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Growth Performance of Hybrid Catfish (*Clarias gariepinus*× *Heterobranchus bidorsalis*) in Earthen Ponds

F.G. Owodeinde, K.A. Fakoya and M.A. Anetekhai
Department of Fisheries, Faculty of Science, Lagos State University, Ojo, P.M.B. 001 LASU Post Office, Ojo Badagry Express Way, Lagos, Nigeria

Corresponding Author: F.G. Owodeinde, Department of Fisheries, Faculty of Science, Lagos State University, Ojo, P.M.B. 001 LASU Post Office, Ojo Badagry Express Way, Lagos, Nigeria

ABSTRACT

Fish seed of the right quality and quantity remain a major challenge facing aquaculture in Nigeria. This study was conducted to evaluate the potentials for culturing the hybrid of *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) (*Heteroclarias*) to commercial size in earthen ponds. Three earthen ponds 0.02 hectares were stocked each with 330 fingerlings of *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) hybrid (popularly called *Heteroclarias*) on the 1st February, 2010. Mean weight at stocking was 7.50±1.50 g. The fish were fed 3% of their body weight two times daily with compounded artificial feed containing 45% crude protein. The changes in length and weight of the fish were measured fortnightly and the feed fed to the fish were accordingly adjusted to reflect the changes in weight. Temperature, dissolved oxygen, pH and total ammonia-nitrogen were measured in each pond. Survival rates, specific growth rate and condition factor were also determined. Survival at harvest (24 weeks after stocking) was 97.3% and the mean weight of the fish was 880±78.72 g (ranged, 610-1150 g). Standing crop at harvest was 282.48 kg/0.02 ha (14,124 kg ha^{-1}). Growth of hybrid (*Heteroclarias*) was positively correlated with the number of weeks of the study (R = 0.9). Results demonstrated the potential of *Heteroclarias* for use in aquaculture and indicate that the fish species can be grown to commercial size within 24 weeks from fingerling stage under semi-intensive pond condition. The best time to selectively harvest the fish for maximum gain in terms of good growth and maximum profit on feed utilization is also 24 weeks.

Key words: *Heteroclarias*, growth performance, earthen pond, maximum profit, feed utilization

INTRODUCTION

The Clariids constitute an excellent food fish of high commercial value. Infact, the catfish species are very important to the sustainability of aquaculture industry in Nigeria (Owodeinde and Ndimele, 2011). The feeding habit of Nigerians tend to support this assumption and this trend started manifesting from the late 1980s. This was when it became apparent that commercially exploited clariid populations were declining and their commercial value especially in the restaurant trade was increasing. Consequently, interest in the culturing of clariid catfishes as commercial food fish then began to develop. Its value as food fish is reflected in the wholesale prices in the local markets which ranged from $4.5 to 7 per kg depending on the size, location and season of capture. This high demand of the Clariid especially in the restaurant trade resulted in generally high prices which serve as an added inducement to would-be fish farmers or groups interested in commercial fish culture.

Hybridization is the production of progeny of parents from different lines, strains and species. It is one of the genetic improvements in aquaculture industry which has been recognized as a tool for stock improvement and management purposes. Several studies have demonstrated that *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) hybrid exhibit superior growth, improved survival and general hardiness than true breed of either *Clarias gariepinus* or *Heterobranchus bidorsalis* (Madu *et al*., 1991, 1992; Madu and Aluko, 1999; Salami *et al*., 1993; Adeyemo *et al*., 1994; Nwadukwe, 1995; Aluko, 1996; Dada and Olarewaju, 1996). Most of these studies have focused on stock manipulations and growth performances at different dietary compositions in indoor and outdoor concrete tanks (Madu *et al*., 1993; Aluko, 1995). However, there is lack of adequate scientific information on the growth performance of hybrid catfish (*Heteroclarias*) under semi-intensive pond condition. This study was designed to evaluate the potentials for culturing the hybrid of *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) (*Heteroclarias*) to commercial size in production quantities in earthen ponds.

