Teugles G. F., 1990: A systematic revision of the African Catfish Heterobranchus Geogray Saint Hilarie (1809) Pisces: Clariidae. Zool J. Liman Soc. 98:237-257.
Villareal Z. W., 1980: culture of tilapia and Cyprinus in fortaleza Bennales Pisco (Peru) Documenta, Vol. 8, No. 74.

GROWTH RESPONSE AND SURVIVAL OF F_1 HYBRID FRY OF *HETEROBRANCHUS LONGIFILIS* AND *CLARIAS GARIEPINUS* REARED IN GLASS AQUARIA AND PLASTIC BASINS

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ABSTRACT.

The growth response of F_1 hybrid fry of female Heterobranchus longifilis and male Clarias gariepinus were investigated under laboratory conditions in glass aquaria glass tanks and plastic basins. The larvae were produced artificially after inducement with Ovaprim. The hatching percentage was very high. Weekly mean length and weight were monitored for 6 weeks. The average length increase was higher in aquaria glass tanks than in plastic basin. However, there were depressed and irregular weight increases in both types of rearing troughs while significant weight increase ($p < 0.05$) was recorded at week 6 in the plastic basin. Generally, the growth rate and survival in both containers were not significantly different.

INTRODUCTION.

The breeding goal of any aquaculture programme should be to adopt methods that will produce quality seed which can survive better, grow faster and resist some routine or common diseases and adverse environmental conditions. Fish hybridization seems to achieve optimum culture characters from different species as a result of heterosis (Hickling, 1966; Moav, 1979;

Kirpichnikov 1981and Chevassus, 1983). Hybridization, a process of producing individuals (offsprings or progeny) from two pure varieties of the same or different species, has been reported both under natural and artificial conditions (Miller, 1950; Smith, 1961). Results obtained so far indicate that hybrids of *H. longifilis* and *Clarias gariepinus* have desirable qualities. These qualities include fast growth rate, high fecundity, better taste, better nutritional qualities and tolerance to unfavourable environmental conditions. These achievements from hybridization have improved the aquaculture potentials of many nations favoured. Jobling (1983) observed that alterations in the growth rate of fish are amongst the most sensitive indicators of environmental change and it is often desirable to conduct laboratory studies to obtain base line values of growth, which can then be applied in ecological studies.

Different culture trials have also been made with fish seed from different sources (both wild and aquaculture) although the average yield still needs to be improved upon. The little successes made were with seeds from artificial spawning or fertilization.

The aim of this present works is to study the growth rate and survival of the hybrid of *Heterobranchus longifilis* and *Clarias gariepinus* in plastic basins and glass aquaria.

MATERIALS AND METHODS

Induced Spawning and Incubation

Male *Clarias gariepinus* and female *Heterobranchus longifilis* were procured. Induced spawning was carried out by injecting the female *Heterobranchus longifilis* first with Ovaprim (R) at a dosage of 0.5ml/kg body weight while the male *Clarias gariepinus* was injected after 3hr interval. After latency period of 16hrs the male was sacrificed and testes dissected. Milt was obtained by making incisions and squeezing of the tissue. The milt was mixed with a pure saline solution of 0.9% NaCl and kept in a beaker. Eggs were stripped from the female by gentle application of hand on the abdomen. The eggs were fertilized by mixing them with the milt three minutes after stripping of eggs. Fertilization was aided with the use of feather. Fertilized eggs were incubated in kakabans immersed in 30L basins of equal sizes filled with water to a depth of about 12cm.

Incubation was carried out with constant aeration and under the following water quality parameters: temperature, 26°C; and of PH 6.5. Hatching took place at about 29hr after fertilization and kakabans were removed 7hr after commencement of hatching. Unfertilized eggs were removed from the containers a day after hatching to avoid fouling of the water, which could lead to mass mortality.

Fry Rearing

The hybrid larvae were reared in the laboratory of Michael Okpara University of Agriculture Umudike using plastic basins and glass aquaria.

