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Performance Characteristics of *Clarias Gariepinus* (Burchell, 1822) Raised in Different Culture Sysytems in Ibadan, Nigeria

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Abstract

The performance characteristics of *Clarias gariepinus* in two culture systems commonly used in Nigeria were studied. Three small-scale commercial farms were selected for each of the culture systems. The objective of this study was to evaluate the effects of culture systems and season on the performance of Clarias gariepinus. Data obtained were analyzed using ANOVA and the means were separated using Duncan Multiple Range test. The earthen pond pH ranges between 6.7 and 8.0, Temperature ranges between 31°C and 35oC, Dissolved oxygen ranges between 5.02mg/l and 47.8mg/l, Total dissolved solids ranges between 261mg/l and 304mg/l throughout the rearing period. In Concrete tank the pH ranges between 6.9 and 8.5, Temperature ranges between 28°C and 30°C, Dissolved oxygen content ranges between 5.08 and 6.7mg/l, Total dissolved solids ranges between 336mg/l and 378mg/l. Fish Length - Weight measurement showed that the culture systems had significant effects ($p<0.05$) on the weight and length of Clarias gariepinus. The season of the year also had significant effects ($p<0.05$) on the performance of fish raised in earthen ponds but with no significant effects ($p>0.05$) on the performance of fish raised in Concrete tanks. The length-weight relationship of Clarias gariepinus under the two culture systems gave a correlation coefficient 0.89 with the equation $\ln W = 16.793 + 0.094 \ln L$. Fish showed high performance in earthen ponds than concrete tanks. The fish raised in earthen pond has the highest weight gain during the wet season and feed conversion efficiency ratio. Efficient management of concrete tanks should be seen as a better option for enhancing the performance of Clarias gariepinus especially in urban areas.

Key words: *Clarias gariepinus; Condition factor; Growth; Seasonal effect*

Introduction

Aquaculture, beyond doubt, is the fastest growing food-producing sector in the world. The important role of aquaculture in providing aquatic animal protein to make up for the short fall in wild fisheries, and its socio-economic role in providing livelihood opportunities and economic security, particularly for the less-developed regions of the world, is now strongly recognized globally (Rohana, 2002). Fish farming is the principal form of aquaculture and it involves raising fish commercially in tanks or enclosures, usually for food. In Nigeria fish are harvested through commercial fishing and aquaculture as well as importation. About 70% of fish consumed in Nigeria is imported. The remaining 30% is produced locally by

river fishing and aquaculture. In 2007, Food and Agricultural Organization (FAO) stated that the total amount of seafood production for local consumption was approximately 500,000 tonnes mostly catfish and small amounts of other freshwater fish species. Fish farming generates employment directly and indirectly in terms of people employed in the production of fishing output and other allied business. It also generates income for all categories of people involved in fish farming and thus contributing to national income (Olagunju., *et al*, 2007).

Many fish species are farmed in Nigeria using various systems and practices, which is a function of availability of space, mode of operation, objectives and more importantly finance (Adeogun., *et al*. 2007). The most commonly cultured species include catfish (Clarias gariepinus, the imported C. lazera and Heterobranchus), tilapia and carp. Many fish farms focus on catfish as they have a market value of two to three times that of tilapia (FAO, 2000). The most commonly practiced culture systems in Nigeria are Earthen Pond system and Concrete Tank system. The objective of this study is to determine the performance characteristics of *Clarias gariepinus* in the different culture systems and to determine the effect of the season of the year on the growth of *Clarias gariepinus.*

Materials and Methods

Based on information obtained from Catfish Farmers Association of Nigeria, all active fish farms (n=60) in Ibadan metropolis were surveyed. Six farms with the two most common fish culture systems (3 concrete tanks (CTs) and 3 earthen pond (EPs) were purposively selected based on frequency of harvest and yield. In these farms, record of management practices, water quality parameters and production outputs were obtained bi-weekly (Adeosun, 2016). Data were analysed using descriptive statistics and ANOVA at $\alpha_{0.05}$

Biological Evaluation

A total of 950 specimens of *Clarias gariepinus* (size range of 14.5cm to 42.5cm) were used on a seasonal basis to calculate length-weight and condition factor of *Clarias gariepinus*. The specimens were measured and weighed to the nearest centimeters (cm) and gram (g) respectively using measuring board and physical balance.

Length - Weight Measurement

A functional relationship between length and weight has been established based on the following empirical formula:

$W = a L^b$ (Huxley, 1924)

Where

W = weight in gram L = total length in centimeter

a = multiplying constant and b = the exponent or growth coefficient.

