Acta Scientific Veterinary Sciences (ISSN: 2582-3183)

Volume 2 Issue 2 February 2020

Research Article

Influence of Blue Crown Feeds on Some Growth Parameters: Condition Factor, Food Conversion Ratio and Contribution to Jumpers Phenomenon in *Clarias gariepinus*

Ada Fidelis Bekah[1]*, Edet Ekpenyong[2] and Ibi Ada Uffia[1]

[1]*Department of Fisheries and Aquaculture, Faculty of Agriculture and Forestry, Cross River University of Technology, Obubra Campus, Nigeria*

[2]*Department of Zoology and Environmental Biology, Faculty of Biological Sciences, University of Calabar, Cross River State, Nigeria*

***Corresponding Author:** Ada Fidelis Bekah, Department of Fisheries and Aquaculture, Faculty of Agriculture and Forestry, Cross River University of Technology, Obubra Campus, Nigeria.

DOI: 10.31080/ASVS.2020.02.0040

Received: January 09, 2020

Published: January 28, 2020

Abstract

Clarias gariepinus has been identified as a candidate that will help to bridge the gap between demand and supply in fish protein in Nigeria due to its suitability for aquaculture in Nigeria. Feeding therefore forms a very high proportion of production cost of this fish especially in concrete ponds where there is total dependence on food supply by farmer. Blue crown feeds were investigated to know its influence on some growth parameters. The mean weight gain in the fish was 715.12 g for males in 120 days. That of females was 734.7 g within the same period. The average daily weight gain for males was 5.96 g/day and that of females was 6.12 g within the period. The specific growth rate for males and females were 2.20 and 2.21 respectively. An increase in length of males and females fish in 120 days was 36.3 cm and 36.7 cm respectively. The fish population exhibited jumpers' phenomenon as the fish final range was 400g - 850 g in weight and 37 cm - 45 cm length. However, the specimens formed a population that was normally distributed, this jumper's was minimal. There was absence of cannibalism in the pond because only one fish died possibly by natural cause. There was a positive allometric growth as the condition factor; K of the fish was greater than 1. Though blue crown has a price which is 0.5 time lower than COPPENS, its effects on growth parameters are optimal and is recommended as a feed of choice for *Clarias gariepinus* culture in Nigeria.

Keywords: Blue Crown Feeds; Condition Factor; Length-Weight Relationship; Clarias gariepinus; Water Quality Parameters

Introduction

It is estimated that in rearing fish for food in Nigeria, feed component of the cost constitutes 70 per cent of the total cost of production especially those in total captivity [1]. El-Sayed and El-Naggar [2] reported that feeds take 75 - 90 per cent of total cost of fish production in Egypt. According to Baki and Yucel [3], fish production in Turkey can have feed component costing as high as 85 per cent but may decrease with weight increment. Amisah., *et al*. [4] quoted 40 to 60 per cent cost of feeds in fish production in Ghana. While Jillian., *et al*. [5] give the World's data as greater than 50 per cent. High cost of feed in Africa is often attributed to the fact that African countries depend mostly on imported feeds [4]. The realization that aquaculture production is fast growing and the expectation that Aquaculture is likely to close the gap between animal protein demand and supply may be thwarted by none feed availability. This has actually led to a huge volume of research in finding alternative feeds and feed ingredients within and outside Nigeria [1,4-10].

Meanwhile, Nigeria now produces and distributes industrial feeds. Examples include Top-feeds Aqua floating pellets by Afri mash Nigeria limited. Other companies include Skretting Nigeria (www.skretting.com/en.NG), Durante Fish Industries Limited (wwwdurantefish-ng.com), Aller Aqua Nigeria Ltd (www.aller-aqua.com), Olam Nigeria or Olamgroup.com (that distributes blue Crown, Aqualis fishfeeds), Live Stock feeds Ltd (www.livestockplc.com), Zeigler Feeds (www.zeiglerfeeds.com) and Dickem Feeds (dickenfarms.com) [11]. At the local scene, Nigerians have not been able to produce the floating type. Blue Crown, which is relatively new into the Nigerian market. Interestingly, Blue Crown has a price, which is about 0.5 times that of COPPENS.