MATERIALS AND METHODS

Collection and acclimation of experimental fish: Fingerlings of the hybrid of *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) (*Heteroclarias*) used in this study were obtained from the Hatchery Complex of the Department of Fisheries, Lagos State University (LASU) Ojo, Nigeria. Upon arrival at the Omague Fish Farm Ijotun, Badagry Local Government of Lagos State, Nigeria, where the experiment was conducted, the fish were kept in the rearing tanks to allow them recover from stress due to transportation and acclimatized them to their new environment. They were in the rearing tanks for two weeks, during which they were fed on compounded diet (56% crude protein).

Experimental procedure: Three rectangular earthen ponds (0.02 ha) were stocked on 1st February, 2010 with 330 randomly selected artificially reared fingerlings of *Heteroclarias* (*Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂)) produced in the Hatchery Complex of the Department of Fisheries, Lagos State University (LASU) Ojo, Nigeria. The fingerlings were produced through induced breeding using a synthetic hormone (Ovaprim), at the rate of 0.5mg (500 IU) per Kg body weight of the female fish and administered intramuscularly in the dorsal muscle mass as described by Viveen *et al*. (1985). Two weeks before stocking, the ponds were filled with water from the farm bore-hole, fertilized with complete inorganic fertilizer (NPK-15-15-15) at the rate of 112 kg ha^{-1} and poultry manure at the rate of 200 kg ha^{-1}, then seeded with plankton collected from a culture farm pond by pumping pond water through plankton net.

Two times daily, the fish were fed on compounded artificial feed containing 45% crude protein, prepared by using the following ingredients fish meal (15.8%), soybean meal (59.4%), yellow maize (18.2%), blood meal (5.1%) vegetable oil (1.0%) and vitamin premix (0.5%) at 3% of their body weight based on the recommendation of Viveen *et al*. (1985). At two weeks interval, the fish were sampled with a 2.0 cm mesh size bag seine net 25 m long to monitor growth. Fish were not fed 24 h before the samples were collected to allow the intestinal contents to be digested. To avoid sampling error at least 30% of the experimental fish species were weighed and the length measured bi-weekly. To avoid stress due to handling, the randomly selected fish were subjected to mild anesthetization in a 20 mg L^{-1} solution of MS-222 (Tricaine methane sulfornate) purchased from Sigma Chemical, St. Louis Missouri, USA. They were measured for the Standard Length (SL), Total Length (TL) (to the nearest 0.1 mm) and wet weights (to the nearest 0.1 g) using graduated long

ruler and top loading sensitive scale (Model 1500). After all measurements, the fish were revived in fresh water and then returned to the ponds. On 30th August, 2010, the ponds were drained; all the fish were removed, counted and weighed to determine the survival rate and standing crops. They were held in three 6 m^3 concrete tanks.

Determination of water quality parameters: Water quality data collected during the study period included temperature, dissolved oxygen, pH and total ammonia-nitrogen. Temperature was monitored with a simple mercury-in-glass thermometer graduated in 0.01°C. Dissolved oxygen was normally measured between 0700-0800 h with a YSI Model-57 DO meter and further authenticated by alkaline-azide – modification of Winkler's method (Boyd, 1981). pH values were determined using a Griffin pH meter (Model 400), while total ammonia-nitrogen were determined by the standard methods as described by Boyd (1981).

Growth analysis: The linear regression relationship between body weight and the number of weeks of growth of *Heteroclarias* was calculated using this formula (Uzoagulu, 1998):

$$Y = B_0+B_1 X_1 \text{ or } Y = a+b X_1$$

where, Y is mean weight of the fish (g), B_0 and B_1. are all constant. B_0 is the intercept on Y-axis, B_1 is slope of the line or gradient and X_1 is No. of weeks of growth. With this equation one was able to determine the size/weight of the study fish at any point in time.

