Survival Rate In Poly Culture Of Catfish H*eteroclarias* /*Tilapia* (*Oreochromis Niloticus*), Fed 2% Body Weight

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ABSTRACT: A twelve week experiment was conducted in the botanical garden of the department of Biological Sciences, University of Abuja, To assess survival rate in Polyculture of catfish *Heteroclarias*/ Tilapia *Oreochromis niloticus* at different stocking ratios of 8 *Heteroclarias/ 8 Oreochromis niloticus*, 8 *Heteroclarias*/ 16 *Oreochromis niloticus* and 8 *Heteroclarias/ 32 Oreochromis niloticus* (1:1, 1:2 and 1:4) were fed formulated diet twice daily of fish meal and rice bran containing 28% crude protein, 8% crude fat, 1.6% crude fiber, 4.5% moisture and 6.2% ash at 2% body weight. The result of the present study showed, statistically significant different (p<.5%) two-way ANOVA for *Heteroclarias/ Oreochromis niloticus* 1:1, while no significant different (p>.5%) two- way ANOVA for *Heteroclarias/ Oreochromis niloticus* 1:2 and 1: 4. The study proved that, fingerlings *Heteroclarias/ Oreochromis niloticus* should be stocked at ratio of *Heteroclarias/ Oreochromis niloticus* 1:1. [New York Science Journal 2010;3(9):68-78]. (ISSN: 1554-0200).

Key Words: Fish meal, rice bran, *Heteroclarias* and Nile Tilapia (*Oreochromis niloticus*).

Introduction And Literature Review

In Africa, especially in Nigeria, the species mostly cultured are *Clarias gariepinus, Heterobranhcus species* and their hybrids. The reasons for their culture are based on their fast growth rate, disease resistance high stocking density, aerial respiration, high feed conversion efficiency among others. Aquaculture in Nigeria is in the developing stage, because it has not been able to meet the demand and supply of the ever – increasing population. Catfish are cultured conveniently under mono and Polyculture systems (Reich 1975).

However, with the intensification of tank culture system where fish culturists rely solely on artificial feed as the only food resource of closely related species of the same family and of the same feeding habit, this type of system, there is the culture of only one single, species known as monoculture. Most catfish culturists in Africa especially in Nigeria have practiced any of these culture systems without knowing the best culture system for their fish. These farmers believe that culturing different species of catfish together or separately have little or no effect on their growth performance as well as their survival.

The major preliminary condition in setting up a polycultured system is to identify an ideal stocking ratio which takes into consideration the intensity of species interaction and utilization of different ecological strata's and a better valorization of the water body (Billad, 1980). In a catfish/tilapia polyculture system, stocking of tilapia at densities equal to or greater than 25% of the weight of stocked catfishes (Hash, 1980). The positive effect of polycultured with predatory fish species in an additional source of food which is later represent by tilapia larvae (Pompa, 1978). Different combination of fish species in polycultured systems have been practiced throughout the world (Elmendo, 1980).

Studies on the growth performance and survival of fish especially the salmon species under the mono and duo culture systems have been reported. Salmon species in duo culture system had better growth than those in monoculture system. (Mork 1982), (Nor dvedt and Holm 1991), reported that salmon species in duo culture system had better than those in monoculture system. However, Salmon reared in duo culture did not grow significantly better than those reared in monoculture no different in growth increments between monoculture of one species and polyculture of several species within the same period (Shephard, 1988). However one species might affect the environment to prove the growth condition for the other species, these increased stocking density will increase interspecific and intraspecific competition and fish production will slow down the body weight at harvest of catfish (160 – 190g) was twice those of tilapia (50 – 70g) range (Alan, 1994). Experimental studies on the hybridization of *Heterobranchus longifilis* and *Clarias garienpinus,* which lead to hybrids with valuable characteristics for culture (Heent and Lublenkhot, 1985). Hybrid morphology was intermediate to that of the parents and had a faster growth and survival (Legendre *et al*; 1991). Intraspecific hybridization of fish has been considered to combine valuable traits from two or more species to obtain hybrids that exceed both parents' species (Pan and Zeng, 1986).

The Nile Tilapia (*Oroechromis Niloticus*) generally is good for polyculture traits because it does not effect the growth and production of most of the species (Cruz, 1980). Observation shows that, the highest stocking ratio *Clarias monganese*/Tilapia were 1:4 and 1:8) had a higher but lower individual weight gains (Sunset and Bayne, 1978). The production in a Tilapia monoculture system was lower than in polyculture with Macrobrachium (Guerrero et *al;* 1977). An individual species could be used as a predator for recruitment control under different stocking ratio (Bedaroi, 1985). The aim of catfish/tilapia polyculture systems is to increase productivity base on the availability of tilapia larvae (Stainer, 1979).

Most of the commercial feed millers in Nigeria are poultry based, fish feed production remain negligible and often incidental through the methodology of producing fish feed is not quite different from poultry; it consumes much time and money than poultry. Many of the machines required are not even available within the country and where they can be improvised local fabrication, the fund becomes a problem to the medium scale farmers. Fish body is mainly protein especially Animal sources (fish meal) is always canvassed (lovell, 1980). Nutrients are better and much higher plants sources, this single reason have been a factor militating against cheap source of fish feed since fish meal is expensive. The prices of other plant source e.g. groundnut cake, soybean meal have recently grown up due to poor cultivation and competition with man and livestock (Fasaking *et al; 2000).*

Poor feed leads to slow growth, high feed conservation ratio, low survival, disease and poor harvest (Eyo, 2001). Good quality feed when fed at recommended rate and other water quality conditions that are adequate lead to profitability in fish culture managements (Sogbensan *et al;* 2003).

