



THE RESPONSE OF HYBRID CATFISH FRY AND FINGERLINGS TO TWO NON EXTRUDED FLOATING FEED

*OVIE S. O., L. M. O. IBIYO, T. O. O. BABALOLA & S. S. EZE

National Institute for Freshwater Fisheries Research, P. M. B. 6006, New Bussa, Nigeria

*Correspondence: Stella_ovie@yahoo.com, +2348054504166

ABSTRACT

Hybrid of male *Heterobranchus longifilis* and female of *Clarias gariepinus*, fry (0.87 ± 0.02 g) and fingerlings (4.42 ± 0.02 g) were stocked 10 fish and 7 fish respectively in 30 litres of water in 54 litre capacity aquaria in triplicates. Two NIFFR floating feed (42.01% C. P., and 44.75% C. P.) were formulated and fed to the fish in triplicates for 56 days. There was no significant variation ($P > 0.05$) in the mean weight gain, protein efficiency ratio, food conversion ratio and specific growth rate of fish fed the various diets. The Feed Conversion Ratio (FCR) and Specific Growth Rate (SGR) were highest in fry than in the fingerlings that were fed with NIFFR diets. The Protein Efficiency Ratio (PER) was best for juveniles than for fingerlings and fry. The condition factor of the fry, fingerlings and juveniles fed the various diets was less than 1 while the regression coefficient (r^2) was 1 for the various treatments in the three experiments. Carcass composition showed that moisture content was higher at stocking than at harvest while all other parameters were higher at harvest than at stocking.

Keywords: reciprocal cross, growth performance, fish meal

INTRODUCTION

Heteroclarias, the hybrid of male *Heterobranchus longifilis* and female *Clarias gariepinus* is one of the most cultured fish in Nigeria. Most fish farmers have resorted to growing *Heteroclarias* because of the perceived vigour, resistance to disease and better growth (Oladosu *et al.*, 1993; Bartley *et al.*, 2000; Odedeyi, 2007). Aluko (1995) reported that the growth performance of male *Heterobranchus longifilis* and female *Clarias anguillaris* had significantly higher weight and length than the reciprocal cross. Nwadu kwue (1995a) stated that the growth performance of *Clarias gariepinus* and *Heterobranchus longifilis* and their F1 hybrids with the reciprocal cross show growth rate that are higher than the smaller of the parents and lower than the bigger of them. Ekelemu (2010) observed differential growth in the hybrids. In another study in ponds, fingerlings of *Heteroclarias* displayed differential growth pattern while their parents grow uniformly (Ekelemu and Ogba, 2005).

In feeding *Heteroclarias* most fish farmers depend on imported floating fish feed such as coppers, vita-feed multi-feed and Durante. These imported feed are more expensive than locally prepared sinking. Odedeyi (2007) stated that food is a basic necessity of life, second only to air and water. There has been a shifted preference for floating imported feed over the sinking feed that is available locally. Ndome *et al.* (2011) stated that fish food supply energy for movement activities and the

building block for growth. They further stated that good nutrition in animal production systems is essential to economically give healthy product. Feed comprise 60 – 70% of the operational cost in fish farming and so reliance on importation would keep profit skeletal low.

Artificial feeding of fish has been known to have the advantage of allowing high stocking density, promote fast growth rate, and stimulate rapid growth of plankton through biodegradation of uneaten food. Floating feed especially enables the farmer to observe the behaviour of the fish (Webster *et al.*, 1999; Adikwu and Haruna, 1999). As the aquaculture industry grows with the introduction of new candidate fish species, the need to produce specific feed formulations for production of quality fish has to be met (Oso *et al.*, 2011). Miles and Chapman (2006) reported that potentials of fish production in Nigeria could be realised through fish farming, however this depends on availability of cheap feedstuff with which to manufacture feeds. The success of the catfish industry for channel catfish, rainbow trouts and salmon in the USA is due mainly to several years of nutritional research which has made available pelleted diets formulated to meet the needs of these species (Adewumi, 2009). This study is to determine the response of *Heteroclarias* fry and fingerlings to two floating feed produced by manipulating feed ingredients.