Jillian., *et al.* [11] pointed that in investigating food conversion to animal's body for human consumption, we may be consider-

ing the total weight of the food not taking to mind the conversion of individual nutrient contents. Often, nutrient contents are the determinant factors in feeds price. For instance, Jillian., *et al*. [5] showed that aquatic animals have lower food conversion ratio. But they will still need higher financial implication to obtain the same weight of food that could be used for land animals. It is argued that aquatic animals have requirements for highly nutrient-dense feeds that likely influence prices of their feeds though FCRs are low. Blue Crown is investigated in this work to evaluate its influence on the growth parameters gonadosomatic and hepatosomatic indeces on *Clarias gariepinus*. This is a fish that has no equal in Nigerian fish culture. It satisfies the criteria of a fish required for Aquaculture in Nigeria and Ghana more than any other species. The features that make it the most cultured and highly acceptable for consumption in the Nigerian environment have been mentioned by several authors [4,12]. Offem., *et al.* [13] identified it as the second most farmed in the region about a decade ago. Today it is occupying the first position [14,15].

The wellbeing of fish called condition factor, could be calculated from length-Weight parameters, called Fulton's condition factor. An allometric growth gives a value of less than or greater than 3. Since isometric growth of 3 signifies a uniform growth of parts, which is also influenced by food (quality and quantity) as well as other biotic and abiotic factors [16,17]. Length - weight relationship is an important parameter useful in assessing the relative wellbeing of a fish population. The length - weight relation can be used as a character for the differentiation of taxonomic units. Length-Weight relation gives a coefficient, which is characteristic of a species, variety and population of the fish. It is said to vary with sex, maturity, season and even time of the day because of the changes in stomach fullness [16,18-20]. In sourcing fish variety for Aquaculture, therefore, fish populations with isometric growth parameters are preferred for culture. Other uses of length - weight relationship include the setting of yield equation for estimating the number of fish landed and comparing the population in space and time. And by measuring the components of this (length or weight) the other could be obtained [21]. This length weight relationship has been investigated in a large number of fishes occupying various bodies of waters [22]. Commercial feed that produces the isometric growth properties can be recommended for culturing of fish.

Materials and Methods

Fingerlings of the same spawn having average length of 50.02 mm with a range 48 - 54 mm and average weight of 16.24 mg were obtained from University of Calabar Fish Farm. See Figure 1. These were cultured for four months from 1st day of August, 2019 to 30th of November, 2019. These were cultured in a flow through system using direct precipitation (rain water) as the only source of water. The flow-through avoided accumulation of un-eaten feeds.

The location of the experiment was in Akamkpa Local Government Area of Cross River State, Nigeria; between Latitude 5032" and 4027" North and Longitude 7040" and 9028" East. This area has annual average rain fall of 350 mm. The Area has two rain regimes: wet season (May - October) and dry season (November - April) [23].

Due to jumper's phenomenon [24,25], the fish were sorted into three sizes after five weeks (5th September, 2019). The three groups served as triplicates. A day prior to measurements, the fish were fed for the last time at 17.00 hours. This was to cause them to evacuate their gut as Yongo and Wairimu [26] noted that length/weight ratio is affected by gut content. They were fed with Blue Crown feeds to satiation.

Length of fish was measured using a meter rule graduated in mm. The weight was badge weighed using a sensitive weight meter … produced by … made in ….

Weight gain (WG) was obtained by formula
WG = FW - IW
Where FW final weight and IW = initial weight.

Gain in length (LG) was also calculated from the formula
LG = FL - IL
Where FL = final length and IL = initial length.

Figure 1: Showing length measurements (Mean = 50.02 mm; range = 48 -54 mm) of fingerlings used in culture.

Average daily weight gain
(ADWG) = FW - IW/ND

Where FW = final weight; IN = initial weight and ND = number of days the fish were cultured [10].

