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The Effect of Photoperiod on the Growth of African Catfish, (*Clarias gariepinus* Burchell, 1822) Juveniles in the Semi-Arid zone of Nigeria

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ABSTRACT

Twenty-seven juveniles of the African mud catfish, *Clarias gariepinus,* were reared in triplicate under three different photoperiods: 24 hours total darkness (00L: 24D), 6 hours light and 18 hours darkness (6L: 18D) and 12 hours light and 12 hours darkness (12D:12L) as control. The effects of light duration on the growth, body coloration, and feed conversion efficiency of the juveniles were investigated. The result showed significant ($P < 0.05$) increases in body weight, specific growth rate, and food conversion efficiency in fish cultured under 00L: 24D, followed by 06L: 18D, while those under 12L: 12D (control group) showed the least growth increase. The high growth, increase recorded in the 00L:24D was attributed to better food conversion efficiency and the suppression of swimming activity, aggression, and stress in the dark. Visual observation of the skin coloration of fish indicated that those subjected to photoperiod regime A (00L: 24D) were darker and black in appearance. Those subjected to photoperiod regime B (06L: 18D) had a lighter grey appearance, while in the case of photoperiod regime C (12L: 12D) had the normal dark grey coloration on the dorsal part with light grey scattered along the sides. The final mean body weight of the males was significantly different from that of the females in the entire experimental period with the final mean body weight of 57.60 ± 3.86g and 47.41 ± 1.31g for the males and females respectively.

Key words: Photoperiod Growth, *Clarias gariepinus*, Juveniles, semi-arid, Nigeria

INTRODUCTION

Spectral composition is a main characteristic of light. In water, light rays of different wavelength pass to different depths depending on light absorption and diffusion as well as availability of admixtures and small organisms in the water body. Most fish species have well developed colour, sights and are therefore very sensitive to coloured light. For instance, the growth rate of silver carp larvae (*Hypopthalmichthys molitrix Val*.) and young carp (*Cyprinus carpio L.)* increased with green light (Ruchin, 2004).

Photoperiod is one of the exogenous factors that directly influence the growth of fish through changes in endocrine functioning and hormone secretion, i.e. melatonin and thyroxin. It regulates the daily endogenous rhythm in fish, and also affects growth, locomotion activity, metabolism rates, body pigmentation, sexual maturation and reproduction (Duston and Saunders 1990; Gross *et al*., 1995; Silver-Garcia 1996; Boef, and Le Bail, 1999; Tripple and Neil 2002; Biswas *et al*., 2002; and Biswas *et al.*, 2005). In nature, light intensity and background colour can affect feed detection and feeding success of culture fish, thus influencing fish growth and mortality. In general highest growth rate of fish larvae are achieved when light conditions and background colour optimize the contrast between the feed and the background (Barahonna-Fernandes, 1979; Hishaw, 1986; Henne and Watanabe, 2003; Jentoft *et al*., 2006; Strand *et al*., 2007).

Adaptation of fish to their natural environment may also influence their response to the farming environment. In most studies, fluorescent lamps are used, resulting in what human perceive as white light, despite the fact that; in nature fish habitat, wavelength of light penetrating water varies greatly from. Fish vision and spectrum perception are strongly adopted to each species, natural and living ethology (Chinen *et al*. 2005, Kusmic and Auatieri, 2000; Neumeyer, 1992; Pointer *et al*., 2000).

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Long and continuous photoperiods can stimulate feed efficiency and enhance the growth in different species, like Atlantic salmon *Salmo salar* L. (Johnston *et al*., 2003a, 2004), sea bream *Pagrus major* (Temminck and Schlegel, 1843) (Biswas *et al*., 2005) and Atlantic halibut *Hippoglossus hippoglossus* L. (Simensen *et al*., 2000). In cod *Gadus morhua* L., Nagasawa *et al*. (2012) found that the mean weight of juveniles reared under continuous light was 13% greater than those kept under a natural photoperiod for 120 days. Batty (1987) also observed that food searching by *Clupea herringus* is most effective at around 5 lx light intensity. The implication here is that when light intensity is too high and food searching becomes negatively affected, then as a result larvae take in less nutrients and their growth becomes negatively affected.