MATERIALS AND METHODS

Experimental diets were placed on the surface of a 35L of water in a bucket to test the length of time it floats and the mean of the least and maximum time was noted. Two experiments were carried out for fry and fingerlings of hybrid (*Heterobranchus longifilis* (male) x *Clarias gariepinus* (female)) catfish for 56 days. The fry (0.87± 0.02 g) and fingerlings (4.42 ± 0.02 g) were stocked 10 fish, 7 fish and 3 fish respectively in 30 litres of water in 54 litre capacity aquaria in triplicates.

The fish was acclimatized for three days, during which they were fed Coppens catfish feed. Coppens feed is an imported feed widely available and commonly used by catfish farmers in Nigeria. Two NIFFR floating feed (42.01% C.P. and 44.75% C.P. Table 1) were formulated and broken to sizes commensurate with the mouth of the fish. They were fed at 5% body weight twice daily (9.00 and 18.00 hrs). The composition of the feed is as shown in Table 1 while Table 2 shows the proximate analysis of NIFFR 3 and NIFFR 4.

The aquaria were cleaned every other day of remnant of feed by siphoning. Water siphoned out was replaced. Complete exchange of water was carried out after every two weeks and on sampling days. Sampling was done biweekly by weighing all the samples in each aquarium. During the experiment aeration was done with air pumps.

The growth parameters were measured as follows:

Mean Weight Gain (MWG) = Wt – Wo where Wo is initial weight and Wt is final weight

Specific Growth Rate (SGR) (%/day) = 100 x (ln Wt – ln Wo)/t

Feed Conversion Ratio (FCR) = dry food intake/Weight gain (g)

Protein Efficiency Ratio (PER) = (weight gain per fish x 100)/ N x 6.25 given per fish

K (Condition factor) = 100W/L³ where w is weight of fish and L is length of fish

The proximate analysis of the experimental fish before and after the experiment was carried out using two samples for fry and fingerlings and one sample for juvenile of fish from each treatment. The proximate composition of the experimental feed was also done according to AOAC (2000).

The statistical analysis was done using the computer package SPSS version 13. Data collected for Mean Weight Gain, Specific Growth Rate, Food Conversion Ratio, Protein Efficiency Ratio and percentage survival were subjected to One – Way analysis of variance (ANOVA) followed by Tukey’s post hoc test of SPSS version 13 Computer package to test the significance of their means.

Some water quality parameters such as dissolved oxygen, pH, temperature and conductivity were measured using standard methods (APHA 1989).

RESULTS

Table 1 shows the composition of the two experimental floating feeds; while Table 2 shows the proximate composition of the two floating feeds fed to *Heteroclaris* fry and fingerlings for 56 days.

Table 1: Percentage composition of ingredients (g) in NIFFR feed

	FM (g)	SBM (g)	GNC (g)	Maize (g)	Yeast (g)	Vit. B.co (g)	Vit. C (g)	Wheat Offal (g)	Premix (g)	Starch (g)	Oil (g)
NIFFR 3	450	50	50	50	50.4	0.3	0.3	300	20	20	5
NIFFR 4	500	50	50	50	54.4	0.3	0.3	250	20	20	5

FM=Fish Meal; SBM= Soybean Meal; GNC=Groundnut Cake

Table 2: Proximate composition of ingredients in NIFFR feeds

	Percent Moisture	Percent Protein	Percent Crude fat	Percent Ash	Percent Fibre	NFE
NIFFR 3	4.60	42.00	12.91	6.40	2.50	31.59
NIFFR4	4.65	44.75	13.49	6.50	2.00	28.61

Both diets floated for 10 to 30 minutes. Tables 3 and 4 show growth parameters of fry and fingerlings of *Heteroclaris* fed the two floating feeds respectively. There was no significant variation (P > 0.05) in the mean weight gain, protein efficiency ratio, food conversion ratio and specific growth rate of fish fed the diets in the two experiments. Among

the two sizes of fish in the experiments there was significant variation (P < 0.05) in the protein efficiency ratio of the fry, fingerlings and juveniles. FCR and SGR were highest in fry than in the fingerlings (Tables 3 and 4). The PER was best for fingerlings than for fry.