Feed conversion ratio was calculated from total weight of feeds fed in grams divided by gain in body weight in grams. The formula for this estimation was:

FCR = total feeds/wet weight gain by fish.

Length weight relationship was calculated from the formula:
$W = aL^b$ after a linear transformation to
LogW = Log a + b

Where W = fish weight in grams, a = intercept or regression constant, b = regression coefficient or slope [27].

The condition factor, K, was obtained by the formula K = 100 Wt/L3, where Wt is body weight in g and L is total length (measured from snout to end of caudal fin) in cm [4,8].

Specific growth rate (% body weight gain/day, SGR) was estimated by ((Log Final fish wt. minus Log Initial fish weight)/Time)) x 100 according to Cook., *et al.* [6].

The liver was dissected out using a surgical blade and weighed using an electronic balance (Scout-pro SPU402). The hepatosomatic index was estimated using the formula

HSI = (weight of the liver/the total weight of the fish) X 100 [28]

Gonadosomatic index

Male and female fishes were sorted based on their genital papillae. the male papilla was pointed while the female's was rounded. A fully ripen female has soft bulging abdomen due to possession of eggs [29]. This was obtained by dividing the weight of the gonads by the weight of the whole fish. For this is the calculation of the gonad mass as a proportion of the total body mass. This was done using the formula:

GSI = [gonad weight/total body weight] ×100 [30]

Water quality

In this experiment, water quality parameters namely; temperature, dissolved oxygen and pH were monitored. Water temperature was measured using mercury in glass thermometer graduated in degree Celsius (0C). Dissolved oxygen was measured using 970 JENWAY DO_2 meter (made by BIBBY scientific Ltd., UK) to the nearest 0.1mg/L. The pH was measured using 3505 JENWAY (made by BIBBY scientific Ltd., UK). These physic-chemical properties of water were measure bi-weekly, usually between the hours of 9.00 - 12.00 Nigerian times

Results

Growth parameters

The mean weight gain in the fish was 715.12 g for males in 120 days. That of females was 734.7 g within the same period. The average daily weight gain for males was 5.96 g/day and that of females was 6.12 g within the period. An increase in length of males and females fish in 120 days was 36.3 cm and 36.7 cm respectively. See Table 1. Result from this experiment showed that the population exhibited jumpers' phenomenon as the fish final range was 400g - 850g in weight and 37 cm - 45 cm length. However, the specimens formed a population that was normally distributed and having this narrow range, shows that this phenomenon was minimal. This was further shown by the absence of cannibalism in the pond because only one fish died possibly by natural cause. There was a positive allometric growth as the condition factor; K of the fish was greater than 1.

Figure 2: Showing the weight indices of the gonads in females and males (GSI = gonadosomatic index) and the hepatosomatic index (HSI) for both males and females.

Figure 3: Length - Weight relationship in Clarias gariepinus (males and females) fed with Blue Crown feeds.

Sex (n)	Initial weight (g)	Initial length (cm)	Final weigh (g) t	Final length (cm)	Weight gain (g)	Length gain (cm)	AWG (g)	SGR (%)	FCR	CF
Males (190)	1.62	5.0	716.12	41.3	715.12	36.3	5.96	2.20	1.154	1.015
Females (10)	1.62	5.0	736.32	41.7	734.7	36.7	6.12	2.21	1.123	1.018

Table 1: Shows the growth parameters of *Clarias gariepinus* fed Blue Crown feeds.

Physic-chemical properties of water

Figure 4: Showing average temperature of water f or culturing the fish during experiment.

Figure 5: Showing mean pH of water for culturing the fish during experiment. There were no significant differences in pH among groups ($p > 0.5$).

Figure 6: Dissolved oxygen concentration in concrete fish enclosure fed with Blue Crown feeds.