One of possible reasons for an increase in feeding incidence and intensity coinciding with an increase in light intensity relates to the functionality of the visual. The majority of the marine fish larvae is visual predators (Pena *et al*., 2004, Puvanendran and Brown 2002). Both of these larvae have a pure cone retina at hatching time and rods are not added to the retina until larvae have grown sufficiently. Because of this, young larvae may have high light requirements than older larvae that have more advanced visual systems (i.e. more rods). That is when the visual stimulants are not enough due to the absence of light, it may be that larvae cannot differentiate prey clearly (Pena *et al*., 2004). Blaxtar (1986) stated that teleost fish have a visual stimulation threshold of 0.1 light intensity, so if there is any less light intensity than this, the larvae are not able to properly locate prey. This could explain why larvae performed so poorly under 0 hours illumination. The increase in feeding incidence and intensity with increase light intensity could thus possibly attributed to an increase in contrast between the prey and the background perceived by larvae (Pena *et al*., 2004). This means that the higher the light intensity, the more easily larvae see the prey items. It was also reported that the availability of light during the early life stage of fish affect the development of the eyes. Studies done on *Haplochromis burtoni* and *Salmo gairdneri*t proved that light deprivation during early life stages of the larvae causes the eyes to develop abnormally, negatively affecting the visual acuity of the fish (Roman *et al*., 1979; Zeutzius and Rahmann, 1984). This improper visual development would most likely negatively affect the rest of the fish development as well. Larvae that cannot properly identify prey or predators due to decreased visual activity would have decreased survival and growth rate.

Some observed effect of photoperiod on growth of fish is contradictory Brown (1946) found that in 6 hours of daylight Brown trout (*Salmon trutta L.*) grew faster than at a longer period of light exposure. Attributed this result to increase rest and energy conservation at longer darkness (dark period). Contrarily, Gross *et al*., 1965 using sunfish *Lepomis cyonellus* and Hugh *et al*. (1976) using yellow perch (*Perca flavescens*) respectively exposed to a longer light period of light. Lungrish (1980) showed that at a longer period of light, immature Baltic salmon Parr (*Salmon salar L.*), grew faster while sexually mature males grew more slowly. He suggested that there was hormonal inhibition of photoperiod-stimulated growth in preconscious males.

A study of the rockfish *Sebaster diplopora* was reported to have an optimum growth rate with 16 hours light periods (Boehlert, 1981). A study on the sea bass *Dicentrachus labrax* reported an optimum growth rate at 18 hours light periods (Barahonna–Fernandes, 1979). Barlow *et al.* (1995) examined the growth of Barramundi larvae (*Lates calcarifer*) under different photoperiods, and found that individual 8-20 days old had significantly higher growth with 16 hours light. A similar result also obtained for a Sole (*Solea solea*) by Fuchs (1978). In contrast, Kiyonon and Hirano (1981) reported an optimum growth rate of black porgy (*Mylio macrocephalus*) with continuous light. Tandler and Helps (1985) also reported this for Gilthead Sea bream (*Sparus auratus*), Duray and Kohno (1988) for rabbit fish (*Signus guttatus*). Through the wide range of result obtained and received suggests that different families of fishes, both marine and freshwater fishes have different feeding patterns and therefore a different requirement as larvae. Differences in quality of food between each study may also play a role. Understanding light regime of fish species, State of life and feeding behaviour enable breeder, fish farmers and researchers to obtain desired results.

Billions of people, mostly in developing countries depend on fish as a source of animal protein. It was estimated that by the year 2010, demand for fish will increase by 13.5% to 18.5% or to about 105-110 million metric tons (FAO, 2000). Hunger and poverty are among the challenges facing African society today. Intensive aquaculture of local species using simple, low-cost technology could provide a ready solution to overcome these challenges. *Clarias gariepinus* is one of the commonly cultured, indigenous species of fish in Africa. This species is hardy nature, omnivorous, feeding habits, ability to eat a variety of natural and supplemental feeds, resistance to diseases, as well as its ability to tolerate low oxygen and pH levels.

Clarias gariepinus, is generally considered to be one of the most important tropical freshwater fish species for aquaculture whose aquaculture potential have been documented (Dada and Wonah, 2003). Bruton (1979) pointed out that *Clarias gariepinus* has high fecundity rate, grows faster, tolerate high stocking density and environmental extremes. It also accepts a variety of feeding modes in expanded niches. Other attributes such as resistance to diseases, and ability to endure long drought and scarcity of food have endowed this fish species with one amazing capacity to survive (Dunn, 2000).

