Influence of Photoperiod on the growth and Survival of Heteroclarias Fingerlings under Laboratory Conditions

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Abstract

Laboratory study was carried out to determine the influence of photoperiods on the growth and survival rates of *Heteroclarias* fingerlings for a period of 12 weeks. It comprised of four (4) treatments and three (3) replicates each. One thousand and eight hundred (1,800) fingerlings, with mean weight 0.89g were used. The treatments are as follows: control (normal day and night period), 12hrsof light and 12hrs of darkness (12L: 12D), continuous light (24L: 0D) and total darkness (24D: 0L).Lighting condition was maintained by using artificial fluorescent bulb on the water surface. Commercial diet (coppens) of 56.0% Crude Protein (CP) was fed twice daily to satiation. Growth performance of the fingerlings and physicochemical parameters of water were determined weekly. Survival rates were recorded daily following standard procedures. The results showed that photoperiod had no significant ($P>0.05$) effects on *Heteroclarias* fingerlings growth, except weight gain. Final body weight ranged from 15.12 g in control to 15.90 g in 24L:0D, weight gain ranged from 14.23g in control to 15.01g to 24L:0D, percentage weight gain ranged from 1598.88% in control to 1684.27% in 24D: OL, specific growth rate ranged from 1.46% day in control/12D : 12L to 1.49% day in 24L:0D / 24D:0L, total length ranged from 12.97cm 24D : 0L to 13.18 cm in 12L : 12D and standard length ranged from 11.09 cm in 12L : 12 D to 11.45 cm in 24L: 0D. Similarly, photoperiod had no significant ($P>0.05$) effect on the physicochemical parameters of water. All were within the recommended range for fish growth in the tropics. Photoperiod had no influence on fish length (standard and total length), body weight, percentage weight gain, specific growth rate and physico-chemical parameters of culture water of *Heteroclarias* fingerlings. The weight gain of the fingerlings exposed to 24D: 0L increased continuously from week 9 to the end of the study. The survival rates of the fingerlings were significantly reduced ($P<0.05$) at 24L: 0D. Optimum growth performance and survival rates of Heteroclarias fingerlings can be enhanced by using control, 12D:12L and 24D: 0L without significant ($P<0.05$) stress.

Keywords: Photoperiod, Growth performance, Survival rates, Heteroclarias fingerlings and physicochemical parameters

Introduction

The reduction in the production of fish from natural water bodies has been a bottleneck to fish farmers, in order to provide enough fish protein to ever increasing human population. Hence, utilisation of water bodies with species diversification along with simple and low-cost techniques may be the fore-runner activities for the enhanced fish production in future times (Manoranjan *et al.*, 2014). Heteroclarias hybrid (parents: male, *Heterobranchus bidorsalis* and female, *Clarias gariepinus*) has been known to be the most widespread and accepted fish in Nigeria (Ayanwale *et al.*, 2014). To support the above submission Tsadu *et al.* (2008) reported a rising increase in the demand for Heteroclarias or *Clariasbranchus* hybrids than their pure breeds for aquaculture because of their resistance to diseases, fast and high growth rates. Among the cultivable food fish in Nigeria, catfish like *Heteroclarias* is the most sought. It is very popular among fish farmers and consumers. It also commands a very good commercial value in Nigerian markets (Oladosu *et al.*, 1993). The catfish, Heteroclarias is very important in the sustainability of the aquaculture industry in the country. Unfortunately, most of the consumed fish in Nigeria are obtained through traditional method of fishing from the wild and partly through fish importation. Khaleg (2000) documented that catfish culture with particular reference to *Heteroclarias* has become an important sector in terms of its potential for contributing to food and family income. He also stated that *Heteroclarias* culture is a profitable business which is capable of assisting people to alleviate poverty, get extra income and farmers should also be educated to culture Heteroclarias instead of culturing only *Clarias or Heterobranchus species*. Lighting conditions are probably one of the most difficult environmental factors to control and in other studies it is characterized by day length, light intensities, spectral content and daily variations (dawn and dusk). Differences in light exposures could therefore explain differential results in fish performances and behaviour reported in light exposure experiments. Fish are either more active in light, less active in darkness, or vice versa (Biswas *et al.*, 2008). Of interest, Dong Han *et al.* (2005) documented reduced growth in Chinese longsnout catfish, *Leiocassis longirostris*, (4.8 ± 0.01 g) when exposed to low (5 lux) or high (443 lux) light intensities, where the specific growth rate (SGR) and feed conversion efficiency (FCE) were higher on the medium light intensity (74 lux). However, some species can grow better at low light intensity, such as juvenile haddock at 30 lux (Trippel and Neil, 2003). Effect of light intensity on growth and survival are species-specific (Puvanendran and Brown, 2002). On the other hand, study of the growth performance in striped knifejaw, *Oplegnathus fasciatus* (body weight 100–300 g) reared under four photoperiods (6hrsL: 6hrsD, 12hrsL: 12hrsD, 16hrsL: 8hrsD and 24 hrsL: 0hrsD), showed a significant different of photoperiod with higher weight gain, SGR, and FCE in fish under 12hrsL: 12hrsD than fish exposed to 6L: 6D, 16L: 8D (Biswas *et al.*, 2008). Photoperiod requirements are specific for each species, and the positive effects on the growth and/or survival can occur under continuous light (Moustakas *et al.*, 2004), intermediary photoperiods (Solbakken and Pittman, 2004), or continuous darkness (Baldisserotto, 2002).Appelbaum and Kamler (2000) reported that *C. gariepinus* reared in the dark were larger than those reared in the light. Almazan *et al.* (2005) also reported that absence of light resulted in an increased growth of this species. Appelbaum and Kamler (2000), and Adewolu *et al.* (2008) reported growth increase in *C. gariepinus* under total darkness (0L: 24D) and suggested reasons like high feeding activity in the dark for the high growth rate, more so because these fishes are nocturnal feeders. Appelbaum and Kamler (2000) also reported that during darkness more energy is channeled into growth and less energy is spent on other activities.

