.94% recorded for *C. gariepinus*. This may be because the *H. bidorsalis* exhibited high cannibalistic characteristics in the plastic tank, which could have hindered their survival rate. This is similar to the findings of Okonji (2004) who noted high aggressive behaviour among *H. bidorsalis* in aquarium tanks due to limited space.

Table 1: Survival rate of Experimental species

Time weeks	*C. gariepinus*	*H. bidorsalis*	Heteroclarias	Mean**
2	100.0	97.8	100.0	99.3b
4	100.0	97.8	100.0	99.3b
6	100.0	91.1	91.1	94.1ab
8	100.0	91.1	88.9	93.3ab
10	100.0	88.9	88.9	92.6ab
12	100.0	88.9	88.9	92.6ab
14	95.6	84.4	88.9	89.6ab
16	93.3	82.2	88.9	88.9ab
18	93.3	82.2	88.9	88.1ab
20	93.3	82.2	88.9	88.1ab
22	93.3	62.2	88.9	81.5a
24	93.3	62.2	86.7	80.7a
Mean*	97.0a	84.3b	90.7a	

Note: Means with different alphabetic remarks are significantly different at 5% probability level.
** Horizontal comparison for the fish types only*
*** Vertical comparison only for the time in weeks*

Growth rates

There was a significant ($P<0.05$) difference in the absolute weight gain among the three Clariid catfish types. *C. gariepinus* had the highest weight gain per day (i.e. 0.73g/day) than *H. bidorsalis* and *Heteroclarias* that were statistically similar (Table 2). Similarly, there was significant ($P<0.05$) difference (Figure 1) in the bi-weekly weight gain. *Clarias gariepinus* had significantly ($P<0.05$) higher bi-weekly mean weight gain than

Heterobranchus bidorsalis and Heteroclarias. This agrees with the findings of Adams *et al.*, (2014) who recorded higher bi-weekly weight gain for *C. gariepinus* (173.78g) over 42.78g recorded for *Heterobranchus longifilis*.

Table 2: Absolute weight gain in experimental fish species

Time weeks	*C. gariepinus*	*H. bidorsalis*	Heteroclarias	Mean**
2	0.433	0.093	0.180	0.236a
4	1.520	0.433	0.360	0.771e
6	0.897	0.333	0.153	0.461bcd
8	1.130	0.153	0.163	0.482cd
10	0.663	0.323	0.477	0.488cd
12	1.403	0.323	0.127	0.618de
14	0.477	0.173	0.377	0.342abc
16	0.540	0.143	0.157	0.280ab
18	0.500	0.293	0.393	0.396abc
20	0.413	0.207	0.407	0.342abc
22	0.633	-0.100	0.133	0.222a
24	0.200	0.374	0.167	0.247a
Mean*	0.734a	0.229b	0.258b	

Note: Means with different alphabetic remarks are significantly different at 5% probability level.
** Horizontal comparion for the fish types only*
*** Vertical comparison only for the time in weeks*

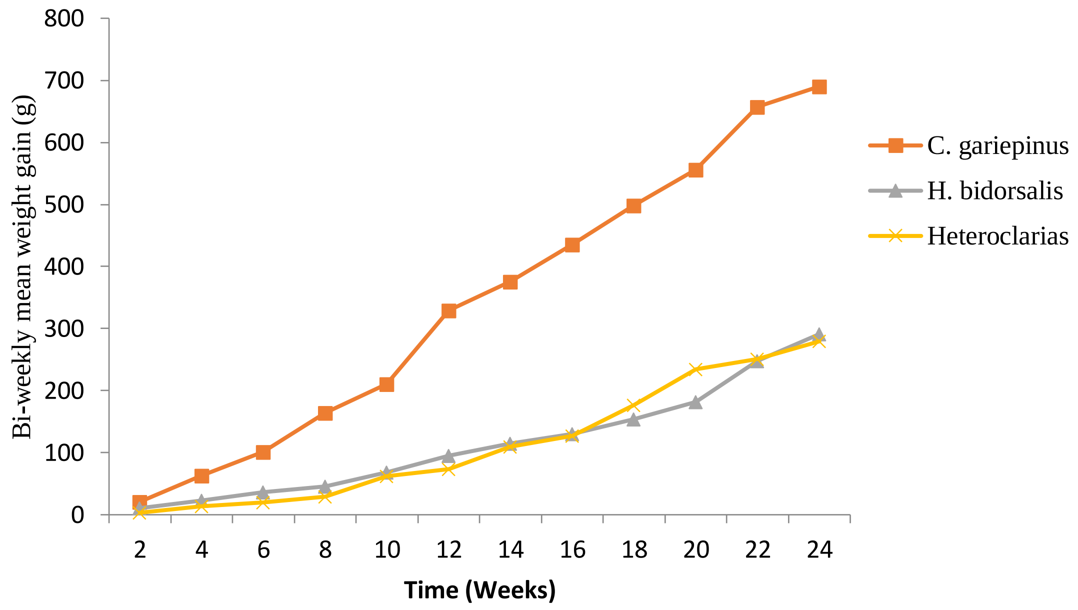

Fig 1: Bi-weekly weight gain of various Clariid Catfishes over time

Fish yield

The result of total fish yield shows significant difference (P<0.05). *C. gariepinus* (53.98 g/m^3/180days) yielded more than *H. bidorsalis* (16.01g/m^3/180days) and Heteroclarias (20.09 g/m^3/180days). Bigger sizes (500-1000g) of fish were found in *C. gariepinus*. This reveals better growth and weight gain in *C. gariepinus*. This agrees with the research work of Okonji and Ewutanure (2011), who reported high yield of *C. gariepinus* under culture with various feeding regime. It however disagrees with the findings of Fleuren, (2008) and Anibeze and Eze, (2000) who reported that Heteroclarias and *H. bidorsalis* had higher yield compared to *C. gariepinus* respectively when reared in concrete tanks. Differences in yield may be due to differences in culture facilities.