Discussion

Zhu *et al.* [31] found wild females of Clarias gariepinus maturing at 174 mm at the weight of 119.5g having gonadosomatic index of 8.50%; and males with length of 250 mm weighing 116.2g, having gonadosomatic index of 0.45%. They recorded the age of these fish as greater than one year. These workers equally observed that the gonadosomatic index of this fish has a linear relationship with the morphometric parameters like length and weight. These were equally demonstrated in the result of this experiment as shown in Figure 2. The fish here especially female did not have mature gametes at the age of four months, but were having higher body weight than that recorded by Zhu., et al. [31]. The failure of maturation of fish at higher body weight and length in this experiment is possibly due to high quality food with the necessary nutrients required for growth at the early stages of life. This is because at age of 1/3 years, the fish had attended average length of 41.3 + 4.26 cm and weight of 715.12 ± 235.16 g. See Table 1.

The condition factor of females was higher than that of males ($p \geq 0.5$). That does not necessarily mean that the condition factor for the males was low (1.02). Condition factor, which was greater than 1 is an indication that the fish were fat. Differences in condition factors between males and females was also observed by Abannikannda., *et al*. [32] and drew attention to the fact that condition factor is influenced by sex. The number of males was higher than the females in the population. This should not be surprising as sex determination in fish is not solely genetically influenced but is equally influenced by environmental factors such as temperature and radiations. Santi [33] revealed that at age 6 - 8 days, temperature of 36.5^0C can result in all male sex in Clarias gariepinus.

Given enough food and appropriate temperature requirements and other factors, such as optimal pH, as was observed in this work, these physicochemical parameters were not outside the values recorded as favourable for Clarias gariepinus by Marimuthu., et al. [34]. The pH range was 6.8 to 7.6. This kind of pH has been recorded as the best for fish living environment.

Endogenous factors including the genetic constitution of the fish also plays important role in growth parameters. It could sometimes be responsible for heterogeneity in populations of the same

species. The narrow range in individual sizes is evidence that the jumping phenomenon may have been due to genetics alone. Environmental contribution to this phenomenon may have been minimal; because all individuals had optimum food, dissolved oxygen, pH and temperature. Though environmental factors mentioned earlier (food and temperature) and other physico-chemical properties of the water are usual contributors [27,35,36].

Ekelemu [37] fed Clarias gariepinus, Heterobranchus bidorsalis and their F1 hybrid ad-libatum with fish meal and recorded a condition factor, K greater than 1 after three weeks. Results here were similar to Ekelemu's [37] results but different from what could be observed in the wild with poor food availability. The condition factor value was high due to the nutritious value of the feed. Kiriratnikom and Kiriratnikom [8] described condition factor as an indicator of fatness, gross nutritional state and the level of reserve nutrients.

Genes, starvation and poor water quality are contributors to jumping in the growth of any group of organisms. Food scarcity results in some members that are stronger ingesting more food, thus depriving the weak individuals of enough food. The fast growing members do turn round to consume the stunts (cannibalism). Feed with appropriate nutrients supplied at appropriate rate could reduce jumping phenomenon in fish [36]. This is because even the weak members have enough food to pick and are not living in fear. This is the reason for lack of a multimodal or skewed population in this experiment when lengths of all the individuals were plotted together as seen in Figure 1. Literature has indicated that at low temperatures, growth in organisms may be slow. High temperature leads to fast growth in which individuals reach maturity earlier but with less final maximum size [38]. Apart from temperature, food availability is grossly responsible for growth rate and final size reached at the end of growth. Food substances are raw materials for body building. It is shown that during food abundance, organisms grow fast and grow more slowly or not at all during food scarcity. This has been explained as a reason why hard parts (such as scales, bones and otolliths) of fish can show growth rings [38-40]. Growth is accentuated with dwindling food quantity and quality supply in a system. Temperature of the water was within tolerable range for optimal survival of this fish. The temperature was observed as shown in Figure 5. There was no high temperature variability especially among the three groups because they receive the same source of water in a flow through.

Conclusion

It is logical to conclude that Blue Crown feeds are good, because it did not cause deterioration in the physicochemical properties of the water. Favourable environmental conditions coupled with adequate nutrient composition in the feeds. This may have resulted in the growth parameters observed. It is therefore safe to recommend that the feeds should be used for the culturing of *Clarias gariepinus* due to the feeds' low price and its environmental friendliness.