African catfish, *Clarias gariepinus* is elongated with fairly long dorsal and anal fins. The dorsal fins have 61 – 80 soft rays. Moreover, the anal fins has 45 -65 soft rays, they have strong pectoral fins with spines that are serrated on the outer side (Teugels, 1986). This species can attain sizes of up to 1.7 meters long including the tail and can weigh up to 59kg when fully grown. They possess nasal and maxillary barbells and somewhat smallish eyes. Their colouring is dark green and black dorsally and cream coloured vertically. Adult possesses dark longitudinal lines on either side of the head. However, this is absent in young ones of the specie. Adults head is coarsely granulated, while the head is smooth in young ones. Their head is large depressed, and heavily boned. The mouth is quite large and sub-terminal (Skelton, 1983).

Clarias gariepinus has broadband of recurved teeth on the jaws and pharyngeal teeth preventing prey from escaping. It also has an abundant network of sensory organs of the body, head, lips and barbells. These barbells; are extensively used for prey detection and fixation. *Clarias gariepinus* (Burchell 1822) with barbell were 22.6% more efficient at catching prey than those without barbells. This indicates that tactile behaviour is important in the prey catching process. Another important aspect of predation by *Clarias gariepinus* is their ability to switch feeding from one type of prey to another. In Lake Sibaya (South Africa), catfish ignores (or cannot catch) fish prey during daylight and feed mainly on invertebrates, which are abundant and relatively easy to catch. By contrast, at night, when fish prey becomes more venerable, they switch their feeding habits to fish prey (Bruton, 1979).

African catfish lives in a variety of fresh water environment, including water, like lakes, ponds and pools. They are also very prominent in flowing rivers, rapid and round dams. They are adoptive to extreme environmental conditions and can live in pH (partial hydrogen) range of 6.5 - 8.0. They are able to live in very turbid water and can tolerate temperature of 8 – 35 degree Celsius (8-35^{o}c). Their optimal temperature for growth is 28 – 30 degree Celsius (28-35^{o}c). They are benthic dwellers and do most of their feeding there. They are also obligated air breathers, which mean they do spend sometimes on the surface. This species of fish can live in very poor oxygenated water and is one of the last specie to live in such an uninhabitable place (Piennar, 1992). They are also able to secrete muscles to prevent drying and are able to burrow in the muddy substrate of a drying body of water (Skelton, 1993). *C. gariepinus* is the most cultured fish species in the area. The amount of photoperiod is high in the study area, hence its slogan The Sunshine State”. Fish farmers in the study area shade their fish ponds with the intention of reducing the high temperature as well the sunshine penetration (photoperiod) into the ponds. The knowledge of the culture condition of the most economical fish species will increase the performance of the species. This study, therefore, was designed to determine the effects of photoperiod on growth and skin pigmentation of *Clarias gariepinus* juveniles.

MATERIALS AND METHODS

Study area

This research was carried out in the Laboratory of the Department of Fisheries, School of Agriculture and Agricultural Technology, Modibbo Adama University of Technology Yola. Adamawa State, Nigeria.

Experimental fish

The juvenile of *Clarias gariepinus* were obtained from private fish hatchery at Hayin Gada in Girei local government of Adamawa state, Nigeria. The initial mean length and weight of the juveniles were

13.00cm and 20.00g, respectively. The fish were acclimatized in three 25 litres experimental bowls (0.2 m in diameter) under laboratory conditions for two days prior to the start of the experiment.

Experimental design

The acclimatized were stocked in three bowls at three fish per bowl in replicates. The fish were exposed to three photoperiod regimes (light: dark, L: D) cycles: 00L: 24D continuous darkness group (A), 06L: 18D six hours light group (B), and 12L: 12D control group (C) with natural light and darkness. Group A was placed in a ventilated dark room, while group B was illuminated with light intensity for a period of six hours light and subjected to darkness for eighteen hours in a ventilated dark room. The fish were fed to satiation with commercial feed twice daily (10:00 am and 6:00 pm).

All of the fish weighed individually at the beginning and the end of the study. Total length (TL) in cm and body weight (BW) in g were recorded using a measuring board (0.1-30cm). Weighing balance 0.01-300g once per week was done to determine fish growth. The weight gain, weight gain percentage, specific growth rate, feed conversion ratio, and feed conversion efficiency were estimated for each treatment according to Liu *et al.* (1998). Direct visual observation of individual fish in each treatment tank was used to analyse body coloration. The growth parameters studied were: (i) Specific growth rate (SGR) = FW-IW (g) /T (days) x 100 (ii) Weight gain (W G) FW-IW/IW (g) x 100 (iii) (iv) Feed conversation ratio (F, C, R) = DFG (g) /WWG (g) (v) Daily growth rate (DGR) FW-IW/IW (g) /EP x IW (g) (vi) Condition factor (K) = W/L^3. Where, FW = Final Weight (g), IW = Initial Weight (g), EP = Experimental period, W = Body Weight, T = Time (days), DFG = Dry Feed Given (g), WWG = Wet Weight Gain (g).