The condition factor of the fry and fingerlings fed the various diets was less than 1 while the

regression coefficient (r^2) was 1 for the various treatments in the two experiments.

Table 3: Growth of *Heteroclaris* fry fed two NIFFR feeds

	MIW	MFW	MWG	FCR	SGR	PER	PS	K
NIFFR 3	0.85 ± 0.02	8.23 ± 0.32	7.38 ± 2.31	0.63 ± 0.12	5.2 ± 0 1.6	3.28 ± 1.03	80 ± 14.14	0.34
NIFFR 4	0.88 ± 0.02	9.7 ± 1.99	8.83 ± 1.99	0.56 ± 0.05	4.86 ± 1.28	3.29 ± 0.74	50 ± 28.3	0.68

Table 4: Growth of *Heteroclaris* fingerlings fed two NIFFR feeds

	MIW	MFW	MWG	FCR	SGR	PER	PS	K
NIFFR 3	4.43 ± 0.12	14.01 ± 2.16	9.58 ± 2.07	0.53 ± 0.07	2.04 ± 0.25	4.26 ± 0.92	42.28 ± 50.5	0.979
NIFFR 4	4.4 ± 0.05	18.54 ± 9.05	14.14 ± 9.01	0.59 ± 0.02	2.39 ± 1.07	5.28 ± 3.36	50 ± 50.5	0.76

Table 5 shows the carcass composition of *Heteroclaris* fry fed the two feed while Table 6 shows the carcass composition of fingerlings *Heteroclaris* fed two feed. The carcass composition of the two sizes of fish in the two experiments

showed the same pattern such that the moisture content of the fish at the end of the experiment was lower than that of the fish stocked. The crude protein, crude fat, crude fibre ash and NFE were higher at the end of the experiment than at the initial stocking.

Table 5: Proximate composition of carcass of fry of *Heteroclaris* fed two NIFFR feeds

	Percent Moisture	Percent Protein	Percent Crude Fat	Percent Ash	Percent Fibre	Crude NFE
INITIAL	78.49	14.10	3.33	1.00	2.20	0.88
NIFFR 3	70.80	23.35	3.58	1.00	0.98	0.29
NIFFR 4	70.25	22.99	3.60	1.75	1.00	0.41

Table 6: Proximate composition of carcass of fingerling *Heteroclaris* fed two NIFFR feeds

	Percent Moisture	Percent Protein	Percent Crude Fat	Percent Ash	Percent Fibre	Crude NFE
INITIAL	73.98	18.44	5.13	1.00	0.90	0.55
NIFFR 3	66.37	25.85	5.48	1.30	0.92	0.08
NIFFR 4	67.25	25.14	5.01	1.50	1.0	0.10

DISCUSSION

Fish like other animals grow in length and weight and the relationship shows changes in body shape or condition of the animal. The condition factor recorded for the fry and fingerlings of hybrid, *Heteroclaris* was less than 1 in the two treatments. It is not an indication that the fish is in bad state as the growth pattern is due to allometric growth, where the length increased more than weight. This observation is common with fish even in the wild as reported with some species in Ona Lake, Southern Nigeria (Ekelemu and Zelibe, 2006). In the treatments the correlation coefficient $r^2=1$ an indication that the fish were in good condition. Similarly, in the culture of *O. niloticus* this pattern of growth was observed (Olurin and Aderibigbe, 2006).

The FCR for hybrid, *Heteroclaris* in the experiments showed good utilization and conversion of feed in the two stages. In considering the SGR, the fry experiments performed better than the fingerlings with both diets. This is similar to the SGR obtained in monoculture of *Heteroclaris* (Adewolu *et al.*, 2008). The SGR of fingerlings was also fairly good being higher than that which Davies *et al.* (2006) observed for *Heteroclaris* fed a 52% C.P. diet (Odedeyi, 2007) and *H. longifilis* fed commercial floating feed of 40% C.P. (Davies *et al.*, 2006). The FCR shows that the various stages of the fish would require different formulations as there was significant difference ($P < 0.05$) in their ability to convert the same feed. According to Oso *et al.*, (2011) the development of new species – specific diet