At day 8 after hatching, the larvae were transferred to glass aquaria and plastic basins with four replicates of each at the rate of 100 fry per container, $^1/_3$ filled with water to a depth of 12cm. Larvae were fed once daily with live mixed zooplankton 3 days after hatching while 40% crude protein supplementary feed was combined with the mixed zooplankton at day 8. This continued for the next 5 weeks. The leftover food was siphoned out from the base of the containers regularly.

Data Collection

Weight and length measurements were carried out weekly for a period of 6 weeks. The fry were weighed to the nearest 0.1g with Acculab 333 balance length measurements were carried out with the aid of a metric ruler. Fry survival was recorded according to the formula below

$$\% \text{ Survival} = \frac{\text{Number of Survivors}}{\text{Total number of fry stocked}} \times \frac{100}{1}$$

The experiment was continued to week 6 after hatching at ambient temperature ($26^0 - 27^oC$).

Experimental Design/Statistical Analysis

A Factorial experiment in a completely randomized design was carried out. Two types of containers made up of plastic basins and glass aquarium were used with four replicates of each, and a stocking density of 100 fry per container.

Statistical analysis followed the General Linear Model (GLM) procedures of the Statistical Analysis System (SAS, 1991). Analysis of variance (ANOVA) was performed to detect any variations in length and weight based on the type of container used and between the weeks. The means were separated following the new Duncan Multiple Range Test (DMRT) where any statistical differences occurred. The percentage survival was analyzed graphically while regression between survival and weight as well as survival and length were made.

RESULTS

Administration of a single dose of Ovaprim (R) at 0.5ml/kg fish weight and a latency period of 18h before stripping at 25-27°C successfully induced spawning and hybridization of *Heterobranchus longifilis* and *Clarias gariepinus*. The fertilization rate was high (80%) and the incubation technique resulted in good percentage hatchability (70%) and the, hatching commenced at about 27.39hr within the above temperature range. The percentage of normal fry was high in all the containers.

Tables 1 & 2 show the mean length and mean weight variations respectively during the weeks under study. There were no significant differences ($p > 0.05$) in the treatments while there were significant differences ($p < 0.05$) between the weeks, mean lengths and mean weights. The hybrid larvae showed high length increase in both glass aquaria and plastic basins at weeks 3, 5, and highest at week 6, which was more pronounced in the glass aquarium. Significant length increase ($p < 0.05$) were observed from weeks 3 to 6 in the glass container while plastic basins recorded significant length values ($p < 0.05$) only at the 3rd, 5th and 6th weeks. The observed length increase in both containers was more pronounced at week 6 with about 5% higher length value in the glass aquaria than plastic basin. Again, close observation of the mean weights showed a decrease in weight at week 2 (when larva were subjected to additional feeding with artificial feed) and 4 in glass container while plastic basins showed no weight increase at week 3 when feeding with artificial feed was intensified.

Figure 1 showed that at weeks 2 and 3, the fry had higher length increase in plastic basins while from week 4, growth was better in the glass aquaria. There was also a higher length value of 2.03cm in glass aquaria and a lower value of 1.93cm in plastic basins at week 6. Duncan's Multiple Range Test at 5% level of significance showed that there were significant differences between the weeks in mean length increase except between week 1 and 2 when artificial feed was introduced.

Figure 2 revealed the fact that glass aquaria had irregular weight increase. The weight increase in glass aquarium was higher than plastic basin at week 3 when the plastic basin recorded no increase in weight while the plastic basins had higher increase in the rest of the week after week 1, when the both containers indicated equal weights.

Table 4, is the Duncan's Multiple Range Test at 5% level of significant for weight, which reveals that a distinct growth occurred at week 6. Again, a careful look at the means (Duncan's Multiple Range Test) showed that week 5 is not significantly different from week 3 and 4, and week 3 and 4 also have no distinct growth from week 1 and 2.

Figure 3, shows a sharp decrease in survival in week 2 immediately after stocking to rearing containers. But a close look at the graph indicates that after stocking (weeks 2), the fry had maximum survival value of 39.1% in plastic basin and minimum value of 30.8% in glass aquarium at that same week. Also there was relatively progressive decrease in survival in both containers.