The hybridization of *Heterobranchus. longifilis* and *Clarias garienpinus,* which leads to hybrids with valuable characteristics for culture (Hecht and Lublenkhof, 1985). Hybrid morphology was intermediate that of the parents and had a faster growth performance (Lengendre *et al;* 1991). Intra-specific hybridization of fish has been considered to combine valuable traits from two or more species to obtain hybrids that exceed both parent species (Naevdal *et al;* 1987).

The final body weight of stocking ratio 1:1, 1:3 and 1:5 (Hybrid: Tilapia) fed rice bran/blood meal was not significant different, though the combine net produced of hybrid and Tilapia was highest in the 1:5 stocking ratio, which produced highest Tilapia recruits (Solomon, 2006). The feeding of *Heteroclarias,* fingerlings on maggot diets resulted in high survival rate (Sogbensan *et al;* 2006). Maggot is readily available free from man's competition and has been accredited for its high quality protein with amino acids profile showing its biological value to be superior to Soybean and groundnut Cake (Adejinmi, 2000). This organism can be included in fish feed to promote feeds like chironomids, toad earthworm polycheates, duckweed, water hyacinth, garden snail mussels, Lizard and frog (Sogbesan *et al;* 2005). Maggots are easily digested by fish (Jhringram 1983). *Heteroclarias,* fingerlings fed combined animal protein feed has better weight gain, daily growth index, relative weight gain, metabolic growth rate and specific growth rate values than those fed single animal protein source feed (Mazid; *et al;* 1997).

Tilapia feed of 25% crude protein is fed at 5% body weight (Falayi 2008). The Production and survival of Shrimps was improved in an intensive polyculture system with red Tilapia (Akiyama and Anggawati 1999). While the presence of Nile tilapia resulted in better growth and survival of shrimp at 0.4 Tilapia /m^2 but poorer shrimp performance at 0.6 Tilapia /m^2 in Semi-intensive culture (Gonzales-carr, 1988). Red Tilapia of larger size (60-100g) at densities of 0.2 and 0.3 Tilapia/m^2, which resulted in higher fish standing crops (Akiyama and Aggawati, 1999). In intensive shrimp monoculture, wastes derived from feeding after stimulate phytoplankton growth and lead to dense blooms in ponds and the collapses of phytoplankton can cause shrimp stresses (Briggs and Fung-Smit ,1998). And Mortality through disease, Oxygen depletion, and increased metabolic toxicity (Fast and Menasveta, 2000). Study showed that the concentrations of chlorophyll '*a*' in the tilapia-shrimp polyculture ponds were not lower than those in the shrimp monoculture ponds. Probably, the roles of Nile tilapia are not to reduce phytoplankton biomass but to stabilize water quality in the tilapia shrimp polyculture (Tian; *et al;* 2004).

The forms and modes included wet Chicken manure broad casted into culture water, wet chicken manure tied in jute bags and dry chicken manure broadcasted into pond, the effect was compared on the growth rate *Oreochromis Niloticus* (Okonji and Olanusi, 2000). Mean comparison showed that the wet chicken manure broadcasted into culture units produced the highest growth performance in terms of total weigh gain, absolute growth rate, and was recommended that wet chicken manure broadcasted directly into culture ponds of *Oreochromis niloticus,* should be adopted as best option of fertilizing (Okongi and Olanusi, 2000).

Observation was made on the aggressive behavior of the fingerlings of two fish species, *Heterobranchus bidorsalis* and *Oroechromis niloticus,* commonly used in polyculture of an indoor aquarium Tanks measuring 30cm x 45 cm x 60cm, was recommended that stocking of *Heterobranchus bidorsalis* and *Oreochromis niloticus*, in polyculture increased the survival rate and harvestable number of *Heterobranchus bidorsalis* (Okonji, 2004).

The cannibalistic nature of *Clarias gariepinus,* multiple sorting is essential, for fry/fingerlings rearing, screening of tanks with mosquito nets is recommended to prevent dragonfly and other predatory insects from breeding in the ponds (Adewunai, 2009).

Feeding of catfishes in grow outs are perhaps the most documented in literature, various efforts have been made to establish the crude protein and amino acid requirement of *Clarias gariepinus* (Ayinla, 1988).

The survival rate for *Heteroclarias,* hybrid was low in all the stocking ratios. This is common in low and high polycultured densities (Tidwell and Mims, 1990). Experimental studies showed that fingerlings of different species of Clariid catfish have different growth performance and different feed utilization efficiency under different culture system (Adewolu *et al;* 2008). It was observed that hybrids exhibited a high degree of cannibalism and a resulting high individual growth rate with a corresponding low production (yield) due to high mortality rate (van der Waal, 1978).

Weight gain of *Clarias gariepinus, Heterobranchus longitilis* and their hybrid reared in all the three stocking (culture systems viz: monoculture, duo culture and trio culture), monoculture system gave the best weight gain (Adewolu *et at;* 2008). Tilapia yield decreased due to the presence of hybrid which led to competition for food (Lazerd, 1980). Tilapia uncontrolled high reproduction ratio gives excessive recruitment and resulting low yields of harvestable size Tilapia from cultured pond (Guero, 1982). During the one way ANOVA, Proved significant due to the fact that growth was dependent on population densities (Le Cren, 1965). Tilapia recruitment had the lowest value, with a higher annual production obtained (Schoonbee and Prinsloo, 1988).

In a polyculture setting shrimp and Nile Tilapia can utilize different niches. In extensive culture Tilapia can filter feed on phytoplankton and Zooplankton in the upper water column, while shrimp spend most of the time in the pond bottom grazing on bacterial films on the bottom substrate and on the detritus setting from above. In intensive culture receiving pelleted feeds, Tilapia may monopolize the feed especially for floating feed (Fast and Menasveta, 2000).

