International Journal of
AGRICULTURE AND BIOSCIENCES
www.ijagbio.com P-ISSN: 2305-6622 E-ISSN: 2306-3599 editor@ijagbio.com

RESEARCH ARTICLE

# Studies on the Effects of Stocking Densities on Growth Performance and Survival Level of *Heteroclarias* (Hybrid)

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**ARTICLE INFO**

Received: March 10, 2014
Revised: May 13, 2014
Accepted: May 20, 2014

**Key words:**
Cannibalism
*Clarias gariepinus*
*Heterobranchus* spp
*Heteroclarias* (Hybrid)
Percentage survival
Protein diet
Stocking density

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**ABSTRACT**

*Clarias gariepinus* female and *Heterobranchus spp* male were crossed to obtain *Heteroclarias* hybrid fingerlings of 1.00gm. They were reared under different stocking densities of 5, 10, 20, 40 and 60 per 25 litre of water in plastic bowl under laboratory condition for sixteen weeks and were tagged treatment A, B, C, D and E respectively. They were fed with 35% protein diet at 5% total body weight twice daily. Treatments A(5) and B(10), performed better in terms of mean length growth of 10.60cm and 10.20cm and mean weight gain of 14.10g and 3.50g respectively than treatments C(20), D(40) and E(60), with higher stocking biomass. The percentage survival (PS) of 100% recorded in treatment A(5) per 25 litre of water , was highest than other treatments , B(10) 95%, C(20) 85%, D(40) 22.5% and E(60)13%. There was a significant difference ($P<0.05$) in the percentage in the percentage growth in length, weight and percentage survival of treatments A, B, C, D and E. A Least Significant Difference of 0.98 was recorded. In pair comparison, there was no significant difference ($P>0.05$) in weight gain between treatments A and B with least significant difference of 0.2. there were significant difference ($P<0.05$), in weight gain between treatments B(10) and C(20) with mean difference of 1.05, treatments C(20) and D(40) with mean difference of 3.4 and treatments D(40) and E(60) with mean difference of 2.4. The percentage survival of treatments A, B, C, D and E were 100, 95, 85, 22.5 and 13% respectively, indicating that the st0cking densities and space, outside the natural traits of Catfish like cannibalism, play vital role in homestead fish production of *Heteroclarias* (HYBRID). There were no death recorded in treatments A and B. The dead fingerlings in treatment C were recovered and had no wounds or lesion on their skins, an indication that death was not caused by cannibalism. Treatments D and E recorded a death percentage of 77.5% and 87% respectively. Not all the carcass was recovered and those recovered, had wounds and lesion on their bodies. Treatment A (5) with the highest percentage survival of 100%, was not best in terms of economic returns consequences of low stocking densities. Treatment B(10) and C(20) were recommend because of relatively high percentage survival of 95% and 85%, and higher stocking density, which will lead to higher economic returns

**Cite This Article as:** Okeke PA, 2014. Studies on the effects of stocking densities on growth performance and survival level of *heteroclarias* (hybrid). Inter J Agri Biosci, 3(3): 136-140. www.ijagbio.com

## INTRODUCTION

The continuous depletion of fish is the inland, brackish and marine waters, consequence of climate change (global warming), flooding, tsunami, siltation, obnoxious fishing methods (plant poison, explosives and dynamiters), erosion over exploitation and the ever increasing world population, has aroused the interest many countries to look for alternative means to ensure availability of fish and fishery products (Okeke *et al.*, 2013). The global economic recession of 1950-1976 and the current recession has made many countries to look inward. That is why countries like China, Japan, USA and Western countries have embraced aquaculture Satia (1990) and Coche (1994) observed that many Nigerians have started to develop interest in aquaculture, with the result that by 1988 at least 3,000 homestead concrete ponds (25 $m^2$-40 $m^2$), 2,000 earthen fish ponds (0.02-0.20

ha) and over 26 commercial fish farms had been established in Nigeria. The above figures have increased more than ten times in 2013 (Satia, 1990).

Anyanwu *et al.* (1989) estimated annual production from small scale fish farms to be; 1 ton/ha. /yr. for earthen ponds and 32-38 kg/ 32 $m^2$ per six month rearing cycle for concrete fish ponds. History has shown that the art of fish culture is over 400 years old. Anadu and Nwokoye (1993) stated that years of aquaculture have been more of government business with little or no private sector involvement. The problem encountered in fish culturing includes; the type of culture system, the size and age of fries, fingerlings and juvenile to stock. Also, the required protein diets to feed the fish at various stages of development to achieve optimum growth and lack of culturable fish species and pedigree records of cultured species.