Data analysis

The Data obtained from the experiment were subjected to one-way analysis of variance (AVOVA). Duncan's Multiple Range Test (DMRT) was used to determine the difference between the means (p=0. 05).

RESULT

The growth performance values presented in Table 1 indicated that the highest mean growth performance (the weight increase) was observed in photoperiod regime A, followed by group B, while photoperiod regime C had the least growth (weight) increase. The final mean body weight of *Clarias gariepinus* reared in the three photoperiods was 68.34±1.010g, 49.28±1.515g, and 40.45±7.26g for photoperiod regimes A, B, and C, respectively.

Table 1: Mean (±SEM) weekly body weight (g) of *Clarias gariepinus* juveniles exposed to three different photoperiod regimes

Sampling date	Photoperiod regime			
	Time (days)	A (00L:24D)	B (06L:18D)	C (12L:12D)
22/06/2015	Initial	$20.00±0.04^a$	$20.00±0.04^a$	$20.00±0.04^a$
27/06/2015	5	$38.56±1.565^a$	$35.46±0.888^a$	$23.91±2.150^b$
02/07/2015	10	$49.96±5.139^a$	$43.43±1.042^{ab}$	$30.35±3.997^b$
07/07/2015	15	$50.69±8.125^a$	$46.34±1.241^{ab}$	$35.86±4.083^b$
12/07/2015	20	$68.34±1.010^a$	$49.28±1.515^{ab}$	$40.45±7.260^b$

Mean values in the same row with different superscripts are significantly different (P<0.05)

The growth performance (body weight) values are presented in Table 2. The highest mean growth performance (length increase) was observed in photoperiod regime A, followed by regime B, while regime C had the least growth (length) increase. The final mean Body length of *Clarias gariepinus* reared in the three different photoperiods was 21.30±1.311cm, 18.73±0.267cm, and 17.63±1.700cm for regimes A, B and C respectively.

Table 3 shows that, there is significant different in feed intake between photoperiod regime A and photoperiod regimes B and C, but there is no significant different between B groups and C in week 1 (5-days). It was also observed that those fish maintained in 24 hours darkness (photoperiod regime A) consumed less feed, but utilizes it efficiently and higher weight gained over those kept or maintained with 6 hours light and 12 hours of light respectively. Feed intake of the fish increases with increased of light regime and time (days). This indicated that *Clarias gariepinus* could detect feed/food in the absence of light; this is because being benthic and possessed a mechanism (barbells) that are very sensitive in detecting any material that comes into their environment.

Table 2: Mean (±SEM) body length values (cm) of *Clarias gariepinus* juveniles exposed to three different photoperiod regimes

Sampling Date	**Photoperiod regime**			
	Time (days)	**A (00L:24D)**	**B (06L:18D)**	**C (12L:12D)**
22/06/2015	Initial	13.00 ± 0.02^{a}	13.0 ± 0.02^{a}	13.00 ± 0.02^{a}
27/06/2015	5	16.73 ± 0.333^{a}	16.67 ± 0.167^{a}	13.90 ± 0.600^{b}
02/07/2015	10	18.40 ± 0.458^{a}	17.49 ± 0.320^{a}	15.07 ± 1.068^{b}
07/07/2015	15	19.88 ± 0.533^{a}	17.87 ± 0.376^{ab}	16.63 ± 0.977^{b}
12/07/2015	20	21.30 ± 1.311^{a}	18.73 ± 0.267^{ab}	17.63 ± 1.700^{b}

Mean values in the same row with different superscripts are significantly different (P<0.05)

Table 3: Mean (±SEM) weekly feed intake (g) of *Clarias gariepinus* juveniles exposed to three different photoperiod regimes

Feeding cycle (days)	**Photoperiod regime**		
	A (00L:24D)	**B (06L:18D)**	**C (12L:12D)**
5	2.30 ± 0.049^{b}	2.36 ± 0.019^{a}	2.39 ± 0.048^{a}
10	2.58 ± 0.063^{c}	2.69 ± 0.068^{b}	2.77 ± 0.095^{a}
15	2.95 ± 0.209^{c}	3.22 ± 0.104^{b}	3.47 ± 0.108^{a}
20	4.85 ± 0.236^{c}	$4.92\pm0.0.197^{b}$	5.21 ± 0.259^{a}

Mean values in the same row with different superscripts are significantly different (P<0.05)

The males performed better than the females during the experimental period. The final mean body weight values recorded were 57.60±3.86g and 47.41±1.31g for the males and females respectively (Table 4). There was significant difference between the mean body weight values of the male and female juveniles.