Purchase *et al.* (2000) reported that the duration of experiment plays an important role in the achievement of significant effects of photoperiods on growth performance of fish. In their study on yellowtail flounder, Purchase *et al.* (2000) did not find any significance in growth or survival but outlined that at the end of the study, fish under shorter photoperiods were smaller than those exposed to longer photoperiods. Moshood *et al.* (2012) reported that *C. gariepinus* (Burchell), reared under three different photoperiods (24D:0L); (24L:0D); (12D:12L) showed significant ($P < 0.05$) increase in body weight, specific growth rate, and food conversion efficiency when the fish were cultured under 24D:0L, followed by 24L:0D. Those fish cultured under 12D:12L showed the

least growth increase. The high growth increase recorded in the 24D: 0L was attributed to better food conversion efficiency and the suppression of swimming activity, aggression, and stress in the dark. All these enabled more energy to be converted to body weight. It should be noted that virtually all of these studies involve juvenile or adult fish and the behavioural response of these fishes to photoperiod could be either different or less flexible (Burke *et al.*, 2005). Light is also indispensable for body pigmentation, an important phenomenon involved in the early development and growth. Too intensive light can be stressful or even lethal (Solomon and Okomoda, 2012). The environmental requirements for optimum production of fresh water fish may vary from one locality to another, especially photoperiod. There is also paucity of information on how photoperiod affects some growth parameters and survival rates of *Heteroclarias* fingerlings, hence, this study.

MATERIALS AND METHODS

The study was conducted in Minna, Niger State, Nigeria. Minna is located between latitude 9°31 and 9°45 North and longitude 6°31 and 6°45 East of the equator. The area falls within the Southern Guinea savannah vegetation zone of Nigeria. The climates are: an annual precipitation varying from 1,100 to 1,600mm and a mean temperature range between 21°C and 36.5° C , 12 hrs day time 12hrs night periods. Minna experiences two distinct seasons; dry, from November to March and wet, from April to October (The Nigerian Congress, 2007).

One thousand eight hundred, four (4) weeks old *Heteroclarias* fingerlings of average weight of 0.89 g were purchased from a private fish farm and transported to the Biology Laboratory at Federal University of Technology, Minna, in 50 litres jerry-can with openings at the top for ventilation and to prevent mortality.

The fingerlings upon arrival were allowed to acclimatize to their new environment for a period of seven days in the laboratory. They were disinfected with salt bath. During this period, the fish were fed with coppens commercial fish feed (Catco fish concentrate). They were fed to satiation, twice daily (8.00 a.m and 8.00 p.m.) following the method of Dong Han *et al.* (2005).