formulations support the aquaculture industry as it expands to satisfy growing need for reasonably priced, safe and excellent fish. These diets therefore, could serve as catfish feed. Miles and Chapman (2006) reported that the fisheries prospects of Nigeria could be developed through fish farming. This growth in aquaculture will depend on available good quality and relatively cheap feed ingredients for the manufacture of fish feeds. This study has shown that fish size specific diets are also important in that unnecessary wastage would be avoided. In the two experiments it was observed that the growth parameters did not vary much between the two diets, an indication of good food intake. This compares well with Sotolu (2010).

The body protein deposition at the end of the two experiments shows protein retention due to optimal utilization for growth. Hybrid *Heteroclarias* in this study showed good conversion efficiency and a good candidate for sustenance of aquaculture as stated by Adebayo and Popoola (2008). The fat content of the carcass for the two experiments showed increase over the initial fat content at stocking, indicative of the adequacy of the fat in the diets for activity and metabolism which may have contributed in protein sparing resulting in more protein intake for fish growth and tissue development. This reflects a balance in the Protein/Energy ratio (Reis *et al.*, 1989). The decrease in moisture content of the carcass of the fish at harvest over the moisture content at stocking is due to the increase in protein and fat content and this observation compares well with the results for feeding *H. longifilis* by Fagbenro *et al.*, (1992) and Ufodike and Matty (1983) for *Cyprinus carpio*.

CONCLUSION

NIFFR 3 (42% C.P.) could be considered as the cost effective standard feed for hybrid *Heteroclarias* fry and juveniles as it contains a lower quantity of fish meal and relatively cheaper to formulate.

REFERENCES

Adebayo O. T. and Popoola, O. M. (2008). Comparative evaluation of efficacy and cost of synthetic and non – synthetic hormones for artificial breeding of African catfish (*C. gariepinus* Burchell 1822) *Journal of Fish. Aquat. Sci.*, 3(1): 66 – 71.

Adewolu, M. A., Ogunsanmi, A. O. and Yunusa Abubaka (2008) Studies on growth performance and feed utilization of two Clariid catfish and their hybrid reared under different culture systems. *European Journal of Scientific Research* 23 (2) 252 – 260.

Adewumi A. A., 2009. Catfish culture in Nigeria: Progress, Prospects and Problems <http://snakehead-fish.com/2009/05/21/catfish-culture>.

Adikwu I. A., and Haruna, A. A. (1999). Nutritional evaluation of hydrolysed feather meal/ plant protein blends as replacement for fishmeal protein in diets for juvenile *C. gariepinus* (Burchell 1822) *African Journal of Applied Zoology* 17: 17 – 22.

Aluko P. O., (1995). Growth characteristics of first, second and back cross generations of the hybrids between *H. longifilis* and *C. anguillaris*. National Inst. For Freshwater Fisheries Research Annual Report New Bussa Nigeria pp 74 – 78.

AOAC, (2000). Official Methods of Analysis (22nd Ed.) *Association of Official Analytical Chemists* Arlington VA.

A.P.H.A (1989) *American Public Health Association* (APHA) American water works association and water pollution control federation (1989). Standard methods for the examination of water and waste water (17TH edition) APHA, New York USA.

Bartley, D. M., K. Rena and Immink A. J. (2000). The use of inter-specific Hybrids in Aquaculture and Fisheries. *Reviews in Fish Biology and Fisheries*, 10:325 - 337 .

Dada B. F., and Gnanadoss, D. A. S. (1983). Nigeria fisheries development challenges and opportunities of the 1980's in proceeding of the 3rd Annual Conference of FISON. p14.

Davies, O. A., Inko – Tariah, M. B. and Amachree, D. (2006). Growth response and survival of *Heterobranchus longifilis* fingerlings fed at different feeding frequencies. *African Journal of Biotechnology* 5 (9) 778-780.