A one – hectare polyculture pond can be initially stocked with 20,000 Tilapia fingerling of mean weight 2g and 2000 carp fingerling mean weight at 10g. Tilapia fingerlings are to be fed in first 2 months during which feed with 25-30% c.p can be fed to the fish. These requirements meet the need of tilapia and carp fishes and subsequently with fry and fingerlings would eventually serve as food for the catfish to be stocked after two months. At the beginning of the third month (when fry are noticed in pond) 500 catfish fingerlings of mean weight 3-4g can be stocked to include the earlier stocked fishes (Okoye, 1996). The fry fingerlings bred by tilapia would now serve as food and 50 percent of the earlier stocked and many of their progeny may be cannibalized by the stocked catfish (Okoye, 1996).

Temperature is a vital parameter for growth which ranged from 23-28^{0}C, and (Degani *et al*, 1998). Confirmed 27^{0}C as the ideal temperature, the better specific growth rate which is affected by body weight (Hogendoorn and Koops, 1983).

MATERIALS AND METHODS

AQUARIUM AND TREATMENTS

Three glass aquaria each having a dimension of 1.165m^3 was used in the experiment base on laboratory subjection. The aquaria were obtained from the department of biological sciences, University of Abuja. There were 3 treatments having different Ratios and Stocking densities designated A,B and C each of their aquaria was stocked at Ratio of 8 catfish *Heteroclarias* and 8 Tilapia *Oreochromis niloticus* fingerlings, (A) 8 catfish *Heteroclarias*/16 Tilapia O*reochromis niloticus* (B) fingerlings and 8 catfish *Heteroclarias* /32 Tilapia *Oreochromis niloticus* fingerlings (1:1,1:2 and 1:4) respectively. The catfish Tilapia fingerlings stocked in each aquarium were of the same size. This is to investigate cannibalism. 30 fingerlings of catfish *Heteroclarias* fingerlings of Tilapia *Oreochromis niloticus* were obtained from Ajima fish farm, Kuje Abuja. The fishes were acclimated for Seven days in the Biological science garden. The initial individual weight, length, mean length and mean weight were recorded. Fishes were assigned to their respective ratios and densities. The fishes were starved for 24 hours to empty the gut content and prepare them for experimental formulated diet. This exercise helps in making the fishes hungry and thus be adapted to the new formulated feed. The fishes were fed 2% of their body weight and the aquaria were aerated, the aquaria were covered with mosquito net to prevent fingerlings from jumping out, intrusion of insects and others forging bodies (lizards, geckos etc) freshwater was used throughout the experiments.

PROXIMATE ANALYSIS OF FISH MEAL AND RICE BRAN

METHODOLOGY FOR PROXIMATE ANALYSIS

Proximate analysis also known as nutritive value is applied to investigate if the sample could be formulated into a diet as a source of protein or energy.

Moisture: This is essential in monitoring the moisture % in powered food/sample to avoid the risk of contamination by fungi and bacteria during storage.

Ash: These consist of oxidizing organic matter in the sample of the ash remaining. It is also considered as total mineral or organic content.

Crude lipids: This method involves extraction of fats/oil from the sample using the appropriate organic solvent.

Crude protein: For the amount of protein present in the food.

Procedures

- Aluminum crucible was washed and dried in the oven at 105^0C, cool in the desiccators.
- Aluminum crucible was weighed (W1)
- Weight of sample in the reweighed crucible was recorded (W2).
- The oven was set at a temperature of 105^0C (i.e. above water boiling point), for total moisture removal.
- Sample was placed in the oven, cool in the desiccators after one hour and weighed. Repeat this was repeated consecutively till the weight is constant.
- Final weight (W3) was recorded.
- Moisture content was calculated in percentage as:

$$\% \text{ moisture} = \frac{W2 - W3}{W2 - W1} \times 100$$

ASH DETERMINATION

Procedures

- Porcelain crucible was washed, dried and weighed (W1)
- A known gram of sample was place in the crucible (W2)
- The crucible containing the sample was placed in a Furnace at a temperature of 550^0C for 5 – 8hrs.
- It was Removed after incineration and cool in the Dedicator. Then, the weigh (W3) was recorded.
- Ash content was calculated in percentage as:

$$\% \text{ Ash} = \frac{W3 - W1}{W2 - W1} \times 100$$

CRUDE FIBRE DETERMINATION

Procedures

- About 2g of the sample was weighed into a round bottom flask.
- About 100m1 of 0.25m sulphuric acid was added, boiled under reflux for 30mins.
- The hot solution was filtered, and then washed severally with warm water until its acid free.
- The residue was transferred back into the flask Quantitatively.
- About 100m1 of 0.25m NaOH solution was poured and Boil for 30mins.
- It was filtered under suction and washed with warm Water until its base free.
- The weight of crucible (W1) was recorded, then added The sample and weighed (W2).
- It was dried in the oven at 1050C for 2hrs, cool and Weighed (W3).
- Calculated as the percentage crude fiber, using the formula as in percentage moisture determination.

CRUDE LIPID (FAT) DETERMINATION

Procedures

- About 2g of moisture free sampled was weighed Transferred into a thimble.
- Using soxhlet extraction was, allowed to reflux for about 6hrs using an organic solvent e.g. hexane, petroleum ether.
- Thimble was removed with care, dry in the oven at 105 – 100^0C for 1hr.
- The oven transferred into the desiccators and allows cooling; Then weighed.
- Calculation;

$$\% \text{ Fat} = \frac{\text{Weight of fat}}{\text{Weight of sample}} \times 100$$

CRUDE PROTEIN (NITROGEN) DETERMINATION

Procedures

- About 1.5g of sample was weighed accurately into Pyrex Kjedahi flask.
- About 10g of potassium Sulphate was added and 0.7g of Mercury (as catalyst), was Poured 25m1 conc. H_2SO_4, Shaked until content is mixed.
- The flask was incline at 60^0C, closed the flask with a Loosely fitting glass stopper or funnel.
- was heated gently until frothing stops. When foaming Ceases heat was, increase heat and continue for 90 – 120mins until solution becomes colorless.