Culturable fish species in Nigeria: because of the abundance of aqua resources in Nigeria waters, some fish species have been found to be very goods as culturable species either for monoculture or polyculture. These includes *Tilapia melanoplura* or *Oreochromis niloticus, Tilapia niloticus, Tilapia zilli, Chrysichthys nigrodigitatus,* Catfish-*Clarias Spp* (Mud cat fish), *Heterobranchus spp, Heterotis niloticus Ethmalosa spp* (Bonga), *Lates niloticus* (Nile perch), *Ponaeus duorarum* (pink shnmp), *Lutjanus spp* (Snapper).

Among the indigenous species which has gained public acceptance in Nigeria is the Catfish. The two most important catfish families are Claridae and Heterobranchidae. The former has a single ray dorsal fin which extends almost to the tail. The later has a tong base, rayed dorsal fin and an adipose fin. *Heteroclanas* (Hybrid) is a cross from *Heterobranchus spp* and *Clanas gariepinus.*

General Classification of Heteroclarias

| | | |
|---|---|---|
| Kingdom | - | Animalia |
| Phyllum | - | Chordata |
| Sub phylum | - | Vertebrate |
| Class | - | Osteichthyes |
| Sub class | - | Actmorpterygii |
| Order | - | Cypriniformes |
| Sub order | - | Siluroidae |
| Family | - | 1. Heterobranchidae |
| | | 2. Claridae |
| Genus | - | 1. Heterobranchus |
| | | 2. Clarias |
| Hybrid | - | Heteroclarias |

Because it is a hybrid, it has qualities that are better than its both parents. *Heteroclarias* hybrid is an omnivore with more inclination to eating flesh than plant. It is both pelagic and benthic feeder. It is very palatable and nutritious, hardy and highly cherished in Nigeria (Aguigwo, 1994).

The major problem in culturing catfishes is their high rate of cannibalism resulting from "Jumpers or shooter" amongst hatchlings of the same age.

## MATERIALS AND METHODS

### Acquisition of *heteroclarias* fingerlings and acclimatization

Four hundred and fifty (450) *Heteroclarias* fingerlings (mean weight 1.00g + 0.029) were specially ordered and obtained from the Aqua Fish Farm at No. 258 Ziks Avenue, Awka, Anambra State, on the 2nd of August, 2012. These were transported between 11am and 12noon in a 20 litre plastic container in an air condition car to the laboratory. The plastic container was covered with a mesh of 1.2mm to prevent the fingerlings from jumping out of the container. The fish fingerlings were acclimatize for 14 days in a 100 litre plastic bowl in the laboratory and were fed with the experimental feed of 35% Crude Protein (CP). This was to make them familiar to the formulated feed. Fingerlings were fed to satiation three times daily.

At the end of acclimatization, a total of four hundred and five fingerlings were randomly selected and distributed in five plastic bowl (30 litre) each, at the stocking densities of 5,10,20,40 and 60 as treatment A,B,C,D and E respectively. Each 30 litre plastic bowl were filled with 25 litre of clean water and covered with mesh materials to prevent fingerlings jumping out, a characteristic behavior of catfishes. Initial mean length (cm) and weight (gm) of fingerings contained in each treatment were recorded before placing them in the plastic bowl.

The water were changed every 24hrs throughout the duration of the experiment changing of water were done in the mornings to avoid stress. The fingerlings were fed at the rate of 5% body weight of the total biomass three times daily. Each day ration was divided into three equal parts and each part was fed at 7.30am, 12.30pm and 5.30pm. The total weight and length of fish were taken bi-weekly, during which the quantity of feed required for each treatment was determined and adjusted. The mortality count was recorded as it occurred daily. The temperature of water was between 24°C-26°C throughout the experimental period of 16 weeks.

The data collected were subjected to statistical analysis using Analysis of Variance (ANOVA) and Correlation Coefficient (r).

## RESULTS

### Growth

Table 2, Shows the growth in length of treatments A-E. The whole treatments recorded growth in length throughout the duration of the experiment. The bi weekly variation in length growth of treatment A,B and C stocked with 5, 10, 20 fingerlings of *Heteroclarias* hybrid respectively had the highest growth in length in that order, than treatment D and E stocked with 40 and 60s fingerlings ($P<0.05$)

Percentage Growth Rate (PGR) in length in treatment A, B, C, D and E were as follows 65.10, 62.75, 49.32, 18.68 and 16.28% respectively.