Ekelemu J. K., (2010). Differential growth pattern of *C. gariepinus*, *H. bidorsalis*, and hybrid *Heteroclarias* fed commercially prepared diets. *Agriculture and Biology Journal of North America* 1 (4) 658 – 661.

Ekelemu J. K., Ogba, O. (2005). Growth performance of *Clarias gariepinus* fed rations of maggot meal as replacement for fish meal. Pp. 159 – 162. In proceedings of the 20th Annual Conference of the Fisheries Society of Nigeria (FISON) Port Harcourt 14th – 18th Nov. 2005.

- Ekelemu J. K. and Zelibe, S. A. A. (2006). Growth patterns and condition factors of four dominant fish species in Ona Lake, Southern Nigeria. *Journal of Fisheries International* 1 (2-4) 157 – 162.
- Fagbenro O. A., A. M. Balogun and Anyanwu, C. N. (1992). Optimal dietary protein level for *Heterobranchus bidorsalis* fingerlings fed compound diets. *The Israeli Journal of Aquaculture – Bamidgah*, 44 (3) 87 – 92.
- FAO, (2000). Projected population and fish demand and supply in Nigeria. [http://www :FAO./ filfep /NGA/bodyhtm.march,2000](http://www:FAO./filfep/NGA/bodyhtm.march,2000).
- Federal Department of Fisheries (FDF), 2002/ 2004. Fisheries Statistics of Nigeria.
- Miles R. D. and Chapman, F. A. (2006). Benefits of fish meal in aquaculture. IFAS Extension. University of Florida.
- Ndome, Chris B. , A. O. Ekwu and Alfred A. Ateb (2011). Effect of feeding frequency on feed consumption, growth and feed conversion of *Clarias gariepinus* x *Heterobranchus longifilis* and hybrids. *American-Eurasian Journal of Scientific Research* 6 (1): 6 – 12.
- Nwadukwe F. O., (1995a). Analysis of production, early growth and survival of *C. gariepinus* (Burchell 1822) *H. longifilis* (Val.) Pisces: Claridae and their F1 hybrids in ponds. *Netherlands Journal of Aquatic Ecology* 29 (2): 177 – 182.
- Odedeyi D. O., (2007). Survival and Growth of hybrid (female *Clarias gariepinus* and male *H. longifilis*) fingerlings: Effect of broodstock sizes. *American – Eurasian Journal of Scientific Research* 2(1) : 19 – 23.
- Oladosu, G. A., O. A. Ayinla, A. A. Adeyemo, A. F. Yakubu and Ajani A. A. (1993). A comparative study of the reproductive capacity of the African catfish species *Heterobranchus bidorsalis* Geoffrey, *Clarias gariepinus* Burchell and their Hybrid Heteroclarias. NIOMR Technical Paper, pp:92.
- Olurin K. B. and Aderibigbe, O. A. (2006). Length – Weight relationship and condition factor of pond reared juvenile *Oreochromis niloticus*. *World Journal of Zoology* 1(2) 82 – 85.
- Oso J. A., Idowu E. O. and Agoi, O. F. (2011). Growth responses of *Clarias gariepinus* fingerlings fed *Parkia biglobosa* diet as protein source. *Indian Journal of Science and Tech.* 4(2): 82 – 84.
- Reis L. M., Reutebuch E. M. and Lovell, R. T. (1989). Protein to energy ratios in production diets and growth, feed conversion and body composition of channel catfish. *Aquaculture*. 77 : 21 – 27.
- Sotolu A. O., (2010). Growth performance of *C. gariepinus* (Burchell 1822) fed varying inclusions of *Leucaena leucocephala* seed meal. *Tropicultura* 28 (3): 168 – 172.
- Ufodike E. B. C. and Matty, A. J. (1983). Growth responses and nutrient digestibility in Mirror Carp (*Cyprinus carpio*) fed different levels of cassava and rice. *Aquaculture*, 31: 41 – 50.
- Webster C. D., Tiu L. G. and Morgans, A. M. (1999). Effects of partial and total replacement of fish meal on growth and body composition of sunshine bass (*Morone chrysops* x *M. saxatilis*) fed practical diets. *Journal of the World Aquaculture Society*. 30(4) 443-453.