- Solution was allowed to cool, when cold, was added
Carefully a little at a time and with frequent shaking 100ml
Of water and cool the flask.
- About 25ml of 0.5m Sodium Thiosulphare was added.
- Few fragments of porous porcelair was added, followed by
Excess of 70ml cold 50% NaOH.
- Distill off Ammonia was distill off into excess standard acid
(100ml).
- A blank determination was carried out exactly as above
But with the Nitrogen – containing sample omitted.
- Was Titrated with NaOH – (blank titration).
- Using 2 drops of methyl red.

FEEDING AND MEASUREMENT

The proximate analysis of fishmeal and rice brand. Fish meal contained (72.91% crude protein, 8% lipid, 15.82% crude fiber, 15.03% 4.63% Ash, and 2.61% moisture) and rice bran (1.51% crude protein, 10.96% lipid, 34.82% cradle fiber, 11.51 Ash and 10.11% moisture).

Formulated diet chemical component of fish meal and rice bran (28% crude proteins , 8% crude fat , 1.6% crude fiber, 4.5% and 6.2% ash was used). Percentage impute of prepared feed fed to fingerlings of *Heteroclarias/Oreochromis* was 45.1g fish meal, 35.9 rice bran, 10.8g minerals premix and salt 8.2g (%). Procedure. Fish meal was granded and was mixed with other ingredient /input of the above percentage in the total feed prepared, pap was used to bind the mixture after which was pelleted using pelleting machine and was dried.

The fingerlings were fed 2% body weight twice daily, morning (8.00am – 9.00am) and evening (5.00pm – 6.00pm). Water was first reduced for the sampling of fish for weight and length measurement. This was done with a scope net. Fisht weigh (g) was taken using a loading balance (Model OHAUS PRECISIM PLUS). The fingerlings were weighted in-groups. In each group Tilapia fingerlings were first weighted because of their fragility. The standard length of fish was taken to the nearest cm with the aid of measuring board. Depleted water was replaced with fresh water to an effective depth of 20 cm after each cleaning.

PHYSIOCHEMICAL PARAMETERS

The physiochemical parameters of the water were carried before polluted water is changed. Both surface water Temperature and atmospheric temperature were read daily to the nearest 0^{o}c with the aid of mercury in-glass thermometer. The Dissolved oxygen was determined once a week by titration with 0.1 NAOH and the azide modification of the Winkler method (American Public Health Association, 1976). PH was determined with the aid of digital P^{H} meter. Biological oxygen demand was also determined.

NUTRIENT UTILIZATION PARAMETERS

Mean Weight gain (%). This was calculated as

$$MWG\ \% = \frac{\text{final mean weight}}{\text{Initial mean weight}} \times 100$$

Mean Length gain (%). This was calculated as,

$$MNG\ \% = \frac{\text{final mean length}}{\text{Initial mean length}} \times 100$$

Specific growth rate (SGR). This was calculated from data on the changes of body weight over given time.

$$G = \frac{Ln\ WT\ Ln\ Wt \times 100}{T - t}$$

Where WT = final weight,
Wt = Initial weight
T = Final Time
t = initial time
Ln = Natural logarithm.

(Solomon, 2006)

Food conversion efficiency (FCE). The food conversion efficiency was calculated as:

$$\frac{\text{Weight gain}}{\text{Feed intake}} \times \frac{100}{1}$$

Mean Growth Rate (MGR). This was computed using the standard equation.

$$MGR = \frac{W2 - W2}{0.5\ (W.W2)} \times \frac{100/t}{1}$$

Where W1 = Initial weight
W2 = Final Weight
t = period of experiment in days
0.5 = constant.

Survival Rate (SR). The survival rate, SR was calculated as total fish number harvested/total fish number stocked expressed in percentage.

$$SR = \frac{\text{Total fish number harvest}}{\text{Total fish number stocked}}$$

(Akinwole *et al,* 2006).

Data generated were subjected to a One-way and two-way ANOVA using the SPSS (statistical package computer software 2003 version), Duncan multiple range Test. fisher least significant different were used to compare differences among individual mean at (p<.5%).

Result

The results of the production parameters for the three treatments (A, B and C) are presented in table 1, 2 and 3. While the physiochemical parameters are ranged between their tolerable ranges.

All values of the measurement of various production parameters in the three treatment showed that treatment A, had the highest mean weight (g) and length(cm) with values (7.18g, 12.94cm *Heteroclarias* and 7.133g, 8.66cms for *Oreochromis niloticus*), and The survival rate of treatment A, 56% (75% *Heteroclarias* and 37% *Oreochromis niloticus*). Treatment B had 16% (50% *Heteroclarias* and 0% O*reochromis niloticus*) and treatment C had the lowest 7% (37.5% *Heteroclarias* and 0% O*reochromis niloticus*).The final Mean weight gain% in all the three treatment was highest in treatment A (134.88 H*eteroclarias* and 0% *Oreochromis niloticus*), treatment B (114.39 *Heteroclarias* and 0% *Oreochromis niloticus*) and lowest in treatment C (106.61 *Heteroclarias* and 0% *Oreochromis niloticus*).

Physiochemical parameters

Atmospheric temperature throughout the study period varied between 26^{o}c and 32^{o}c while water temperature occurred between 25^{o}c and 28^{o}c.The highest water temperature occurred at the month 12^{th} because of increased in atmosphere temperature.