The experimental design was a completely randomized Design (CRD) with a total of 4 treatments each replicated 3 times was adopted in this experiment.

The experiment consisted of four treatments with three replicates. Treatment 1 was the control (Normal Day and Night period). Treatments 2, 3 and 4 had 12 hours of darkness and 12 hours of light (12D: 12L), 24 hours of light (24L: 0D) and total darkness (24D: 0L) respectively (Adewolu *et al.*, 2008). Photoperiodic levels were determined using the 24 hours period according to the method of Biswas *et al.*, (2008). Twelve plastic indoor aquaria tanks, 25 litres capacity ($55\times35\times35cm^3$) filled with borehole water up to 20 cm level were stocked with 150 fingerlings each. The artificial lightning in treatments 2 and 3 were maintained with the aid of inverter as an alternative source of electricity in case of power outage. Fluorescent bulbs were used for artificial light, while darkness was created by completely wrapping the aquarium tanks with a black polyethylene paper to prevent light from any other source that may interfere with the setup. Treatment 4 tanks were covered completely with the aid of cardboard papers to create the dark period. The experiment lasted for a period of twelve weeks.

The following physico-chemical parameters of water in the experimental tanks were measured:

Water temperatures of the treatments were determined with mercury in bulb thermometer (10-110°C range). Temperature was determined by lowering the thermometer into the tanks in an inclined position for about 5 minutes to allow for equilibrium before taking the reading at 10.00am in the morning throughout the duration of the experiment.

Dissolved oxygen was determined by using Winkler Azide method (American Public Health Association, 1995).

Biochemical Oxygen Demand (BOD) of water was determined by collecting water samples from the control and treatment tanks incubated for 5days in the dark before the titration for oxygen using Winkler Azide method (APHA, 1995).

BOD5mg/L = Dissolved oxygen at day 1 – Dissolved oxygen at day

The pH of the water samples were determined with Jenway 3305 pH meter model at room temperature. The pH meter probe was inserted into the sampled water for about 5minutes until it stabilized before the reading was taken. The meter was standardized with buffer solutions of pH 4.0, 7.0 and 9.0 before the readings were taken.

Determining Ammonia (NH_3) level of water, 100ml of the water sample from control and treatment tanks was pipetted into a Markham distillation apparatus (Kjeldal flask) according to the method described by American Public Health Association (1995).

Growth parameters of the fish were determined as follows:

Determining Standard Length (SL) and Total Length (TL) at the beginning of every week, subsequently ten fingerlings from each tank were randomly sampled as described by Ayanwale *et al.*, (2017a). Each fish was sampled one by one using a laboratory spoon- like net and gently placed on blotting paper to absorb the adhering water. The SL was determined by measuring the length between the mouth and the caudal peduncle while the TL was determined by measuring the interval between the mouth and the tail fin. They were individually measured with a graduated transparent meter ruler in centimeters. This method of manipulation and measurement was safe for the fish and they were returned to their respective tanks without any loss (Ayanwale *et al.*, 2017a).

The weight of the fish was determined initially and then subsequently weekly by taking the individual weight of ten randomly sampled fingerlings. Weight was determined by using a sensitive compact scale model *CS 2000 HAUS* following the method of Ayanwale *et. al.*, 2017a).

Weight Gain was calculated as: Weight Gain (WTG) = Final mean weight – initial mean weight (Adewolu *et al.*, 2008).

Percentage Weight Gain (PWG) was calculated as: $PWG = 100 \quad \frac{Y-W}{X}$

as described by Adewolu *et al.* (2008).

Where:

Y= final mean body weight (g)

X= initial mean body weight (g)

Specific Growth Rate (SGR) was calculated as:

$$SGR \quad \frac{\log e\, W_2 - \log e\, W_1}{T_2 - T_1}$$

Where W_2= weight of fish at time T_2 in days

W_1= weight of fish at time T_1 in days

T_1= Day Zero

T_2= Eighty four (84) Days

Log_e natural log to base e as described by Dong Han *et al.* (2005).

Survival rates from ththe experimental tanks were monitored daily to remove dead fish and the mortality was recorded; using the formular of Adewolu *et al.* (2008).