Table 4: Mean (±SEM) Weekly body weight values (g) of male and female *Clarias gariepinus* juveniles exposed to three different photoperiod regimes

Sampling Date	**Photoperiod regime**		
	Time (days)	**Male**	**Female**
22/06/2015	Initial	20.00 ± 0.02^{a}	20.00 ± 0.02^{a}
27/06/2015	5	33.78 ± 1.89^{a}	28.21 ± 1.46^{b}
02/07/2015	10	43.51 ± 2.31^{a}	34.75 ± 1.99^{b}
07/07/2015	15	55.24 ± 7.09^{a}	38.23 ± 4.31^{b}
12/07/2015	20	57.60 ± 3.86^{a}	47.41 ± 1.31^{b}

Mean values in the same row with different superscripts are significantly different (P<0.05)

The growth response of *Clarias gariepinus* Juveniles exposed to different photoperiods is shown in table 5. Growth parameters such as WG, SGR, DGR, LG, FCR, and K during the course of the study were also affected by the photoperiod. This indicates that *Clarias gariepinus*, juveniles maintained under 00L: 24D had the best performance; weight gain (WG= 48.34%), specific growth rate (SGR= 241.78 %), daily growth rate (DGR= 12.08 %), length gain (LG= 8.30 %), feed conversion ratio (FCR= 0.18%) and condition factor (K= 3.21) over fish subjected to photoperiod regime B 06L: 18D weight gain (WG= 29.28%), specific growth rate (SGR= 146.40 %), daily growth rate (DGR= 7.32 %), length gain (LG= 5.73 %), feed conversion ratio (FCR= 0.27%) and condition factor (K= 2.63) and photoperiod regime C (12L: 12D) which exhibited the lowest growth performance weight gain (WG=

20.75%), specific growth rate (SGR= 103.80%), daily growth rate (DGR= 5.19 %), length gain (LG= 4.63%), feed conversion ratio (FCR= 0.34%) and condition factor (K= 2.31). There was no mortality therefore fish survival 100%. This was achieved through proper management of the experimental fish.

Table 5: Mean (±SEM) growth response of *Clarias gariepinus* Juveniles exposed to different photoperiods

Parameters	**Photoperiod regime**		
	A (00L:24D)	**B (06L:18D)**	**C 12L:12D**
Initial mean weight (g)	20.00±0.04^{a}	20.00±0.04^{a}	20.00±0.04^{a}
Final mean weight (g)	68.34±1.01^{a}	49.28±1.51^{ab}	40.45±7.26^{b}
Mean weight gain (g)	48.34±0.08^{a}	29.28±0.10^{b}	20.75±0.22^{c}
Initial mean length (cm)	13.00±0.02^{a}	13.00±0.02^{a}	13.00±0.02^{a}
Final mean length (cm)	21.30±1.31^{a}	18.73±0.27^{ab}	17.63±1.70^{b}
Mean length gain (cm)	8.30±0.11^{a}	5.73±0.07^{b}	4.63±0.09^{bc}
Specific growth rate (%/day)	241.70±2.34^{a}	146.40±0.56^{b}	103.80±0.99^{c}
Daily growth rate (%)	12.08±0.21^{a}	7.32±0.09^{b}	5.19±0.12^{bc}
Feed conversion ratio	0.18±0.54^{a}	0.27±0.19^{b}	0.34±0.13^{c}
Condition factor (K)	3.21±0.09^{a}	2.63±0.06^{b}	2.31±0.06^{bc}
Survival %	100	100	100

Mean values in the same row with different superscripts are significantly different (P<0.05)