The highest concentration of dissolved oxygen for all the three treatment was recorded in treatment A which varied between 3.1 mg/l and 6.50mg/l while an increase in dissolved oxygen 2.2mgk to 6.01mgk was recorded in treatment C . pH Values in all the three treatments has more or less similar reading ranged between 7.1 and 8.6 mpp. Whereas Biological oxygen demand showed similar concentration throughout the study period for the three treatments ranged between 2.0 and 4.0mg/l.

Table 1: Production measurement for treatment A (1:1)

Parameter	Fish species	1st week	2nd week	3rd week	Fourth week	5th weed	6th week	7th week	8th week	9th week	10th week	11th week	12th week
Means weight (g)	*Heteroclarias* *O.nitolticus*	9.62 3.51	1.937 3.78	2.325 3.95	2.463 4.11	2.814 4.55	2.971 4.95	3.214 5.15	3.82 5.53	4.48 5.86	5.05 6.52	6.25 6.893	7.18 7.133
Means length (cm)	*Heteroclarias* *O.nitolticus*	5.547 5.469	5.82 5.720	6.25 5.981	6.812 6.02	7.087 6.44	7.223 6.84	7.528 7.05	8.24 7.28	9.45 7.42	10.366 7.88	11.071 8.5	12.943 8.667
Mean weight gain %	*Heteroclarias* *O.nitolticus*	0.00 0.00	119.567 107.692	120.030 104.497	105.935 104.050	114.250 110.705	105579 108.791	108.178 104.040	118.855 107.378	117.277 105.967	111.607 111.262	123.762 105.720	134.88 103.481
Mean length gain %	*Heteroclarias* *O.nitolticus*	0.00 0.00	104.921 104.589	107.38 104.562	103.992 100.65	104.0369 106.976	101.890 106.211	104.222 103.07	109.205 103.262	114.949 101.923	109.693 106.199	114.518 103.426	109.030 106.257
Feeding rate	*Heteroclarias* *O.nitolticus*	0.00	12.82	20.83	21.92	28.78	31.19	29.90	33.6	46.30	51.24	71.23	73.03
Specific growth rate (SGR) %	*Heteroclarias* *O.nitolticus*	0.00 0.00	0.859 4.49	0.736 4.92	2.04 5.23	2.51 5.77	3.035 6.529	3.42 7.06	2.95 7.55	5.416 8.147	6..543 8..93	7..99 9.75	9.733 10.21
Food conversation efficiency	*Heteroclarias* *O.nitolticus*	0.00	4.67	2.64	1.35	2.58	1.60	1.47	2.945	2.18	1.60	6.22	7.87
Survival rate	*Heteroclarias* *O.nitolticus*	100 100	100 100	100 100	100 100	100 87.5	87.5 87.5	87.5 75	75 75	7.5 62..5	75 625	75 50	75 37..5

Table 2: Production measurement for treatment B (1:2)

Parameter	Fish species	1st week	2nd week	3rd week	Fourth week	5th weed	6th week	7th week	8th week	9th week	10th week	11th week	12th week
Means weight (g)	*Heteroclarias* *O.nitolticus*	1..39 3..521	1.41 3.78	1.65 3.925	1.971 4.128	2.342 4.327	2.63 4..522	2.9 4.782	3.12 4.911	4.04 5.218	5.12 5.616	5.48 6.10	6.28 - - -
Means length (cm)	*Heteroclarias* *O.nitolticus*	5..32 5.491	5..56 5.593	5.925 5.78	6.423 5.915	6.8926 6.172	7.160 6.337	7.362 6.75	7.78 7.10	8.212 7.31	8.28 7.615	9.31 8.102	10.61 - - -
Mean weight gain %	*Heteroclarias* *O.nitolticus*	0.00 0.00	101.43 107.355	117.021 103.78	115.77 105.22	118.822 104.820	112.297 104.506	110.266 105.749	107.586 102.697	129.487 106.251	129.41 107.627	107.03 108.68	114.598 - - -
Mean length gain %	*Heteroclarias* *O.nitolticus*	0.00 0.00	101.511 101.182	106.564 103.307	108.405 102.53	107.364 104.344	104.169 103.54	102.53 106.51	105.677 105.185	105.55 102.957	100.828 104.172	112.439 106.395	113.963 - - -
Total feeding rate	*Heteroclarias* *O.nitolticus*	0.00	20.55	43.00	39.59	32.31	47.6	40.6	36.4	42.0	53.2	50.4	35.8
specific growth rate %	*Heteroclarias* *O.nitolticus*	0.00 0.00	0.30 64.51	0.463 4.03	0.95 5.22	1.55 5.59	2.21 5.90	2.774 6.36	3.763 6.71	4.280 70.8	6.14 7.68	7.48 8.48	8.421 - - -
food conversion efficiency	*Heteroclarias* *O.nitolticus*	0.00	1.80	1.18	1.39	4.209	2.86	2.98	1.016	2.429	2.43	4.88	3.01
survival rate%	*Heteroclarias* *O.nitolticus*	100 100	100 100	100 93.75	100 81.25	87.5 68.75	87.5 50	75 37.5	75 31.25	62.5 31.25	62.5 18.25	62.5 6.25	50 - - -

Table 3:Production measurement for treatment C (1:4)