The logarithmic transformation of this relationship was expressed by Le Cren (1951)

Log W = Log a + b Log L

The values of 'a' and 'b' are determined empirically from the data. The observed average weight was plotted against the average observed length to examine the nature of parabola.

The condition factor 'K' was determined using the following equation

$$K = \frac{W}{L^3} \times 100$$

Where K = condition factor and W and L are weight (gm) and length (cm) respectively.

Weight gain = Final weight – initial weight

Increase in Standard Length (cm) = $L_2 - L_1$

Where L_2 = final Standard Length

L_1 = initial Standard Length

Specific Growth Rate =

$$\frac{\ln \text{final body weight} - \ln \text{initial body weight}}{\text{Time (days)}} \times 100\%$$

Feed Conversion Ratio (FCR) = $\frac{\text{Total Feed Intake}}{\text{Total wet weight gain}}$

Results and Discussion

Length-weight relationship and Condition Factor

The study of length-weight relationship and condition factor help to understand the general well- being of a fish in a particular habitat. Figures 1-3 showed the length-weight relationship of farmed Clarias gariepinus in different culture systems.

The average length obtained for fish from the earthen pond during wet and dry seasons was 35.4cm with a range of 28.0cm - 41.0cm and 35.5cm with a range of 33.0cm – 39.0cm respectively. The average length obtained for fish raised in concrete tank during wet and dry season was 31.4cm with a range of 17.0cm – 42.5cm and 29.98cm with a range of 19.3cm – 30.0cm respectively. The average length for fish raised in earthen pond during the wet season was not significantly($p<0.05$) different from the average length obtained during the dry season but when that of earthen pond was compared with concrete tank a significant difference was obtained ($p>0.05$). The average weight of fish obtained during the study

showed similar pattern as the average length. The average weight of fish obtained from earthen pond during the wet and dry seasons are 567.57g and 548.42g respectively. Also the average weight of fish obtained from the concrete tank during the wet and dry seasons are 271.60g and 263.75 respectively. The average weight of fish obtained from earthen pond was significantly (p>0.05) different from the average weight of fish obtained from concrete tank. There was also a significant (p>0.05) difference between the average weight of fish obtained during the wet season and dry season. Multiple regression analysis between the length and weight of fish in earthen pond gave a correlation 'r' of 0.81with the following equation ln W = 34.33 + 0.076 ln L and concrete tank gave a correlation of 'r' of 0.89 with the following equation ln W = 19.587 + 0.087ln L. The length-weight relationship of Clarias gariepinus under the two culture systems gave a correlation of 'r' of 0.89 with the following equation ln W = 16.793 + 0.094 ln L. The correlation regression 'r' between length and weight were closer to 1. This means that the relationship between length and weight of the fish was high as the length of the fish increases, the weight also increases.

Farms	OOF	SFL	KFF	VFF	EKF	ASF
Location	Akobo	Apata	Akobo	Bodija	Apata	Idi-Ishin
Ownership	Sole	Sole	Sole	Sole	Sole	Sole
Educational level of manager	Secondary	Secondary	Secondary	Secondary	Tertiary	Tertiary
Type of Facility	Earthen Pond	Earthen Pond	Earthen Pond	Concrete Tank	Concrete Tank	Concrete Tank
Age of Facility (yrs)	9	11	9	7	11	6
Number of facility	3	8	3	10	5	9
Type of fish cultured	Clarias gariepinus	Clarias gariepinus	Clarias gariepinus	Clarias gariepinus	Clarias gariepinus	Clarias gariepinus
Cultured period (months)	5	3	4	6	8	7
Number of employees	4	4	4	5	4	4
Yield per production cycle (tonnes)	2.05	2.7	2.05	13.3	3.2	8.9

Table 1: *General Profile of Fish Farms used in this study.*

Culture Systems	Season	Condition Factor (K)
Earthen Pond	Wet	1.13
	Dry	1.20
	Both	1.18
Concrete Tank	Wet	1.20
	Dry	0.95
	Both	1.12

Table 2: *Variation in Condition Factors of C. gariepinus among Culture Systems.*

Culture environment	Average Length (cm)	Range (cm)	Average Weight (gm)	Range (cm)
Earthen Pond	35.40	28-41.0	567.57	150-1500
Concrete Tank	31.40	17-42.5	271.60	50-750