Mean specific (instantaneous) growth rates estimated as percentage increase in weight per growth period of the hybrid were calculated at the end of each growth period using the formula:

$$SGR = \frac{\log_e (W_t)-\log_e (W_0)}{t}\times 100$$

where, SGR or G is specific growth rate, W_t is the weight (g) at the end of the interval (end of the period), W_0 is the weight (g) at the beginning of the period and t is time (i.e., the duration between initial and final sampling) in days. The calculation of SGR or G which accounts for both initial and final sizes is useful in comparing growth of the fish species at different sizes (Brown, 1946; Brown, 1957). This formula estimated the percentage increase in weight per growth period.

Condition factor (K) to determine the relative robustness (i.e., the state of well being of the fish) were calculated for each growth period according to the equation (Lagler, 1956):

$$K = \frac{W\times 10^5}{L^3}$$

where, W is the fresh weight (g) and L the standard length (mm).

The experimental fish species were fed 3% of their body weight throughout the study period. The amount of food dispensed (kg) to the fish stocked in the three experimental ponds were adjusted bi-weekly by sub-sampling the population of the fish species in order to reflect the forthnightly increase in biomass using the following (Stickney, 1979):

$$W_1 = W_0+(W_0\times F/C)$$

where, W_1 is the weight of the fish at day 1, W_0 is the weight of the fish at day zero, F is the percentage feeding rate and C is the Food Conversion Ratio (FCR).

RESULTS AND DISCUSSION

Several investigators have recently demonstrated that *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) hybrid (*Heteroclarias*) can be grown to commercial size in various types of culture systems (Madu *et al*., 1991, 1993; Madu and Aluko, 1999). The present study yielded the best growth and production rates yet published in Nigeria on *Heteroclarias* (CG ♀×HB ♂) grown to commercial size in commercial quantities in earthen ponds and serves as a further indication of the potential of the hybrid for commercial culture.

Growth, survival and production: After the initial stocking of 330 fish per 0.02 ha in the experimental pond (16,500 fish ha^{-1}), the mean body weight increased from 7.50±1.50-880±78.72 g (ranged between 610-1150 g) (Table 1) and a mean growth rate of 4.75 g day^{-1}. Growth was rapid from May to August which coincides with the raining season. The relationship between the body weight and the number of weeks of growth is shown in Fig. 1. The graphical representations and the statistical computations of the body weight against the number of weeks of growth of the study fish showed that they were highly correlated. The computation of the data provides the following:

$$Y = -47.29+33.71X_1,\ R = 0.98,\ N = 322$$

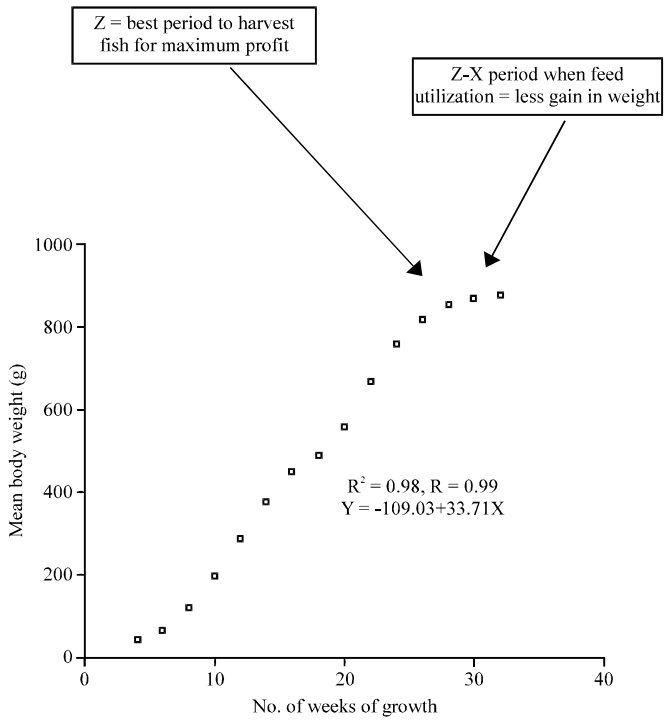

Fig. 1: Relationship between mean body weight and number of weeks of growth in *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) (*Heteroclarias*)

Table 1: Final length-weight relationship, correlation coefficient and condition factor of study fish