Parameter	Fish species	1st week	2nd week	3rd week	Fourth week	5th weed	6th week	7th week	8th week	9th week	10th week	11th week	12th week
Means weight (g)	*Heteroclarias* *O.nitolticus*	1.0625 3.48	1.2625 3.75	1.471 3.80	1.882 3.904	2.012 4.10	2.593 4.27	2.928 4.65	3.28 4.76	3.902 4.92	4.392 5.011	4.816 - - -	5.12 - - -
Means length (cm)	*Heteroclarias* *O.nitolticus*	5.61 5.49	5.825 5.611	5.992 5.793	6.123 5.897	6.416 6.012	6.698 6.188	6.961 6.314	7.103 6.915	7.568 7.1314	7.917 7.713	8.519 - - -	9.122 - - -
Mean weight gain %	*Heteroclarias* *O.nitolticus*	0.00 0.00	118.87 107.75	116.56 101.33	127.940 102.736	106.90 105.020	128.87 104.146	112.91 108.899	112.021 102.365	118.963 103.36	112.55 101.849	109.65 - - -	106.312 - - -
Mean length gain %	*Heteroclarias* *O.nitolticus*	0.00 0.00	103.83 102.204	102.849 103.243	102.185 101.81	104.78 101.95	104.395 101.11	103.926 102.036	102.03 109.51	106.54 103.129	1048.61 108.155	107.607 - - -	107.078 - - -

Total feeding rate %	*Heteroclarias* *O.nitolticus*	0.00	35.0	67.0	61.6	53.2	74.04	59.64	64.4	57.4	40.6	23.6	20.2
specific growth rate	*Heteroclarias*	0.00	0.80	0.540	0.65	1.191	1.74	2.75	3.43	4.35	5.42	6.27	6.91
	O.nitolticus	0.00	4.44	4.75	4.84	5.17	5.51	6.011	6.45	6.69	6.92	- - -	- - -
food conversion efficiency	*Heteroclarias* *O.nitolticus*	0.00	1.171	0.77	1.38	0.95	1.52	2.320	1.925	3.25	3.030	4.334	3.24
survival rate %	*Heteroclarias*	100	100	87.5	75	75	75	50	50	50	50	37.5	37.5
	O.nitolticus	100	96.88	90.63	70.12	62.5	53.125	37.5	25	15.63	6.25	- - -	- - -

DISCUSSION AND CONCLUSION

Physiochemical parameter such as atmospheric temperature, water temperature, PH, dissolved oxygen and Biological oxygen demand (mg/l) were determined for abnormal concentration throughout the rearing period. Likely abnormal concentration of any of these physiochemical parameters may have been the cause of fish death. However, nutritional and density stress are additional parameters for fish death. Thus, high survival rate and cannibalism were observed in treatments with higher stocking densities.

The atmospheric and water temperature recorded during the study period ranged between 26^{o}c to 32^{o}c and 25^{o}c to 28^{o}c respectively. Water and atmospheric temperature readings in all the treatment (A, B and C) were within a permissible range. Thus, shows that the readings were within a required or tolerable ranged for the culture of fish. Swann *et A;* 1990, recorded the normal range of temperature for culture of catfish and Tilapia (*Heteroclarias* and *Oreochromis niloticus*) culture were between 23^o – 32^{o}c.

The pH (hydrogen ion concentration) record for the three treatments ranged from between 7 and 8.8 gm/l. Treatment A (1:1) had the lowest values ranging from 7.0 to 8.0gm/l, B (1:2) had values ranging from 7.1 8.2. while treatment C (1:4) had the highest values ranging from 7.0 to 8.8gm/l. This may have resulted to the different stocking densities. The results demonstrated that concentration of in all the three treatments were alkaline and within the permissible range (6.0-9.0) for the culture of catfish/Tilapia. High level can be influence by the elevation of some of the water qualities parameter (Akinwole and Fatirotic, 2006).

At the early weeks of the present study, concentration of oxygen were high but gradually lowered as the growth of fishes (fingerlings) were achieved in treatment A and dissolved oxygen decreased, this could be considered frequently below the permissible level for good growth of catfish/tilapia (Oyewole and Faturti, 2006; Young et *al;* 2006). The low level resulted due to metabolic activities of the fishes and of bacteria decaying organic material such as under utilized feed were the major contributors to this demand. However, the survival of *Heteroclarias,* is not dependent upon oxygen in the water since it is equipped to obtain energy by gulping air, and means that, inadequate dissolved oxygen is not lethal to catfish growth (Brown, 1957). While the survival of tilapia (*Oreochromis niloticus*) is solely dependent upon dissolved oxygen, this may be the cause why Tilapia fishes could not survival in treatment B and C. It may have seriously affected the health of the fish (Tilapia) and facilitate the spread of disease. Mayer, (1970), reported that the role of low dissolved oxygen level in promotes bacterial infections. Whatever conditions occurred in the aquarium was minimal during the last two weeks and may have affected the survival/ growth of the fishe, as indicated by terminated slope of Tilapia mean weight curve (Appendices 2, 4 and 6).

At the end of twelve month of study, values of the measurement of various production parameter in all the three different stocking ratios, *HxC*/ *Oreochromis niloticus (8:8) HxC*/ *Oreochromis niloticus (8:16)*, and *HxC*/ *Oreochromis niloticus(8:32)* (1:1,1:2 and 1:4) showed that final mean length (cm) and weight gain% (12cm *Heteroclarias* and 8.66cm *Oreochromis niloticus*) exceed that of treatment B (10.61cm *Heteroclarias* and 0 cm *Oreochromis niloticus*) and treatment C (9.12 cm HxC and O cm O niloticus), and treatment A mean weight gain(%) (134.88 (%) *Heteroclarias* and 103.48(%) O. *niloticus*) and C (106. 31(%) *Heteroclarias,* O. *niloticus*) Table 1, 2 and 3) and figure (2, 4 and 6.). The single fact in both the final length (cm) and weight gain percentage for the three treatments may be related to the availability of food and space, as such decreased in competition among fishes in the aquarium. Alon, (1994), stated that increase in stocking density will increase interspecific and intraspecific competition and fish production will slow down the body weight at harvest catfish/Tilapia.