Growth in length was also, subjected to the Analysis of Variance (ANOVA). It showed that treatments A, B, C, D and E with the stocking densities of 5, 10, 20 40 and 50 respectively, were significant at both 1% and 5% level. The Calculated F value 105.2 is greater than the Table values at 1% (5.99) and 5% (3.48) level. The Least Significant Difference (LSD) was 0.98. The mean difference of treatments A and B was 0.20, and this was less than LSD. Therefore, no significant difference. There was significant difference between treatment B and C

**Table 1:** Stocking Density of Various Treatments (A-E) of the *Heterocalrias* Fingerlings

| | Variables fish treatment | | | | |
|---|---|---|---|---|---|
| Treatment | A | B | C | D | E |
| NO of fingering | 5 X 3 | 10 X3 | 20 X 3 | 40 X3 | 50 X 3 |
| Total | 5 | 30 | 60 | 120 | 150 |
| Grand total | | | 405 | | |

**Table 2:** B1-weekly mean length and percentage growth in length of *heteroclarias* fingerlings after 16th week of experimental culture

| | Treatments (CM) | | | | |
|---|---|---|---|---|---|
| Variable | A | B | C | D | E |
| Mean stocking –density) | 5 | 10 | 20 | 40 | 60 |
| Initial length ($F_1$) | 3.70 | 3.80 | 3.70 | 3.70 | 3.60 |
| 2ND week | 6.30 | 6.30 | 5.00 | 3.80 | 3.70 |
| 4TH week | 7.90 | 7.30 | 5.50 | 3.90 | 3.80 |
| 6TH week | 8.90 | 8.70 | 5.80 | 4.00 | 3.90 |
| 8TH week | 9.10 | 8.90 | 6.00 | 4.05 | 3.95 |
| 10TH week | 9.40 | 9.20 | 6.40 | 4.15 | 4.00 |
| 12TH week | 10.00 | 9.40 | 6.70 | 4.25 | 4.10 |
| 14TH week | 10.20 | 10.00 | 7.30 | 4.55 | 4.20 |
| 16TH week | 10.60 | 10.20 | 7.30 | 4.55 | 4.30 |
| Final length ($F_2$) | 10.60 | 10.20 | 7.30 | 4.55 | 4.30 |
| % Growth in length | 65.09 | 62.75 | 49.32 | 18.68 | 16.28 |
| F2 – F X 100 | | | | | |
| F2 1 | | | | | |

**Table 3:** Bi-weekly mean weight and percentage growth in weight of *heteroclarias* (hybrid) fingerlings after 16th week of culture

| Variables | Treatments | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| Mean stocking-density | 5 | 10 | 20 | 40 | 50 |
| Initial weight ($W_1$) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 2ND week | 3.70 | 3.50 | 3.20 | 1.32 | 1.30 |
| 4TH week | 7.60 | 7.50 | 6.00 | 1.57 | 1.50 |
| 6TH week | 10.30 | 8.00 | 6.70 | 1.69 | 1.60 |
| 8TH week | 11.20 | 9.00 | 6.90 | 1.69 | 1.70 |
| 10TH week | 11.50 | 9.80 | 7.30 | 1.90 | 1.80 |
| 12TH week | 11.80 | 10.00 | 7.90 | 2.00 | 1.90 |
| 14TH week | 13.00 | 12.60 | 8.40 | 2.12 | 2.00 |
| 16TH week | 14.10 | 13.50 | 9.00 | 2.32 | 2.20 |
| Final growth weight | 14.10 | 13.50 | 9.00 | 2.32 | 2.20 |
| % Growth weight | | | | | |
| F2 – F X 100 | | | | | |
| F2 1 | | | | | |
| Source: (Utene, 1979 | | | | | |

F = Initial weigh; $F_2$ = Weight; % GW = Percentage Growth Rate

(P<0.05) because means difference (1.05) is greater than LSD (0.98). There was significant difference between C (20) and (D) (40). There was no significant difference (P>0.05) between mean difference of art D and E (0.92), which is less than LSD of 0.98.

**Length-weight relationship**

The Correlation Coefficient (r) various treatments (A-E) are shown in figure 1 the Correlation Coefficient in treatment A is 0.74, B = 0.61, C = 0.55, D = 0.28 an 0.22 in treatment E. The correlation coefficients were positively correlated (P<0.05) the correlation coefficient (r) in treatment A and B had higher (P<0.05) than the correlation coefficient (r) in C, D and E. However, correlation coefficient (r) in treatment D and E were not significant (P>0.05).

**Survival /mortality**

Treatments A, B, C, D and E had percentage survival of 100, 90, 85, 22.8 and 5% respectively. In treatment B, mortality only occurred on the 10th week, in treatment C, mortality started from 6th week and stopped on the 14th week. While in treatments D and E, it started from the 2nd week and stopped in the 14th and 18th weeks respectively.