Parameter	*Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) (*Heteroclarias*)
Weight (g)	
Mean	880±78.72
Range	610-1150
Standard length (mm)	
Mean	318.27±94.37
Range	405-465
Correlation	0.61
N	322
'a'	-2.02
'b'	1.45
K	2.99

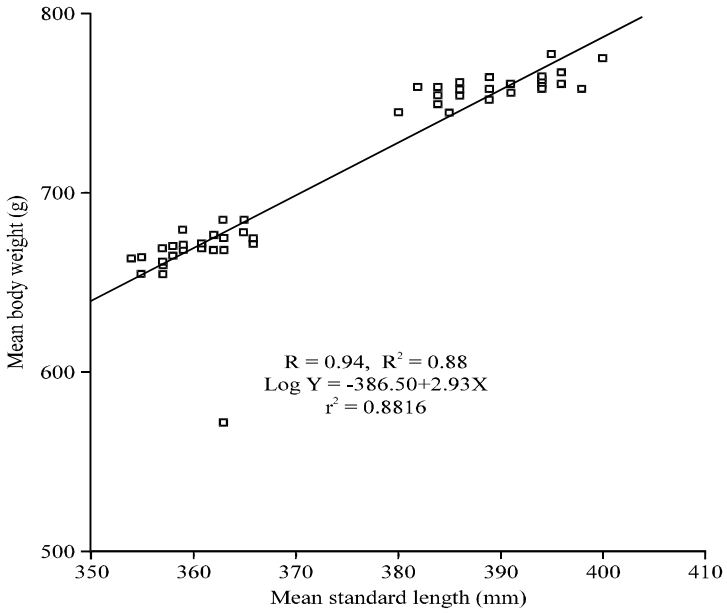

Fig. 2: Relationship between mean body weight and mean standard length of *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) (*Heteroclarias*) in June

A geometric growth curve was observed when the relationships between the two variables were plotted against each other. The observed growth curve showed the best time to harvest the hybrid (*Heteroclarias*) for maximum gain in terms of good growth and when maximum profit on feed utilization can be achieved. The study shows that *Heteroclarias* could better be harvested at 24 weeks from fry stage. Beyond this time, there was decreased efficiency of feed utilization and a decline in growth rate sets in (Fig. 1).

At the final harvest on 30th August, 2010, survival was 97.3% and the mean standing crop was 282.48 kg 0.02 ha^{-1} (14, 124 kg ha^{-1}). Over 99% of the hybrids were considered marketable (= 600 g) and the weight of some exceeded 1150 g (Fig. 1). Weight distributions of the samples in June (Fig. 2), July (Fig. 3) and August (Fig. 4) indicated that about 55, 65, 85 and 99%, respectively were marketable at those ages (5, 6, 7 and 8 months, respectively). About 75% of the fish in the present study were considered commercially harvestable by mid-June [age 6 months],

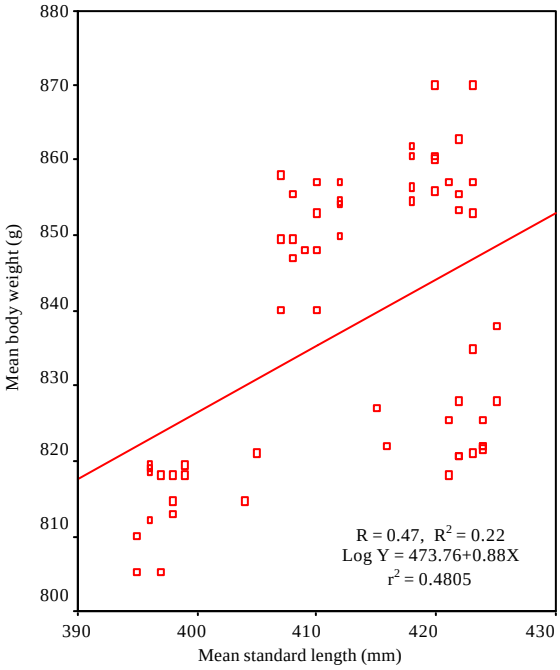

Fig. 3: Relationship between body weight and standard length of *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) (*Heteroclarias*) in July