The final feeding rate value varies between treatments A; (73.6g) exceeded that of treatment B (35.8g).

The specific growth rate of treatment A (9.H*eteroclarias* and 10.21% *Oreochromis niloticus*) exceeded treatment B (8.42 % *Heteroclarias* and O% O. *niloticus*). The food conversion efficiency was higher in treatment A (7.8%) exceeded treatment B (4.01) and treatment C (3.24). Also the survival rate varies between treatment, with treatment A, 56% (75 % *Heteroclarias* and 37.5% *Oreochromis niloticus*) exceeded treatment B, 3.9% (50 *Heteroclarias* and O% *Oreochromis niloticus*) and *treatment* C, 7% (37.5% *Heteroclarias* and 0% *Oreochromis niloticus*), Tables (1, 2, and 3). This result is in relation with

Tang *et al*, 1978, which states that survival decreases as stocking density increase.

Treatment C observed the highest mortalities especially, *Oreochromis niloticus* which may be due to handling stress and probably over crowding during weekly samplings. This study also observed that fishes in treatment C (40, fish capacity) were most likely under high stress rather than those in treatment B, (24 fish per capacity) and A (16, fish per capacity). It was also observed that catfish (*Heteroclarias*) feeds on one another and on Tilapia (Oreochromis. *niloticus*) (Tidwek and Mims 1990). Yield decreased due to the presence of hybrid which leads to competition for food (Lazerd, 1980).

The survival rate on the Productivity of Catfish *Heteroclarias* /Tilapia (*Oreochromis niloticus*) was statistically analyzed using A the One way and Two ANOVA.

One-way ANOVA of *Heteroclarias* for treatment A, showed a significant different (F=1.015533; P-Value =0.4157161; df = 71; F crit = 2.353809; P<.5%) Appendix 7. Treatment B no significant different (df = 71; F=72.49855; P-value = 1.855E – 25; F cret = 2.353809, (P >.5%) Appendix 8. Treatment C had no significant different (df = 71; f = 4.518017; P – value = 0.00013305; F crit = 2.352809; P> .5%) Appendix 9. while *Oreochromis niloticus* showed no significant different in all treatments (A, B and C) with treatment A (df = 83; F = 7.9990615; P-value = 1.03E -06; F crut =2.218817; P > .5%) Appendix 10

Treatment B, no significant different (df=89; F=34.595533 P-Value = 5.924E-22; F crit = 2.123408; P > .5%) Appendix 11 and treatment C no significant different (df = 83, F=34.51387 P-value = 3.873E – 21, F crit = 2.13263 P >.5%) Appendix 12.

Two – way ANOVA for *Heteroclarias/Oreochromis niloticus* for treatment A. The analysis showed a significant different (df=95; F = 1.032136; P-value = 0.41585622; F crit = 2.13099; P<.5%) Appendix 13. Treatment B no. significant different (df = 95; F= 58.60441; P – Value = 0.00, F crit = 2.13099; P >.5%). Appendix 14. Treatment C no. significant different (df= 95; F= 9.41875; P-value 2.18714E.08; F crit 2.13099; P >.5%) Appendix 15. Significant different enhances performance while no significant different may be due to handling stress.

CONCLUSION

The final mean body weight of stocking ratios 1:1,1:2 and 1:4 (*Heteroclarias* and *Oreochromis niloticus*) fed fish meal and rice bran was different though the mean weight (g), mean length (cm), and Survival rate were highest in ratio (1:1). The survival rate (*Heteroclarias*) was significantly different (p<.5%). While that of (*Oreochromis niloticus*) was not (p>.5%). The final mean body weight of stocking ratio. 1:1, 1:3 and 1:4 (Hybrid: Tilapia) fed rice bran/blood meal was not significantly different, though the combine net production of hybrid and Tilapia was highest in 1:4 stocking ratio which produced the highest Tilapia recruits (Solomon, 2006). When the amount of fish stock exceeds the currying capacity of the water supply, water quality and condition of fish deteriorate and mortality increases due to rapid spread of protozoa's, bacterial diseases and parasites (Vigai *et al;* 2002).

The present study showed that hybrids catfish (*Heteroclarias*) can with stand water quality/handling stress and survive at high stocking density, While tilapia can not. *Heteroclarias,* should be encouraged because it performed better and indigenous zooplankton should be promoted because it will drastically reduce the cost of production (Ojutiku, 2008). The present study also advice that fingerlings of catfish (*Heteroclarias*)/Tilapia (*Oreochromis niloticus*) of the same size/length should not be stocked at the same time, if to be stocked together, fingerlings of Tilapia are to be stocked for the two to three month before *Heteroclarias*, are stocked this is to enhance the feeding of *Heteroclarias* on tilapia larvae and water quality should be checked. The pond culture of catfish/Tilapia in Nigeria has potential profit to boost economic success. Therefore, fish farmers are here by advice to improve their productivity.