Bibliography

1. Ochang SN. "Local plant ingredients use in aquafeeds: a review". In: 23rd Annual Conference of the Fisheries Society of Nigeria (FISON), Kaduna, Nigeria (2009): 41-45.

2. El-Sayed AM and El-Naggar GO. "Value chain analysisof the aquaculture feed sector in Egypt". *Aquaculture* 437 (2015): 92-101.

3. Baki B and Yucel S. "Fish cost/production income analysis of Seabass (Dicentrarchus labrax) Aquaculture". *International Journal of Ecosystemand Ecology Sciences* (2017): 859-864.

4. Amisah S., *et al*. "Growth performance of the African catfish, Clarias gariepinus, fed varying inclusion levels of Leucaena leucocephala leaf meal". *Journal of Applied Science and Environmental Management* 13.1 (2009): 21-26.

5. Jillian PF., *et al*. "Feed conversion efficiency in aquaculture: do we measure it correctly". *Environmental Research Letters* (2017).

6. Cook JT., *et al*. "Growth rate, body composition and feed digestibility/conversion of growth-enhanced ž/transgenic Atlantic salmon Salmo salar". *Aquaculture* 188 (2000): 15-32.

7. Jamiu DM and Ayinla OA. "Potentials for the development of Aquaculture in African". *NAGA* 26.3 (2003): 9-13.

8. Kiriratnikom S and Kiriratnikom A. "Growth, feed utilization, survival and body composition of fingerlings of Slender walking catfish, Clarias nieuhofii, fed diets containing different protein levels Songklanakarin". *Journal of Science and Technology* 34.1 (2012): 37-43.

9. Ochang SN., *et al*. "Effects of replacement of Soyabean meal with Beneseed (Sesamum indicum) meal on the growth and haematology of African catfish (Clarias gariepinus)". *Nigerian Journal of Fisheries* 11.1 (2014).

10. Omodu AO., *et al*. "Length Weight Relationship of Clarias Garienpinus (Catfish) Fed with Local Feeds". *New York Science Journal* 10.5 (2017): 46-59.

11. Naijafishing.com (2019).

12. Okey IB., *et al*. "The efficacy of clove (Eugenia caryophyllata) powder as anaesthesia on African catfishes (Clarias gariepinus and Heterobranchus bidorsalis) fingerlings". *Journal of Aquaculture and Marine Biology* 7.4 (2018):182-188.

13. Offem B., *et al*. "Fish Culture Technologies in South Eastern Nigeria". *African Journal of Agricultural Research* 5.18 (2010): 2521-2528.

14. Olufayo MO. "Haematological characteristics of Clarias ariepinus (BURCHELL 1822) juveniles exposed to Derris elliptica root powder". *African Journal of Food Nutrition and Development* 9.3 (2009): 920-933.

15. FAO. "The State of World Fisheries and Aquaculture - Meeting the sustainable development goals". Rome. Licence: CC BY-NC-SA 3.0 IGO (2018).

16. Thomas J., *et al*. "Length-Weight relationship of some deep sea fish inhabiting the continental slope beyond 250 m deep along the West Coast of India". *NAGA World Fish Center Quarterly* 26.2 (2003): 17-21.

17. Olele NF and Obi A. "Morphometric Growth in Citharinus citharus in Onah Lake, Asaba, Delta State, Nigeria". *Nigerian Journal of Fisheries* 2-3 (2006): 290-298.

18. Tesch FW. "Age and Growth". In. Methods in Assessment of fish production in fresh waters, W. E. Ricker edn". Blackwee Scientific Publications, Oxford (1971).

19. Ohaturuonye SO., *et al*. "Length-Weigth relationship and condition factor of Cichlid species of Oguta Lake, Imo State, Nigeria". In. The proceedings of the 32nd Annual Conference of FISON, held in Anambra State (2017): 297-300.

20. Ewutanure SJ and Olaifa FE. "Length- weight relationship and condition factor of Clarias gariepinusfrom Gbalegbe River, Delta State, Nigeria". In. The proceedings of the 32nd Annual Conference of FISON, held 1917 in Anambra State (2017): 327-330.