Table 3: *Length-weight relationship of fresh Clarias gariepinus (Wet Season).*

Culture environment	Average Length (cm)	Range (cm)	Average Weight (gm)	Range (cm)
Earthen Pond	35.50	33.0-39.0	548.42	360-700
Concrete Tank	29.98	19.3-30.0	263.75	50-450

Table 4: *Length-weight relationship of Clarias gariepinus (Dry Season).*

Culture Systems	Parabolic Equations
Earthen Pond	Log W = 0.1875 + 1.078log L (r = 0.901)
Concrete Tank	Log W = 0.1105 + 1.091log L (r = 0.907)
Both	Log W = 0.0899 + 1.10log L (r = 0.945)

Table 5: *Regression analysis of Length- Weight relationships of C. gariepinus in different culture systems.*

Feed Conversion Ratio (FCR) and Specific Growth Rate (SGR)

The fish in the different culture systems and during wet and dry seasons were analysed for growth performance based on weight gain, percentage weight gain and specific growth rate and Feed Conversion Ratio were calculated. The result is presented in table 4.11.

Parameters	Earthen Ponds			Concrete Tanks		
	OOF	SFL	KFF	VFF	EKF	ASF
Mean Initial weight (g)	0.5	1.10	0.5	5.0	5.0	5.0
Mean Final weight(g)	666.20	1417.68	644.4	356.4	258.6	800
Mean Weight gain	665.7	1416.58	643.9	351.4	253.6	755
Specific growth rate(SGR) (%/day)	2.2	2.2	2.2	1.3	1.2	1.6
Feed conversion ratio	0.4	0.9	0.7	0.9	1.1	0.3
No of days for production	141	141	141	141	141	141

Table 6: *Growth performance of Clarias gariepinus raised in different culture systems.*

Conclusion

The fish showed high performance in earthen ponds than concrete tanks therefore, efficient management of concrete tanks should be seen as a better option for enhancing the performance of Clarias gariepinus especially in urban areas. The water quality parameters showed that the water was within the range recommended for freshwater fish hence favourable for the survival of Clarias gariepinus.

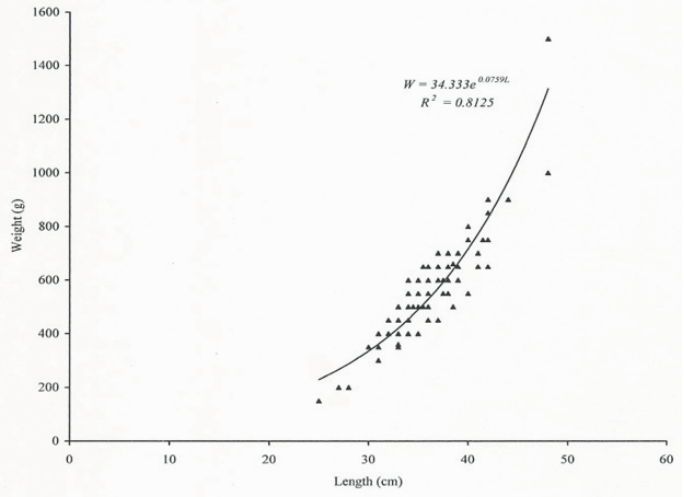

Figure*: Length – weight relationship of Clarias gariepinus under the earthen pond medium.*

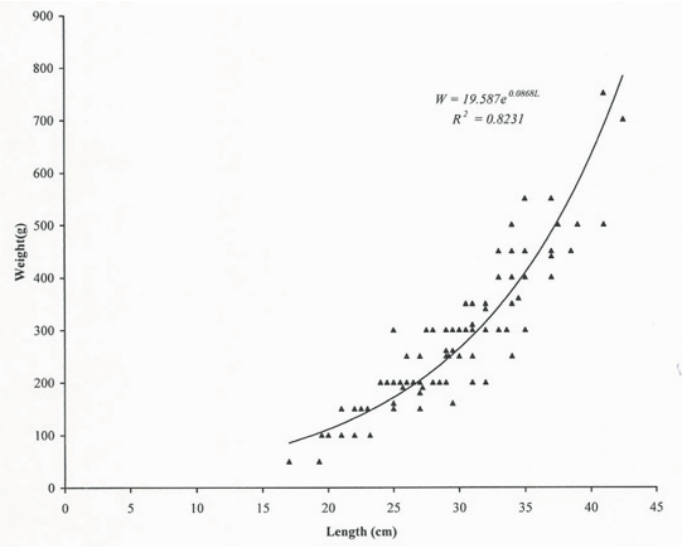

Figure*: Length – weight relationship of Clarias gariepinus under concrete tank medium.*

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