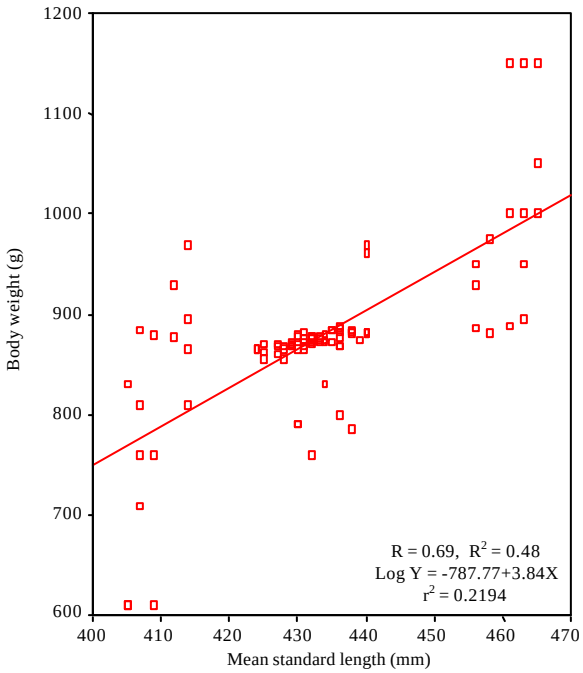

Fig. 4: Relationship between mean body weight and mean standard length of *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) (*Heteroclarias*) in August (at harvest)

and over 95% had attained that status by mid-August [age 8 months], they could have been selectively harvested and sold during the period when prices were at premium. This practice would allow consolidation of smaller fish into fewer ponds for additional growth. The removal of larger fish would also provide early cash return and eliminate the need of looking for buyers for a large percentage of the hybrid which would have been commercially marketable in the restaurant trade (Fig. 2-4).

Specific growth rate and condition factor (K): Daily specific daily growth rate declined from a maximum of 4.14 day^{-1} during the first month of study to as low as -0.75 day^{-1}. High initial specific growth rates that decrease with increasing age and individual fish biomass and consequent increased metabolic costs followed typical pattern of fish growth (Kerby *et al*., 1987). Mean condition factor (K) for fish sampled was 2.99. However, all the fish in the pond had condition factor greater than 1.5 which appeared to represent desirable levels as most fish were healthy and robust. Fish that were sacrificed after the harvest contained appreciable quantities of fats.

Water quality: Water quality parameters were generally within acceptable limits. Bore-hole water with an alkalinity of 27.6 mg L^{-1} as $CaCO_3$ was used to fill the ponds. Water quality values were generally satisfactory for the growth and health of the experimental fish species. Values for total ammonia nitrogen did not exceed 0.08 mg L^{-1} and were normally in a range from 0.02-0.06 mg L^{-1}. The pH ranged between7.3 to 8.7. Temperature 25-27°C, dissolved carbon dioxide 6-9 mg L^{-1} and dissolved oxygen concentrations ranged between 5.5-9.3 mg L^{-1} remained within acceptable limits. All these water quality parameters fall within the range reported by Huet (1979) as good for pond fish culture.

Food conversion: Food Conversion Ratio (FCR) (expressed as weight of dry feed/wet weight of fish) was 3. Though, the FCR in most fishes e.g., catfishes vary from less than 1.5 to 5.0 (Jensen, 1989). We believed that the FCR is a little on the high side in the present study. The reason for this high FCR is not known. Since sinking pelleted feed was used, significant amount of feed might be wasted, this could account for high FCR observed in this study. We believe that feeding practices can be refined to provide more efficient conversion ratios without reducing growth rates.

CONCLUSION

The present study yielded the best growth and production rates yet published in Nigeria on *Clarias gariepinus* (♀)×*Heterobranchus bidorsalis* (♂) hybrid (popularly called *Heteroclarias*) grown to commercial size in commercial quantities in earthen ponds and serves as a further indication of the potential of the hybrid for commercial culture.

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