A regression of mean length and percentage survival as well as regression of mean weight and percentage survival in plastic basins and glass aquaria respectively showed negative or inverse relationships in each container (Figures 4 & 5). As a result of that, a negative coefficient of regression was recorded.

DISCUSSION

Successful hybridization between *Clarias gariepinus* and *heterbranchus longifilis* was established. The result confirmed those of other reports (Hecht and Lublinkhof, 1985. Legendre *et al*., 1992), which also stated that *Clarias gariepinus* and *Heterobranchus longifilis* could be successfully hybridized under artificial conditions. The high latency period (18h at 25-27°C) and ease of egg flow during stripping is supported by the report of Ufodike and Madu (1998). Fertilization and hatching rates obtained, indicates that hormone dosage (0.5/kg ovaprim) and the high latency period can induce spawning and hybridization of *Clarias gariepinus* and *heterobranchus longifilis*. The delay in hatching 28 – 32hr could be due to aeration and a high oxygen tension in the incubating water as recorded by Smith (1957).

High percentage survival after hatching experienced at the on set could be attributed to the good management practices such as siphoning of the deformed fry, dead unfertilized eggs and egg shells (Ayinla, 1991)

According to Hecht and Appelbaum (1988), relatively small variation in size of fry *Clarias gariepinus* could be observed within the first few days after the commencement of exogenous feeding. Fingerling size variations are common phenomenon during African catfish harvest in ponds. This variation is known to be mainly as a result of both genetic and environmental factors (Nwadukwe, 1995). These could be the reasons for growth variation observed during this study because growth segregation was not made. The period of steep length increase phase recorded in the 4th to 6th week may be due to active feeding intensification of exogenous feeding. These findings agreed with report by Aguigwo (1993).

Artificial feed may be harmful to the newly formed digestive system. Secondly, natural food is usually moving, while artificial feed is inert and it is some times difficult to get the larva to accept artificial feed as they are not naturally attracted to it (Van der wind, 1979). This seems to be responsible for decrease in weight gain at 2nd and 4th week in glass aquaria and also in week 3 in plastic basin. Larvae or sac fry are photophobic (Nwadukwe 1991), and observation during the experiment showed that F_1 hybrid in the glass aquaria swim or make more movement in their bid to hide from light or any sensation of danger thereby spending energy and loosing weight. That (light) may be responsible for the higher cannibalistic behaviour in the glass aquarium than plastic basin because larvae could see one another so clearly. According to Aguigwo (1995), mortalities occurring under darkness are very low and indicate that for a successful larval rearing, light effect (natural or artificial) has to be avoided as far as possible. Loadman and Moodie (1986) have demonstrated no increase in growth or survival accruing to either Cannibalistic Walleye. Stizostedion *vitreum* or those predisposed to cannibalism. These authors attributed this to the fact that while cannibalizing a prey fish, predators are unable to feed on zooplankton. This could have favourably contributed to the poor weight increase observed in the two rearing containers although it was more pronounced in glass aquaria. Also the stress of sampling at short intervals might have contributed too.

The observed high mortality of the 2nd week (commencement of this study), which is a confirmation that high mortalities were frequently, observed during the early development stages of intergeneric *hybridization* (Chevassus 1983). This coincides with the report that 90% larval mortality occurred during the period of one to ten days after hatching (Kuo *et al*., 1973). It could also be attributed to sex combination or parental effect, which therefore supports the experience by Nwadukwe (1995), that *Heterobranchus longifilis* and *Clarias gariepinus* hybrids have better survival than the reciprocal hybrid.

Low survival in incubation may be partly due to unnatural confinement of the eggs. Also the use of hormone inducer to accelerate ovulation may have resulted in premature ovulation and release of some oocytes that have low potential viability (Aguigwo, 1993). Charlon and Bergot (1984) reported that low survival of fry fed the commercial dry diet may have been due to a rapid degradation of the excess feed, resulting in a subsequent increase in ammonia in the water. The growth of pathogenic microbes could also have been enhanced in the presence of excess feed. This confirms the earlier report by Van der Wind, (1979). The high mortality experienced in this experiment may be attributed to the introduction of artificial weed in week 2.