**Cannibalism**

No cannibalism was recorded in treatments A, B and C, the dead fingerlings in treatments B and C had no bruises, lesson or wound and were recovered intact. In treatments D and E majority of the fingerlings were not recovered and those recovered had wounds, lesion and missing morphological parts of the body. Some of the fingerling alive had lesion, bruises and wounds.

## DISCUSSION

The result of this research indicates that stocking density had tremendous contributions on the growth performance of *Heteroclarias* hybrid. This was shown by the fact that treatment A with Lowest stocking density grew better than the other treatment, both in length and weight. Since all the physico-chemical parameters were the same in all the treatments, therefore, the difference in growth must be linked to difference in stocking densities. The space factor becomes very crucial in homestead fish culture, because fingerlings in treatment A had more space to operate, less competition for food, good aeration due to reduced crowding. This observation is in agreement with Anadu and Nwokoye (1993) whose studies on *Cyprinus carpio* (Common carp) showed that growth in length/weight of common carps was influenced by the stocking density. Also Backiel and Locren (1978) Pfunderer and Francis (1972) showed that gold fish *Carassius auratus* liberate toxic materials that inhibits growth if stocked in greater number. There was report on reduced growth rate on grass carp *Ctenopharyngodon idella* when stocked at high density even if the fish was fed to satiation (Bergot *et al.*, 1989).

The lack of cannibalism in treatment A and B was probably due to the fact that *Heteroclarias* fingerlings had sufficient space to operate. There was no competition for food and had enough dissolved oxygen. These factors in no small measure favour fish growth and were found to have contributed positively in this research. The non significant difference in length and weight growth in treatments B and C tend to confirm that treatments B and C are better densities for culture of *Heteroclarias* hybrid. This is because, their percentage growth rate were above 80% and had the best growth optimal production. Although, treatment A was highly significant in terms of growth rate, it is not profitable for commercial production. Knight (1987) recommended an initial stocking density of up to 150 larva in one cubic litre. Such stocking density is only possible at larvae stage or where recirculatory system is used, but certainly not in a homestead fish pond. Overcrowding at fingerlings stage will result to cannibalism, competition for food, stunted growth, biomass reduction, and other health related problems. *Tilapia zilli* stocked at a high density, was observed to have a reduction in their growth within two weeks of culture (Mazid *et al.*, 1970).

**Table 4:** The percentage survival and mortality of *heteroclarias* (hybrid) after 16th week of cultive E

| Treatments | A | | B | | C | | D | | E | |
|---|---|---|---|---|---|---|---|---|---|---|
| Stocking – | 25 | | 50 | | 100 | | 200 | | 300 | |
| Density | Surv. | Mort. | Sur. | Mort. | Sur. | Mort. | Sur. | Mort. | Sur. | Mort. |
| 1st week | 25 | Nil | 50wk | | 100 | Nil | 200 | Nil | 300 | Nil |
| 2nd week | " | " | " | | " | " | 190 | 10 | 280 | 20 |
| 4th wk | " | " | " | | " | " | 178 | 12 | 204 | 76 |
| 6th wk | " | Nil | " | | 95 | 5 | 122 | 56 | 124 | 80 |
| 8th Wk | " | " | " | 1 | 94 | 1 | 82 | 40 | 61 | 63 |
| 10th wk | " | " | " | 1 | 88 | 6 | 62 | 20 | 44 | 17 |
| 12th wk | " | " | 1 | 1 | 85 | 3 | 52 | 10 | 39 | 5 |
| 14th wk | " | " | 1 | 2 | 85 | | 45 | 7 | 39 | Nil |
| 16th wk | " | Nil | | | 85 | | | | | |
| Total | 25 | | 45 | 5 | 85 | 15 | 45 | 155 | 39 | 361 |
| Surt. Mort. | | | | | | | | | | |
| % Sur1. Vors | 100% | | 95% | | 85% | | 22.5 | | 13% | |