Survival Rate (SR) was calculated as

$$SR = \frac{N_O - N_t}{N_O} \times 100\%$$

Where N_o = number at the start of the experiment

N_t= number at the end of the experiment.

The data collected were analysed for. significant differences ($P < 0.05$) by the analysis of variance (ANOVA) using a Computer Statistical Package for Social Sciences (SPSS). Duncan Multiple Range Test (Duncan, 1955) method was used to separate the means where there were statistically significant differences ($P < 0.05$).

RESULTS

The results of the mean ± standard deviation of some growth parameters of Heteroclarias fingerlings exposed to different photoperiods are presented in Table 1. The results revealed no significant ($P > 0.05$) differences in the mean total length which ranged from 12.97±0.28 under Total Darkness to 13.18± 0.40 cm at 12D:12L. Similarly, photoperiods had no significant ($P > 0.05$) influence on standard length which ranged from11.09 ± 0.59 at12 D: 12L to 11.45± 0.45 cm at 24L: 0D and body weight which ranged from 15.13± 1.24 at 12D :12L to 15.90 ± 2.12 cm at 24L:0D.

Table: 1 Mean ± Standard Deviation of Growth Parameters of Heteroclarias Fingerlings Cultured at Different Photoperiods for a Period of 12 weeks.

Growth Parameters	Control (Normal Day and Night)	Photoperiods 12D:12L	24L:0D	24D:0L
Total Length (cm)	13.10±0.53[a]	13.01±0.52[a]	13.18±0.40[a]	12.97±0.28[a]
Standard Length(cm)	11.43±0.46[a]	11.45±0.45[a]	11.09±0.59[a]	11.33±0.25[a]
Final Body Weight (g)	15.12±1.55[a]	15.90±2.12[a]	15.13±1.24[a]	15.88±1.57[a]

Value with same superscript(s), in the same row, are not significantly different at P> 0.05 tested by DMRT.

Key:
L= Hours of Light
D= Hours of Darkness

The results of the mean ± standard deviation of growth performance and survival rates of *Heteroclarias* fingerlings exposed to different photoperiods are presented in Table 2. The results indicated that none of the parameters of growth performance of the fishes differed significantly (P > 0.05) among the photoperiod treatments investigated. While, weight gain of the fingerlings ranged from 14.23g in the control group, to 15.01g among fishes exposed to 24 hours of lighting condition; specific growth rate was 1.46% day in 12 hours photoperiod treatment and between 1.46 to 1.49% days in the others including the control experiment. At the end of the study, the survival rates of *Heteroclarias* fingerlings exposed to 24L: 0D (58.67%) was significantly lower ($p<0.05$) than the control (74.83%), 24D: 0L (75.11%) and in the 12D: 12L treatments (73.33%) respectively.

Table 2: Mean Growth Performance and Survival Rates of Heteroclarias Fingerlings exposed to Different Photoperiods for 12 weeks.

Indices of Growth Performance	Photoperiods Control	12D:12L	24L:0D	24D:0L
Initial body weight(g)	0.89[a]	0.89[a]	0.89[a]	0.89[a]
Final body weight (g)	15.12[a]	15.13[a]	15.90[a]	15.88[a]
Weight gain(g)	14.23[a]	14.24[a]	15.01[a]	14.99[a]
Percentage weight gain (%)	1598.88[a]	1600.00[a]	1686.52[a]	1684.27[a]
Specific growth rate (% day)	1.46[a]	1.46[a]	1.49[a]	1.49[a]
Survival rate (%)	74.83[b]	73.33[b]	58.67[a]	75.11[b]

Values with same superscript(s), in the same row, are not significantly different at P> 0.05 tested by DMRT.

The results of physicochemical parameters of the water medium of Heteroclarias fingerlings exposed to different photoperiods for a period of 12 weeks are presented in Table 3. Generally, there were no significant differences (P>0.05) in the Water temperature which ranged from 25.55 ± 0.45 in 24L:0D treatment to 26.75 ± 0.45°C under 24L:0D. Dissolved oxygen concentration ranged from 4.53 ± 0.65mg/L under 24L:0D to 5.17 ± 0.42mg/L under 24D:OL. Ammonia concentration ranged from 0.29 ± 0.05mg/L under control,12L:12D and 24L:0D to 0.30 ± 0.05 mg/L from the fingerlings exposed to 24D: OL. Water pH ranged from 7.38 ± 0.38 under 12L: 12D and under control fingerlings to 7.46 ± 0.36 under 24D: 0L treatment. Biochemical Oxygen Demand Concentration ranged from 1.03 ± 0.37 mg/L under 24L: 0D exposure to 1.36 ± 0.29mg/L under 24D: OL during the experimental period.