DISCUSSION

Growth of *Clarias gariepinus* maintained in three photoperiod regimes

The growth performance and feed efficiency values are presented in Tables 1- 4 indicated that the highest mean growth performance (weight and length increase) was observed in photoperiod regime A, followed by regime B, while regime C had the least growth performance. The final mean body weight (BW) of *Clarias gariepinus* juveniles subjected to the three different photoperiod regimes was 68.34 ± 1.010g, 49.28 ± 1.515g, and 40.45 ± 7.260g for regimes A, B, and C, respectively. SGR (specific growth rate), FCR (food conversion ratio), and FCE (food conversion efficiency) over the course of the study were also affected by the photoperiods. The significant increase in the length and weight of *Clarias gariepinus* juveniles maintained under total darkness (00L:24D) as compared to the other photoperiod regimes was probably due to better feed conversion efficiency, the absence or reduction of stress and aggressiveness, as well as the suppression of locomotory activities in the dark. All these enabled more energy, which would have been expended on these metabolic activities to be converted into body growth. This is similar to the result obtained by Almazan-Rueda *et al.* (2005). Britz and Piennar (1992), Appelbaum and Kamler (2000), and Adewolu (2008) reported growth, increase in *Clarias gariepinus* under total darkness (00L: 24D) and suggested reasons like high feeding activity in the dark for the high growth rate.

The high specific growth rate under total darkness was a result of the complete feeding and utilization of the feed in the dark, more so because these fishes are nocturnal feeders. The absence of light was responsible for the very dark coloration observed in the fish reared under total darkness 00L: 24D. This could be due to the physiological response of the fish in the dark in increasing the stimulation and production of melatonin (Hisar, 2005). Fish reared under continuous darkness or light have become adapted to these photoperiods, thus, they live with them.

The constant change between day and night affected the physiology, feeding efficiency, and metabolism of the fish. This change made the fish more aggressive with the attendant increase in swimming activity thus stressing the fish. All these metabolic activities consumed energy, which would have been converted to body weight had it been that the fish were not engaging in higher energy demanding activities.

Growth in fishes, however is a measure of the relationship between the length/weight and condition factor of the fish exposed to different photoperiods. Saliu (2002) stated that condition factor is not constant for a species or population over time interval and might be influenced by both biotic and abiotic factors, such as feeding regime and state of gonadal development. In African catfish, cannibalism is also a factor other than stocking density such as photoperiod. Many studies have linked increased cannibalism to stress caused by longer periods of light because more time is spent searching for cover and display aggression in territorial behaviour (Appelbaum and Geer 1998).

Skin coloration

Colour variation observed by direct visual observations among the fish in the three treatment tanks. *Clarias gariepinus* in group A (00L: 24D) were darker and black in appearance. Fish from group B (06L: 18D) had a lighter appearance, while fish in group C (12L: 12D) had the normal dark coloration on the dorsal part with light grey scattered along the sides.

The absence of light was responsible for the very dark coloration observed in the fish reared under total darkness 00L: 24D. This could be due to the physiological response of the fish in the dark in increasing the stimulation and production of melatonin (Hisar, 2005). Very dark body coloration of fish species such as *Clarias gariepinus* coupled with high body mass results in better market value and higher prices.

In addition, the male fish species were observed with the highest growth performance compared to female fish species in the entire photoperiod groups, A, B and C respectively, with the final mean body weight: 57.60±3.86g and 47.41±1.31g. Because there was no mortality, therefore fish survival is 100%. This was achieved through intensive management practices, which were applied. Such as a regular daily change of water 100%, sufficient feeding (fed to satiation) in which it prevents cannibalism among them when the fish are staved: since this species are cannibalistic (omnivorous). Meanwhile, maintaining the required photoperiod by every group throughout the experiment was considered. This shows that mono-sex culture/production of *Clarias gariepinus*, could be adopted in achieving the main set goal of culturing or production of the fish species African mud catfish, *Clarias gariepinus.*

Feed intake of the experimental fish (*Clarias gariepinus*)

As the experimental fish were fed to satiation, there was no left over feed, which could lead to oxygen depletion and stressing the fish directly or indirectly during respiration. The group of fish kept in 24 hour darkness consumed less feed, but utilized it efficiently over those maintain in 18 hour darkness and 12 hours darkness respectively; but, the fish in photoperiod regime A (00L: 24D) utilized the feed most efficiently by attaining a higher body weight and length respectively. It was observed that the fish ate more feed in the first feeding cycle of the day (morning) while in the evening they consumed less feed. Moreover, the fish maintained under total darkness responded to feed more quickly than those kept at 18 hours and 12 hours darkness. The feed response and utilization in the dark could be due to the fact that the *Clarias gariepinus* is a nocturnal and benthic feeder.

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