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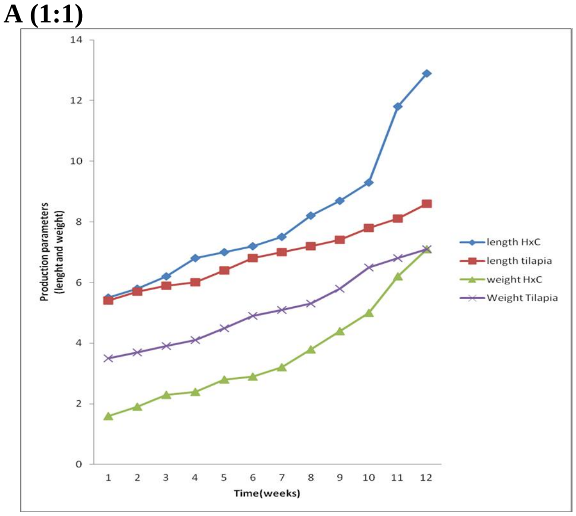
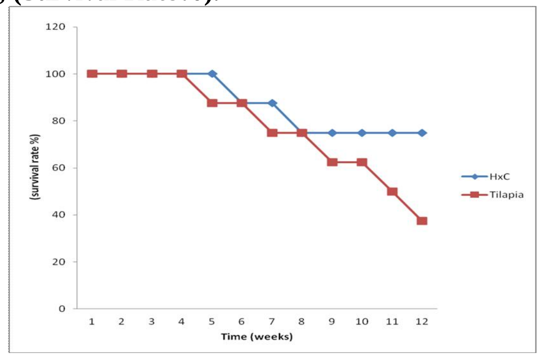
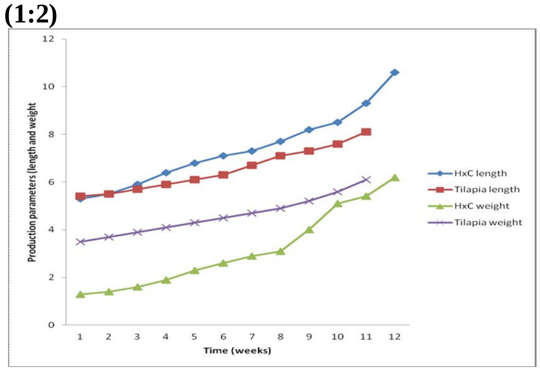
Appendix 1- Production parameters for treatment A (1:1)



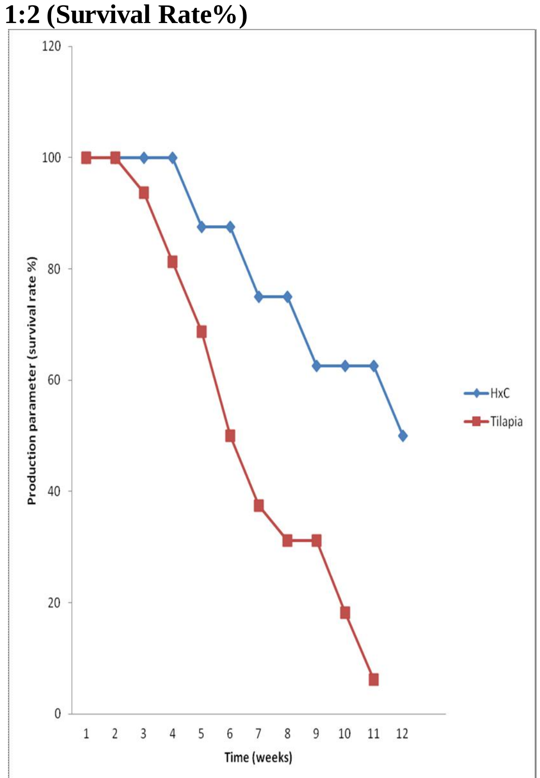
Appendix 2- Production Parameters for Treatment A, (Survival Rate%).



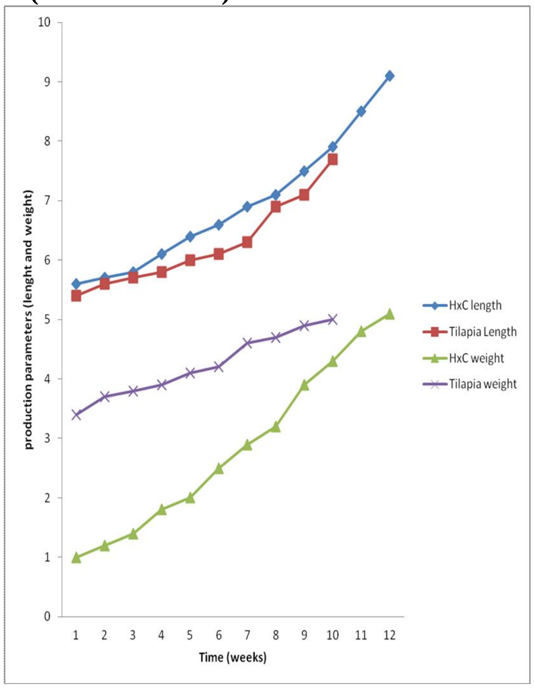
Appendix 3- Production parameters for Treatment B (1:2)



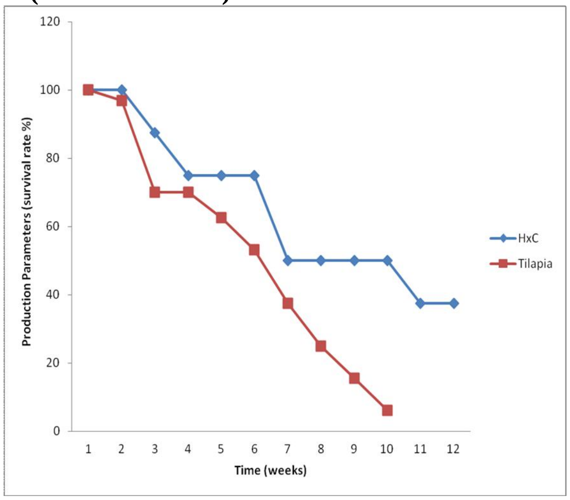
Appendix 4-Production parameters of Treatment B 1:2 (Survival Rate%)



Appendix 5- Production Parameters for Treatment C (Survival Rate%)



Appendix 6- Production Parameters for Treatment C (Survival Rate%)



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