Table 3: Mean Physicochemical Parameters Measured during Experiment on Influence of Different Photoperiods on Heteroclarias Fingerlings for Twelve weeks

Duration of Exposure to Light (Hrs)	Temperature (°C)	DO (mg/L)	Ammonia (mg/L)	pH	BOD (mg/L)
Ambient (Control)	26.19±0.64[a]	4.64±1.00[a]	0.29±0.06[a]	7.38±0.41[a]	1.19±0.21[a]
12D.12L	26.59±0.37[a]	4.94±0.36[a]	0.29±0.06[a]	7.38±0.38[a]	1.14±0.42[a]
24L.0D	25.55±0.45[a]	4.53±0.65[a]	0.29±0.05[a]	7.45±0.37[a]	1.03±0.37[a]
24D.0L	26.75±0.45[a]	5.17±0.42[a]	0.30±0.05[a]	7.46±0.36[a]	1.36±0.29[a]

Values are Mean ± Standard deviation, Values followed by the same superscript(s), in the same column, are not significantly different at (P >0.05) tested by DMRT.

Figure 1 shows the pattern of weight gain of Heteroclarias fingerlings exposed to different photoperiods for a period of 12 weeks. The weight gain of Heteroclarias fingerlings exposed to different photoperiods had similar responses from weeks 1 to 7. However, from weeks 7 to 8 there was a sharp increase in the weight gain of fingerlings exposed to the different photoperiods and subsequent reduction at weeks 8. Fingerlings exposed to 12L: 12D had the least weight gain at the end of the week 9. The weight gain of all the fingerlings increases from week 9, with continuous increase in the fingerlings exposed to 24D: 0L till the termination of the study. Fingerlings exposed to 12L: 12D had the highest weight gain (3.37g) only in week 10 and subsequent reduction. Moreover, the weight gain (4.71 – 4.92 g) of the fingerlings exposed to control and 24L: OD was highest in week 11.