Cannibalism was another likely mortality induced character of hybrids observed during the experiment, which is likely to be due to low feeding rate since Ayinla, (1991) recommended feeding ad libitum 6 times daily. According to Hecht and Appelbaum (1988), relatively small variation in size of fry of *Clarias gariepinus* could be observed within the first few days after the commencement of exogenous feeding. These authors also reported that 'head first' (cannibalism) could be attributed to differential growth rate of the fish that could lead to greater growth rate and greater disparity in length of fish of the same age. Cannibalism encountered in the second week during this study favourably agreed with the report that cannibalism was elevated under the stressful condition of the small culture containers (Aluko *et al*., 2001). According to Hetch and Appelbaum (1988), stocking density is another major factor triggering cannibalism.

In conclusion, growth rate of the hybrid of *Clarias gariepinus* and *Heterobranchus longifilis* was not limited by any of the two rearing containers (glass aquaria and plastic basins) used in this study since there was no significant difference in growth rate ($p < 0.05$) between fry reared in either the plastic basins or glass aquaria. Instead, the limitations must have been genetic, environmental, handling practices or level of fry management.

Therefore, it could be concluded that the hybrid fry of *C. gariepinus* and *H. longifilis* could be spawned and reared successfully in both glass aquarium and plastic basin under laboratory conditions. This practice must however, be carried out under good management practices and careful manipulation of recommended stocking densities.

Table 1: Mean length (cm) variations of the Fry in the various weeks.

Treatment	Weeks					
	1	2	3	4	5	6
Glass Aquaria	0.7870^{a}	0.8845^{a}	1.1705	1.3807^{i}	1.6325^{k}	2.0285^{h}
Plastic basin	0.7910^{b}	0.9255^{b}	1.2015	1.3470^{j}	1.5975^{k}	1.9273^{i}

Values in the same row bearing a similar superscript are not significantly different ($P>0.05$)

Table 2: Mean weight (g) variations of the fry in different weeks

Treatment	Weeks					
	1	2	3	4	5	6
Glass Aquaria	0.0200^{q}	0.0150^{q}	0.0450^{q}	0.0275^{q}	0.04000^{q}	0.0625^{q}
Plastic basin	0.0200^{a}	0.0250^{a}	0.025^{a}	0.0350^{a}	0.0425^{a}	0.0750^{ab}

Values in the same row bearing a similar superscript are not significantly different (P>0.05)

Table 3: Mean length (cm) of the fry in the various weeks

Mean	Week
1.97788^{a}	6
1.61500^{b}	5
1.366375^{c}	4
1.8606^{d}	3
0.90464^{e}	2
0.78925^{f}	1

Means with the same letter are not significantly different

Table 4: Mean weight (g) of the fry in the various weeks

Mean	Week
0.068750^{a}	6
0.041250^{b}	5
0.035000^{bc}	4
0.031250^{bc}	3
0.020000^{c}	2
0.020000^{c}	1

Means with the same letter are not significantly different

REFERENCES

Aguigwo J. N. 1993. Inter and intraspecific hybridization of *Clarias albopunctatus* (Nichols and Lamonte) and *Heterobranchus longifilis* (Cuvier and Valenciennes) in natural and artificial conditions. *Journal of Aquatic Sciences*, 8:45-50.

Aguigwo, J. N. (1995). Studies on the biology of larva of *Clarias albopunctatus* (N. and L.). III: Influence of light on the survival of larvae. *Journal of Aquatic Sciences*, 10: 15 – 17.

Aluko P. O., Nlewadim A.A., and Aremu A. 200-1. Observation of fry cannibalism in *Clarias gariepinus* (Burchell, 1822). *Journal of Aquatic Sciences* 16:1-6.