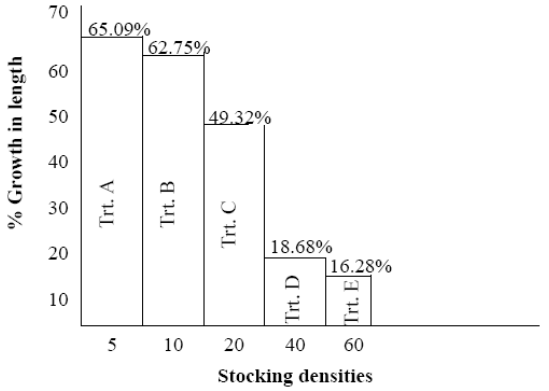


**Fig. 1:** Percentage growth in length of *Heteroclarias* (Hybrids) fingerings stocked at different stocking densities

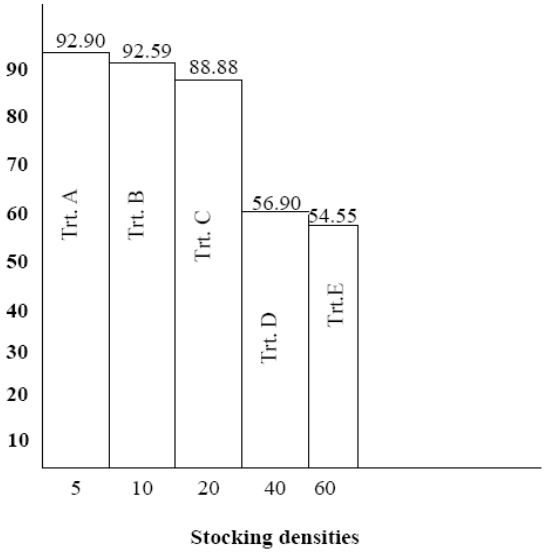


**Fig. 2:** Percentage growth in weight of *Heteroclarias* (Hybrids) fingerings stocked at various stocking densities

The present experiment shows increases in length and weight relationship, thereby indicating that the fingerlings grew in both length and weight. This also showed that the fingerling accepted the feed fed to them. Bergot *et al.*, (1989) obtained similar growth increases when length/ weight measurements were used as parameters for determination of growth. The factors that favour growth

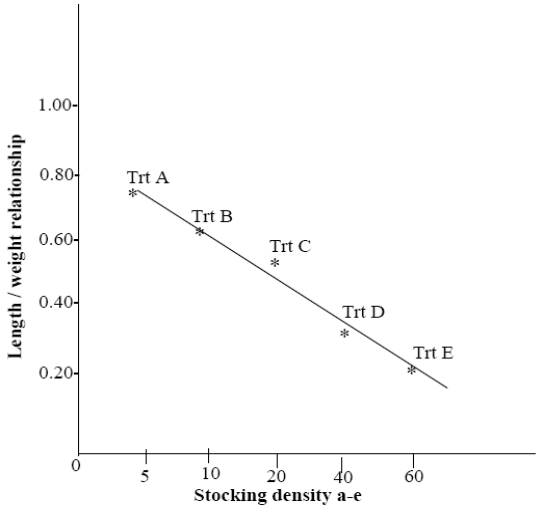


**Fig 3:** The correlation (r) of the length /weight relationship of various treatments (A-E).

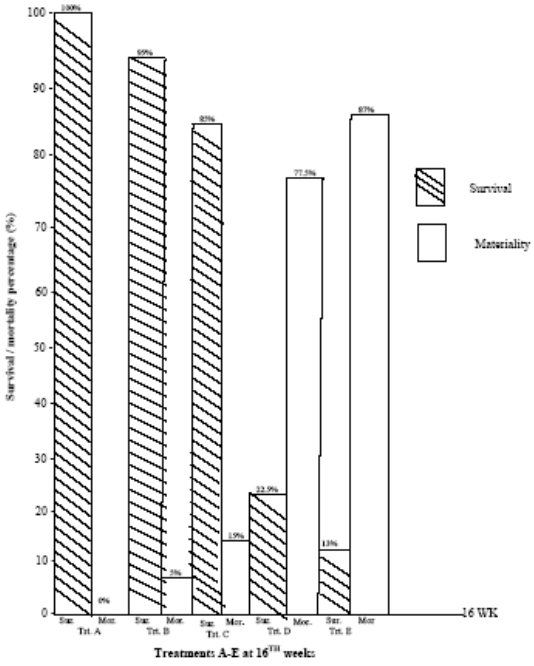


**Fig. 4:** Survival and mortality of *heteroclarias* (hybrid) fingerlings stocked at different stocking densities for 16 weeks.

were maximal in treatment A than in other treatments. Anadu and Nwokoye (1993) obtained high growth result in aquaria with low stocking density.

Cannibalism was observed to have commenced in treatment D and E from 2nd week. This was attributed to the emergence of "Shootout" or "jumper", which began to pray on other fingerlings.

**Recommendation**

It is recommended that the stocking densities of 10 and 20 *Heteroclarias* Fingerlings per 25 litres of water should be practice. This is because their percentage growth rate (PGR) in length and weight are (60.09 and 62.75) and (92.59 and 88.88) respectively. The percentage survival of Treatment B and C are 95% and 85%.

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