21. Haimovici M and Velasco G. "Length-Weight Relationship of Marine Fishes from Southern Brazil". *NAGA ICLARM Quarterly* 23.1 (2000): 1-23.

22. Olurin KB and Adergbe OA. "Length-Weight Relationship and Condition Factor of Pond Reared Juvenile Oreochromis niloticus". *World Journal of Zoology* 1.2 (2006): 82-85.

23. Adie HA., *et al*. "Spatial distribution of urinary schistosomiasisin Cross River State, Nigeria using geographical information system and school based questionnaire". *Pakistan Journal of Biological Sciences* 16 (2013): 1166-1172.

24. Dada AA., *et al*. "Effect of varying stocking density on growth and survival in an African catfish, Heterobranchus bidorsalis fry in out door concrete tanks". *Journal of Fisheries Technology* 2 (2000): 107-116.

25. Ovie SO., *et al*. "Gro7wth and survival of heterobrachus longifilis fry in different stocking densities". *The Zoologist* 6 (2008): 21-26.

26. Yongo E and Wairimu A. "Studies on the Biology of Synodontis victoriae in the Nyanza Gulf of Lake Victoria". *Kenya Fisheries and Aquaculture Journal* 9.2 (2018): 244.

27. Panase P and Mengumphan K. "Growth performance, Length-Weight relationship and condition factors of backcross and reciprocal hybrid catfish reard in net cages". *International Journal of Zoological Research* 11.2 (2015): 57-64.

28. Ada FB and Ayotunde EO. "Ganado-hepato-somatic index of Oreochromis niloticus sub adults exposed to some herbicides". *International Journal of Aquaculture* 3 (2013): 49-54.

29. Buragohain A and Goswami MM. "Relationship of Fecundity and different body parameters of Clarias magur (Hamilton, 1822) in captive condition in the Agro climatic condition of Assam". *India Journal of Agriculture and Veterinary Science* 7.3 (2014): 44-50.

30. Barber BJ and Blake NJ. "Reproductive Physiology in Developments in Aquaculture and Fisheries" *Science* 35 (2006): 357-416.

31. Zhu YJ., *et al*. "Reproductive Biology of exotic fish, Clarias gariepinus (Burchell, 1822) in South China". *Chinese Journal of Ecology* 36.1 (2016): 137-143.

32. Abanikannda OTF., *et al*. "Sexual dimorphism in body weight, morphometric measures and indices in African catfish (Clarias gariepinus)". *Aquaculture* 502 (2019): 148-152.

33. Santi S. "Temperature preference and sex differentiation in African catfish, Clarias gariepinus, Journal of experimental Zoology". *Ecology and Integrated Physiology* (2017).

34. Marimuthu K., *et al*. "Effects of different water ph on hatching and survival rates of African catfish Clarias gariepinus (Pisces: Clariidae)". *Aceh Journal of Animal Science* 4.2 (2019).

35. Shin YJ., *et al*. "Using sizs based indicators to evaluate the ecosystem effects of fishing". *ICES Journal of Marine Science* 62 (2005): 385-396.

36. Ghazwan IM. "The real environmental causes that lead to stunting in fish in nature (2018).

37. Ekelemu JK. "Differential growth pattern of Clarias gariepinus, Heterobranchus bidorsalis and hybrid Heteroclarias fed commercially prepared diets". *Agricultural and Biological Journal of North America* 1 (2010): 658-661.

38. Quick AJR and Bruton MN. "Age and growth of Clarias gariepinus (Pisces: Clariidae) in P. K.Ie Rour Dam". *Sourth African Journal of Zoology* 19 (1984): 37-45.

39. Deangelis DL., *et al*. "Fish cohort dynamics: application of complementary modeling approaches". *The American Naturalist* 142.4 (1993): 604-622.

40. Aung HT. "Stock assessment of Otolithoides pama (Hamilton, 1822) in Thanlwin River Mouth, Mon State, Myanmar". *Journal of Aquaculture and Marine Biology* 7.4 (2018): 241-244.