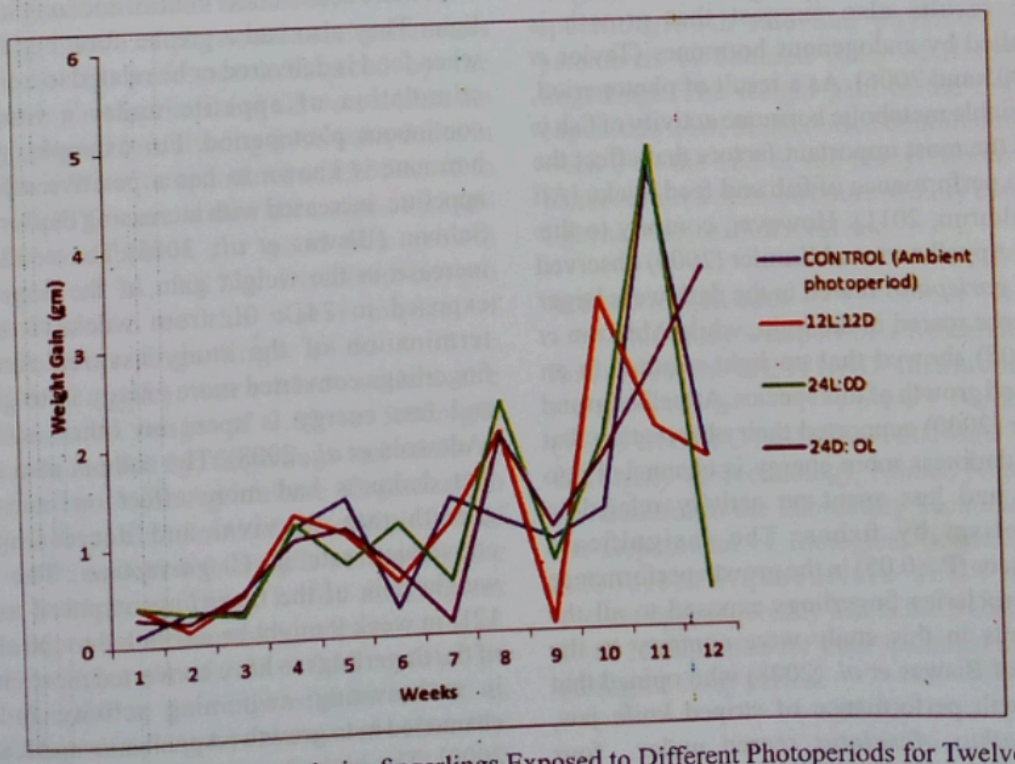

Figure 1: Weight gain of Heteroclarias fingerlings Exposed to Different Photoperiods for Twelve weeks

Discussion

The results of this study agreed with the works of Puvanendran and Brown (2002) who reported that effects of photoperiod on the growth of fish are species specific. Therefore, the positive effects on the growth can occur under continuous light (Moustakas *et al.*, 2004), intermediate photoperiods (Solbakken and Pittman 2004) or continuous darkness (Baldisserotto, 2002). The insignificant differences ($P > 0.05$) on the fish length (Total and Standard) and body weight in all the treatments (Control, 12L:12D, 24L:OD and OL:24D) agreed with the observations of Purchase *et al.* (2000) who reported no significance difference in growth or survival of yellow tail flounder fish under different photoperiods at the end of their study. The observed values also agreed with the findings of Burke *et al.* (2005) who documented that studies of photoperiodism on behavioural response of fingerling, juvenile and adult fish could be both different and less flexible. To support the above submission, Bonnet *et al.*, 2007 and Puvanendran and Brown (2002) reported that the effect of photoperiods on the growth performance of fish even varies depending on the developmental stages, but, after a certain stage of development, the difference in light treatment did not affect growth rate or survival. These results also suggest that growth is controlled by endogenous hormones (Taylor *et al.*, 2005 and 2006). As a result of photoperiod, the variable metabolic hormone activity of fish is one of the most important factors that affect the growth performance of fish and feed intake (Ali and Yıldırım, 2011). However, contrary to this report, Appelbaum and Kamler (2000) observed that *C. gariepinus* reared in the dark were larger than those reared in the light, while Almazan *et al.* (2005) showed that no light resulted in an increased growth of this species. Appelbaum and Kamler (2000) supported their observation that during darkness more energy is channeled into growth and less spent on activity related to metabolism by fishes. The insignificant differences ($P > 0.05$) in the growth performance of Heteroclarias fingerlings exposed to all the treatments in this study were contrary to the reports of Biswas *et al.* (2008) who opined that the growth performance of striped knife jaw, *Oplegnathus sfasciatus* reared under four photoperiods (6L:6D, 12L:12D, 16L :8D and 24L :OD), showed a significant different ($P < 0.05$) of effect of photoperiod with higher weight gain, specific growth rate and food conversion efficiency in fish under 12L:12D than fish exposed to 6L:6D and 16L:8D.

The findings of this study was also not in agreement with the works of Moshood *et al.* (2012) who reported that *C. gariepinus* (Burchell) reared under three different photoperiods (24D:0L),(24L:0D), (12D :12L) indicated significant increase in body weight, specific growth rate and food conversion efficiency among the fish cultured under 24D:0L , followed by 24L :OD, while those under 12D:12L showed the least growth increase. They added that high growth increase recorded in 24D: 0L was attributed to better food conversion efficiency and the suppression of swimming activity, aggression and stress on the dark. All these enabled more energy to be converted to body weight. The similar weight gain obtained by the fingerlings exposed to all the treatments from weeks 1 to7 suggested that photoperiod requirement for growth is extremely variable, can be with or without effect and is related to environmental adaptation species and age specific (Adewolu *et al.*, 2008). The sharp increase in the weight gain of fingerlings exposed to different photoperiods from weeks 7 to 8 revealed that the fingerlings were more active under control and long hours of light. They also had a greater foraging activity when food is delivered or be related to hormonal stimulation of appetite under a long and continuous photoperiod. For example, growth hormone is known to has a positive effect on appetitte, increased with increasing day length in Salmon (Biswas *et al.*, 2005).The continuous increase in the weight gain of the fingerlings exposed to 24D: 0L from weeks 9 to the termination of the study assured that the fingerlings converted more energy in to growth and less energy is spent on other activities (Adewolu *et al.*, 2008). The authors also added that darkness had more effect on increasing growth rate, survival and decreasing the conversion rate in *C. gariepinus*. The least weight gain of the fingerlings exposed to12D: 12D in week 9 might be attributed to the ability of the fingerlings to have converted more energy in to browsing, swimming activity and not channeled in to growth (Appelbaum and Kamler 2000). The highest weight gain recorded in the fingerlings exposed to 12L: `2D in week 10; control and 24L: 0D in weeks 11 respectively,