Feed Utilization

Result in Table 3 indicated that there was no significant (p>0.05) difference in the feed conversion values among the three Clariid catfish types. This indicates that these Clariid Catfishes converts feed to body weight at same level of efficiency. This may be related to their similar feeding habits as Clariid catfishes.

CONCLUSION

In this study, *C. gariepinus* had better growth performance compared to *H. bidorsalis* and Heteroclarias because of their better adaptability to plastic tank. It is therefore advisable to culture *Clarias gariepinus* in plastic tanks.

Table 3: Feed conversion ratio for experimental fish species

Time weeks	*C. gariepinus*	*H. bidorsalis*	Heteroclarias	Mean**
2	1.52	4.70	1.20	2.41bc
4	0.53	0.67	0.14	0.45a
6	0.95	1.05	1.00	1.00a
8	0.69	1.33	0.44	0.82a
10	1.50	0.40	0.72	0.87a
12	0.86	1.40	2.17	1.48ab
14	1.51	1.44	0.59	1.18a
16	3.48	3.33	1.67	2.83c
18	2.07	0.64	1.28	1.33ab
20	2.18	1.26	0.41	1.28ab
22	1.69	0.55	1.63	1.29ab
24	1.60	0.31	1.67	1.19a
Mean*	1.55a	1.42a	1.06a	

Note: Means with different alphabetic remarks are significantly different at 5% probability level.
** Horizontal comparion for the fish types only*
*** Vertical comparison only for the time in weeks*

REFERENCES

Adams, F. Y., Nkemakolam, A. N., Ekenezer, D. O., Olufemi, O. A., James, O. A, Tamitope, E. A., Esther, E. O. and Mercy, E. 2014. A comparative study on growth performance and survival rate of *Clarias gariepinus* Burchell, 1822 and *Heterobranchus longifilis* Velenciesnnes, 1740 under water recirculation system. *Journal of Agriculture, Forestry and Fisheries*. 3 (1):30-33.

Adewolu, M. A. and Adoti, A. J. 2010. Effect of mixed feeding schedules with varying dietary crude protein levels on the growth and feed utilization of *Clarias gariepinus* (Burchell 1822) fingerlings. *Journal of fisheries and Aquatic Science*, 5:304-310.

Akinwole, A. O. 2011. Design and Operation of Recirculating Fish Production System. *In Aiyeloja, A. A and Ijeomah, H. M (eds) Book of Reading in Forestry, Wildlife Management and Fisheries*: 823-852.

Anibeze, C. I. P. and Eze , A. 2000. Growth rates of two African catfishes (osteichthys clariidae) in homestead concrete ponds. *Journal of Aquatic sciences*, 15:55-58.

Ayoola, O. A. and Fredrick, C. A. 2012. Effects of the shapes of culture tanks on production of the Africa catfish *Clarias gariepinus* juveniles. *Journal of agriculture and social research* 12 (1):130-142.

Dixie, G. and Ohen, S. 2006. The markets for Catfish and Aquaculture products in Nigeria. USAID Nigeria Maximizing Agricultural Revenue and Key Enterprises in Target Sites. (in Winrock eds.) implemented by Chemonics Internatuonal, 50p.

Food and Agriculture Organisation 2010. Climate-Smart Agriculture: Policies, practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organization of the United Nations (FAO) Vaile Della Terme Di Caracalla, 00153.

Fleuren, W. 2008. Reproductive and Grow out Management of African Catfish in the Netherlands; in Ponzoni R.W.and N.H. Nguyen (eds) 2008. Proceeding of a workshop on the development of a genetic improvement program for African Catfish *Clarias gariepinus*. *World Fish Center Conference Proceedings number* 189. The World Fish Center, Penang, Malaysia, 130p.

Legendre, M. 1986. Seasonal changes in sexual maturity and fecundity and HCG-induced breeding of the catfish, *Heterobranchus longifilis* val. (Clariidae), reared in Ebrie Lagoon (Ivory Coast). *Aquaculture* 55:201-213.

Nwadukwe, F. O. and Ndome, I. G. 2000. Effects of rearing periods on the production of hybrid catfish (*Clarias gariepinus* & *Heterobranchus longifilis*) fingerlings *Journal of Aquatic sciences*, 15:23-26.

Okonji, V. A. and Ewutanure, S. J. 2011. The effect of daily and alternate feeding days on the growth rates of *Clarias gariepinus* fingerlings fed with commercial feed (coppens). *Nigerian Journal of Agriculture food and Environment*. 7(3):33-38.

Okonji, V.A. 2004. Observations on Aggressive behaviour of *Heterobranchus bidorsalis* and *Oreochromis niloticus* in co-culture. *Nigerian Journal of Applied Science* 22:182-186.

Omitoyin, B. O. 2007 Introduction to fish farming in Nigeria. University of Ibadan Press,p.90.