Ayinla O. A. 1991. Spawning of selected cultivable fish species. *In:* proceedings of the Fish seed production course. (Ed. O. A. Ayinla) NIOMR Port Harcourt, Nigeria. 37pp

Charlon N. and Bergot P., 1984. Rearing system for feeding fish larvae on dry diet; Trial with carp (*Cyprinus carpio*) larvae. *Aquaculture*, 41:1-9.

Chevassus, B. 1983. Hybridization in fish. *Aquaculture*, *33*: 245-262.

Hecht T. and Lublinkhof W. 1985. *Clarias gariepinus X Heterobranchus longifilis* (Clariidae: Pisces): a new hybrid for aquaculture. *South African Journal of Science 81*: 620-621.

Hecht, T and Appelbaum, S. 1988. Observations on intraspecific aggression and coeval sibling cannibalism by larval and juvenile *Clarias gariepinus* (Clariidae: Pisces) under controlled conditions. *Journal of Zoology London*, 214: 21-44.

Hickling C. F. 1966. Fish hybridization. Proc. of the world symp. On warm water pond fish culture. Rome, 18-25 May. *FAO Fish Rep, 44* (4): 1-11.

Jobling, M. 1983. Growth studies with fish – overcoming the problems of size variation. *Journ. Fish Biol., 22*: 153 – 157.

Kirpichnikov, V. S. 1981. Genetic bases of fish selection (Translated by G. G. Gause). Springer – Verlag, New York, 410pp.

Kuo, C. M., Shehadeh, Z. H. and Millisen, K. K. 1973. A preliminary report on the development, growth and survival of laboratory reared larvae of grey mullet. *Journal of Fish Biology*, 5: 459 – 470.

Legendre M., Teugels, G. G.; Cauty. C., and Jalabert. B. 1992. A comparative study on the morphology, growth rate and reproduction of *Clarias gariepinus* (Burchel 1822); *Heterobranchus longifilis* (Valenciennes, 1840) and their hybrids (Pisces, Clariidae). *J. Fish Biol.*, 40: 59-79.

Loadman N. L. and Moodie G. E. E. 1986. Significance of cannibalism inlarval Walleye (*Stizostedion vitreum*). *Canadian Journal of Fisheries and Aquatic Sciences*, 43:613 – 618.

Miller R.R. 1950. Notes on the cutthroat and Rainbow trout with the description of the new species from the Gila River, New Mexico. *Occ. Pap. Mus. Zool. Uni.* Mich, *529:1-42*.

Mcav R. 1979. Genetic improvement in aquaculture industry. In T. R. V. Pillary and W. A. Diiis (eds.) Advances in Aquaculture. Fishing News Books Ltd; Famham, Surrey, England. 610-622pp.

Nwadukwe F. O. 1995. Analysis of production, early growth and survival of *Clarias gariepinus* (Burchell), *Heterobranchus longifilis* (Val) (Pisces: Clariidae) and their F_1 hybrids in Ponds. *Netherlands Journal of Aquatic Ecology*, 29(2): 177 – 182.

Nwadukwe F.O. 1991. Broodstock management and seed production. In: Proceedings of the Fish Seed Production Course (Ed. O. A. Ayinla) NIOMR Port Harcourt, Nigeria, 19pp.

SAS. 1991. SAS Users Guide: Statistics. SAS Institute Inc., Cary NC, U. S. A.

Smith S. B. 1961. Selectivity and hybridization in management of fish stocks. *Can Fish*-cult, *39*: 45-50.

Smith S., 1957. Early development and hatching In: M. E. Brow. Ed. The physiology of fishes. Vol 1: Metabolism, Academic press, New York. 323 – 359pp.

Ufodike E. B. C. and Madu C. T. 1998. Effect of latency period between hypophysation and artificial fertilization on fecundity in *Clarias anguillaris*. *Journal of Aquatic Science*, 13:1-3.

Van der Wind. J. J. 1979. Feeds and feeding in fry and fingerling culture. *FAO/ELFAC Tech. Pap.*, 35 (1), 59-72.