may be due to higher food intake and food conversion efficiency as visual feeder fish required light (Cox and Pankhurst, 2000 and Biswas *et al.*, 2006). The least survival rate (58.67%) observed in the fishes exposed to 24L: 0D compared to those raised in ambient photoperiod (control), 12D:12L and 24D: 0L at the end of the study. This observation may be attributed to stress caused by longer periods of light, as more time is spent searching for cover and display of aggression in territorial behavior, cannibalism and increased stress (Appelbaum and Kamler, 2000). The observation also agreed with the works of Solomon and Okomoda (2012) who attributed decrease in survival rate in *C. gariepinus* juvenile to higher incidence of light regime and cannibalistic tendency of the growing juveniles in the 24L: 0D treatment. The higher values recorded in the survival rates of the fingerlings exposed to control, 12L:12D and 24D:0L were similar to the works of Sampaio *et al.* (2009) who reported no mortality in fish species cultured under different photoperiods. However, the results were contrary to the reports of Giri *et al.* (2002) who documented that gaint cat fish larvae recorded the lowest mortality rate when exposed to longer photoperiods while showing the highest mortality rate in a 24.00 hours dark regime presumably as a result of reduced feed contrast for the larvae.

The results of physiochemical parameters in this study were not influenced by the respective photoperiods and all were within the range approved for culturing fresh water fishes in the tropics. Water temperatures of 25.55 ±0.45 to 26.59± 0.37°C were within the range of 25.00-32.00°C acceptable for good fish growth (Ayanwale *et al.*, 2017b). Dissolved oxygen concentration of the water media of Heteroclarias fingerlings; (4.53±0.65 to 5.17±0.42mg/L) were also within the recommended range of 3.00 to 5.00mg/L recommended for fry, fingerlings and adults as reported by Food Agriculture Organization (FAO, 2006). The Ammonia concentration of 0.29 ± 0.05 to 0.30 ± 0.05mg/L were within the range 0.01 to 1.55mg/L for freshwater fingerlings as documented by Ayanwale *et al.* (2017b). Water pH of 7.38 ± 0.38 to 7.4±0.36 were also within the range of 6.50 to 9.00 as documented by Ayanwale *et al.* (2017b). Similarly, the Biochemical oxygen demand concentration of 1.03±0.37 to 1.36 ±0.29 mg/L recorded in this study were also within the acceptable range of 1.0 to 5.00mg/L recommended for fish growth in the tropics (CIESE, 2009). These results suggested no organic pollution from left over feed or faecal matter in the rearing media of Heteroclarias fingerlings throughout the experimental period which in turn increased the Dissolved oxygen concentration. These findings might be attributed to constant aeration and changing of water in all the experimental tanks (Ayoola and Fredrick, 2012). Therefore, to increase the productivity of Heteroclarias in captivity adequate aeration and refreshment (recirculatory system) of pond water must be put in place by such fish farmers. The insignificant influence of photoperiods on the physicochemical parameters recorded in this study were in conformity with the findings of Campagnolo and Nuner (2008) who reported that *Pseudoplatystoma corruscans* fingerlings exposed to different photoperiod levels indicated no significant differences ($p>0.05$) in all the physiochemical parameters measured and also stayed within the acceptable range for fish culture.

Conclusion

The study indicated that photoperiod had no influence on fish length (standard and total length), body weight, percentage weight gain, specific growth rate and physico-chemical parameters of cultured water of Heteroclarias fingerlings. The weight gain of the fingerlings exposed to 24D: 0L increased continuously from week 9 to the end of the study. Moreover, the fishes cultured in 24.00 hours of daily continuous light had the least survival rate.

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